MATHEMATICS AND CURRICULUM TENDENCIES IN KANSAS HIGH SCHOOLS

A Thesis

Presented to

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and the Graduate Council of the

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Master of Science

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by

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CHAPTER I

INTRODUCTION

Since the beginning of the century there have been changes taking place in the world: changes in the balance of power of nations, in communication, in transportation, in industry, in our work, and in the homes we live in. Quite naturally the schools have changed; it is the purpose of this study to determine what changes have taken place in the mathematics curriculum of the Kansas High Schools, and if the enrollments in mathematics classes indicate mathematics is losing its place in the high school program.

I. THE PROBLEM

Statement of the problem. It was the purpose of this study to find (1) what mathematics is being taught; (2) what per cent of the students are taking mathematics courses; (3) how well prepared are the mathematics teachers; (4) how many fields are the mathematics teachers teaching in.

Method of procedure. The data for this study was collected from the High School Principals Reports for the 1959-60 school year filed in the office of the State Department of Education at Topeka. This report contains a program of studies with enrollments in each class; also, it contains

a table listing the courses offered for credit and the grades in which they are offered. It was possible from this report to ascertain what branches of mathematics were offered, the grade in which the subject is taught, and the total enrollment of the school.

In studies of this type it is usual to group the high schools according to some natural division for the purpose of determining any variation in the different types of schools. The usual method used is to divide the schools into First and Second Class Cities, and Rural High Schools and Common School Districts. The terms, "Rural" High School and "Common" School District, refer to the laws under which the school is organized and does not necessarily indicate that these schools are any smaller or larger, or that they serve any different class of students than the city schools. The schools selected were grouped into three groups: (1) the large schools with enrollments of 200 or over; (2) medium-sized schools with over 50 and less than 200; (3) the small schools with enrollments less than 50. The very large schools were not considered because of the small number of schools that could be considered very large and because broad geographic representation was desired.

TABLE IA

SELECTED SCHOOLS: GROUP I

School	Enrollment 1952	1957*	1959	Classification
1. Abilene	365	422	453	A
2. Bonner Springs	251	418	428	A
3. Colby	213	300	291	A
4. Concordia	539	910	370	A
5. Fredonia	292	220	240	A
6. Goodland	342	352	334	A
7. Holton	263	217	227	A B**
8. McPherson	518	557	608	A
9. Oberlin	242	228	233	A
10. Stafford	208	204	149	A

NOTE: This table gives data on ten selected schools having enrollments of 200 or more.

*Changed to this for school year 1957-58 according to a report by John M. Burger.

**Changed to this for school year 1959-60.

TABLE IB (cont'd)

SELECTED SCHOOLS: GROUP II

School		Enrollment 1952	1957*	1959	Classification
11.	Arga	55	58	63	B
12.	Alma	122	112	131	A
13.	Alton	59	41	38	A B**
14.	Altoona	106	79	78	B C**
15.	Americus	53	47	62	C B**
16.	Andale	153	166	170	A
17.	Andover	65	142	155	C A***
18.	Arcadia	81	71	66	A
19.	Argonia	87	62	91	A
20.	Arlington	75	63	63	A B**
21.	Assaria	61	55	68	A B**
22.	Attica	78	126	123	A
23.	Barnes	56	68	66	B
24.	Belle Plain	56	68	174	A
25.	Bern	57	61	75	C
26.	Burden	67	56	65	A C***
27.	Burdett	55	54	56	B
28.	Bushton	73	88	65	A
29.	Canton	95	79	77	B

TABLE IB (continued)

SELECTED SCHOOLS: GROUP II

School		Enrollment 1952	1957*	1959	Classification
30.	Cedar Vale	136	112	105	A
31.	Chase	138	115	110	A
32.	Chetopa	147	120	110	A
33.	Cimarron	177	179	111	A
34.	Clearwater	130	253	221	A B***
35.	Concordia Catholic	78	/	82	C
36.	Corning	84	62	56	B
37.	Cottonwood Falls	84	95	90	A
38.	Damar	56	/	51	B
39.	Denison	81	43	40	A B* C***
40.	Dorance	74	65	61	A
41.	Elwood	63	75	59	C
42.	Esbon	64	71	55	B
43.	Everest	58	59	74	C B*
44.	Ford	61	51	50	A
45.	Gardner	83	149	179	B A*
46.	Gaylord	52	55	41	C B*
47.	Geneseo	82	72	77	B A*
48.	Glasco	80	89	86	A B* A***

TABLE IB (continued)

SELECTED SCHOOLS: GROUP II

School	Enrollment 1952	Enrollment 1957*	Enrollment 1959	Classification
49. Gorham	69	58	50	A B**
50. Haven	132	201	218	A
51. Hoxie	186	166	151	A
52. Ingalls	54	41	54	B
53. Jetmore	119	77	103	C A*
54. Jewell City	84	57	66	A
55. Johnson	100	59	84	A
56. Kinsley	170	197	183	A
57. Leoti	137	178	183	A
58. Lincoln	186	158	154	A
59. Longton	119	58	49	B
60. Oxford	111	123	139	A
61. Sharon	62	48	46	B
62. Sharon Springs	96	100	102	A
63. St. Francis	180	186	185	A
64. Tribune	118	137	134	A
65. Ulysses	180	243	249	A

NOTE: This table gives data for schools selected with enrollments more than 50 and less than 200.

*Changed to this for the school year 1957-58 according to a report by John M. Burger.

**Changed to this for the school year 1959-60.

/No information available for school year 1957-58.

TABLE IC

SELECTED SCHOOLS: GROUP III

School		Enrollment 1952	1957*	1959	Classification
66.	Abbyville	37	21	ØØ	B M*
67.	Adams	21	19	31	C M***
68.	Alexander	29	32	40	C
69.	Allen	35	97		C
70.	Benedict	34	18	ØØ	B C*
71.	Bloom	35	19	36	M C* M***
72.	Bluff City	43	33	33	B C*
73.	Brownell	49	37	15	C M*
74.	Buffalo	48	68	ØØ	B C*
75.	Cambridge	37	27	11	C M***
76.	Clements	21	9	ØØ	C M*
77.	Climax	30	Ø	ØØ	C
78.	Coolidge	23	25	28	C
79.	Copeland	33	42	45	C B*
80.	Cullison	50	46	29	B
81.	Dexter	48	59	91	C
82.	Durham	45	36	37	C B*
83.	Dwight	46	67	57	C B*
84.	Edmond	44	17	ØØ	C M*
85.	Edson	41	27	31	B C*

TABLE IC (continued)

SELECTED SCHOOLS: GROUP III

School	Enrollment 1952	1957*	1959	Classification
86. Elmdale	32	23	38	C M* C**
87. Enterprise	43	40	38	B
88. Elk Falls	24	27	19	C
89. Fall River	47	31	45	C
90. Galesburg	48	56	40	C B*
91. Garfield	40	49	48	B
92. Hanson	39	59	48	B
93. Harlan	13	ø	øø	M
94. Hepler	49	41	øø	B
95. Hunter	34	34	32	B
96. Keats	31	26	øø	C
97. Oneida	26	17	129	M C*
98. Manter	39	42	33	C
99. Nashville	30	28	30	C

NOTE: This table gives data for schools selected with enrollments 50 and under.

*Changed to this for the school year 1957-58 according to a report by John M. Burger.

**Changed to this for school year 1959-60.

øNo school during school year 1957-58.

øøNo school for school year 1959-60.

CHAPTER II

REVIEW OF LITERATURE

It will be easier to understand the recent movements in the teaching of mathematics if we know how we arrived at our present mathematics curriculum. For that reason, a brief sketch of the mathematics in the United States is included.

Early mathematics. The mathematics taught in early American colleges was called simply "mathematics," and taught from a textbook entitled "mathematics."[1] There was no division of subject matter into separate courses of algebra, geometry, etc., as we know them today. As these colleges grew and expanded their programs in mathematics the whole field of mathematics was broken up into sections that could be taught in a year's time. The whole field was organized and divided into units so that each topic followed the other in an orderly, logical arrangement. These divisions were arithmetic, algebra and geometry.

With the rise of the academies, arithmetic and, later, algebra, then geometry, were made college entrance

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[1] J. Paul Shelden, "Mathematics and Curriculum Tendencies in Kansas High Schools," (unpublished Master's thesis, The University of Kansas, Topeka, 1937), p. 7.

requirements. The colleges designated what material was to be studied, and often the textbooks to be used. In the case of subjects also taught in the colleges, these textbooks were frequently the textbooks prepared by college students in conjunction with the college courses. Gradually, these subjects arrived at what we call their traditional place in the public school curriculum. Arithmetic was taught in the elementary school, algebra in the ninth grade, and geometry in the tenth grade.

These subjects were no sooner firmly established in their traditional position than some leaders in secondary education became dissatisfied with the content of the courses, the textbooks used, and the order in which subject matter was taught. They objected to mathematics being broken up into "watertight" compartments of algebra, geometry, and so on.

In 1893, the Committee of Ten, appointed by the National Education Association, made its report. It recommended, among other things that intuitive geometry be taught parallel in the elementary school and that algebra and geometry be taught parallel in the tenth and eleventh grades, two and one half hours a week being devoted to each subject. This gave rise to the correlated mathematics movement in which the emphasis was placed on the correlating of algebra and geometry and sometimes other related subjects.

The Chicago section of the American Mathematical Society was active in promoting interest in correlated mathematics.

By 1916 the General Mathematics movement had begun. The leaders of this movement advocated using some correlated material but their main emphasis was on teaching the best materials, the most useful materials, and teaching the easier material first. In 1915, W. D. Reeve, in the University High School at the University of Minnesota,[2] started experimenting with classes taught in this manner. After a few years of this experiment, he and R. Schorling[3] prepared a textbook of general mathematics. Since that time many others, including E. R. Breslich of the University High School of Chicago University have carried on extensive experiments in general mathematics.

The value of traditional mathematics for the majority of high school pupils has been questioned rather severely in recent years. George S. Counts in his work, "The Senior High School Curriculum," summarizes the criticism of algebra and geometry in the following quotation:

> The case against these subjects as basic offerings in mathematics for the great majority of high school pupils is clear. They reached the place which they occupy in secondary education largely by historical accident and by the grace of the doctrine of formal discipline. They

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[2] Ibid., p. 8. [3] Loc. cit.

> contain but little material that is related to either the present or the probable future needs of the pupils. Experimentation indicates that even for that small group of individuals who possess great mathematical talent and who should be encouraged to pursue higher mathematics, some other organization of mathematics would give superior training.[4]

The more conservative position is very well expressed by Arthur Robert Crathorne in a paper read at the 14th annual conference of Kansas High Schools:

> The problem "should mathematics be required of all high school pupils" is not yet solved . . . . But at present, I believe that injustice will be done a high school pupil who is allowed to go through school without mathematics, one practical reason being that the door of entrance to a profession for which he is peculiarly fitted may be closed to him. We should try to present to every high school pupil a broad view of what he may be better able to judge for himself as to his best line of endeavor.[5]

There have been several studies made in the past of the holding power of mathematics in high schools of the United States. V. T. Thayer, in Educational Administration and Supervision, reports a study made for the North Central Association in 1925-26 by Clavin O. Davis. It was found that all secondary schools belonging to the Association offered algebra and geometry but only 7.6 per cent of the high schools offered general mathematics. It was also found

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[4]George S. Counts, "The Senior High School Curriculum." The University of Chicago, Chicago, Ill. 1926, p. 59.

[5]Arthur Crathorne, "Required Mathematics," School and Society, July 7, 1917.

that 42.8 per cent of all high school pupils studying mathematics are enrolled in algebra classes, 34 per cent are in beginning geometry and only 4 per cent in general mathematics. V. T. Thayer, himself, found that from 1914 to 1922 algebra had lost in the country as a whole by 9 per cent and geometry had actually increased its holding power by 1.5 per cent.[6]

J. Paul Shelden, in a study made at the University of Kansas in 1937 found that 20 per cent of the Kansas high schools offered General Mathematics, over 90 per cent taught Elementary Algebra, and almost 84 per cent offered Plane Geometry.[7]

John M. Burger, in a study made at Emporia State Teachers College in 1958, found 24 per cent of all high school students enrolled in mathematics were enrolled in general mathematics, 40 per cent in elementary algebra, and 23 per cent in plane geometry.[8]

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[6]V. T. Thayer, "Mathematics and Curriculum Tendencies in Secondary Education," Educational Administration and Supervision, Vol. 13, Sept. 1927, p. 381.

[7]Shelden, op. cit., p. 25.

[8]John M. Burger. Unpublished data collected in the preparation of "Background and Academic Preparation of the Mathematics Teachers in the Public High Schools of Kansas 1957-58," The Emporia State Research Studies, Vol. 7, 1959.

CHAPTER III

REGULATIONS AND COMMITTEE RECOMMENDATION

The teaching of mathematics in Kansas high schools reflects the recommendations and influence of state and national special committees and also state and local regulations.

Kansas State Department. In order to get a clear understanding of the state regulations it is necessary to know how the Kansas State Department of Education is organized. In Kansas the State Department of Education is administered by a "State Superintendent of Public Instruction" and a "State Board of Education." The State Board is composed of seven members appointed by the governor for a term of three years. The members are selected from the two political parties casting the highest and second highest number of votes at the last general election. Not more than four members can be from any one party.[1]

State Superintendent of Public Instruction. The State Superintendent must present to the State Board plans, methods, rules and regulations for: (1) courses of study,

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[1] Kansas School Laws, 1957, p. 335.

curriculum and standards, school literature and textbooks; (2) the issuance, renewal, and registration of certificates for teachers, administrators and supervisors.[2]

Textbooks. The 1957 Kansas legislature created an agency known as the textbook screening committee. This committee of fifteen (15) competent citizens is appointed by the State Superintendent of Public Instruction, subject to the approval of the State Board of Education. Three (3) members of this committee shall be persons who are not engaged in school work; four (4) shall be teachers or administrative officers in schools with grades one to six, inclusive; four (4) shall be teachers or administrative officers in schools with grades ten to twelve, inclusive. It is the duty of the textbook screening committee to (a) examine all textbooks and workbooks offered for sale in Kansas in the various subject matter fields, including kindergarten and grades one to twelve, inclusive, and (b) submit annually to the State Superintendent of Public Instruction a list of those textbooks and workbooks which, in the opinion of such committee, are suitable for the various subject matter fields. The State Superintendent of Public Instruction shall annually have such lists printed or

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[2] Kansas School Laws, 1957, p. 331.

duplicated for distribution to the governing body of each school district. The governing body of any school district is authorized to select or adopt textbooks or workbooks for use of the schools under its jurisdiction from the list provided by the State Superintendent of Public Instruction.

National committees. Writers of textbooks have generally tried to conform to suggestions of certain committees of national recognition. The reports of the Committee of Fifteen, the Committee on the Reorganization of Mathematics in Secondary Education and the College Entrance Examination Board have probably had the greatest amount of influence on textbook writers.

The College Entrance Examination Board. The College Entrance Board was organized in 1900; its purposes were threefold.

> The College Entrance Examination Board for the middle states and Maryland was established in 1900. The purpose of the Board was:
>
> (a) to provide a substitute for the separate admission examinations that had prevailed in the past;
>
> (b) to set a uniform standard that may serve to guide the work of the secondary school;
>
> (c) to bring an end to the period characterized by the preparation of students to meet the peculiar requirements of institutions more or less isolated from each other--requirements that have been dictated by several individuals.

TABLE II

APPROVED MATHEMATICS TEXTBOOKS 1959-60

Title of Book	Author	Publisher	Copy-right
PLANE GEOMETRY			
Plane Geometry	Leary	Scribner's	1955
Today's Geometry	Spiller	Prentice-Hall	1957
Plane Geometry	Smith	World	1956
Plane Geometry	Shute	American	1957
Plane Geometry	Barton	Webster	1954
Plane Geometry	Morgan	Houghton-Mifflin	1957
New Plane Geometry	Welchons	Gin	1956
Plane Geometry	Seymour	Macmillan	1949
Plane Geometry	Hart	Heath	1950
Plane Geometry	Schacht	Holt	1957
Plane Geometry	Mallory	Singer	1953
Plane Geometry-A Clear Thinking Approach	Schnell	McGraw-Hill	1953
SOLID GEOMETRY			
Solid Geometry	Smith	World	1957
Solid Geometry	Hart	Heath	1952
Solid Geometry	Mallory	Singer	1954
Solid Geometry	Shute	American	1957
Solid Geometry	Morgan	Houghton-Mifflin	1953
Solid Geometry, A Clear Thinking Approach	Schnell	McGraw-Hill	1953
New Solid Geometry	Welchons	Ginn	1955
TRIGONOMETRY			
Plane Trigonometry	Corliss	Houghton-Mifflin	1950
Trigonometry for Secondary Schools	Butler	Heath	1957
Plane and Spherical Trigonometry with Tables	Morgan	American	1951
Trigonometry with Tables	Welchons	Ginn	1957
A Modern Course in Trigonometry	Hooper	Holt	1953
New Trigonometry	Mallory	Signer	1956

TABLE II (continued)

APPROVED MATHEMATICS TEXTBOOKS 1959-60

Title of Book	Author	Publisher	Copy-right
Trigonometry	Smith	World	1957
Trigonometry for Today	Brooks	McGraw-Hill	1951
ALGEBRA I			
Algebra I	Smith	Row-Peterson	1954
Algebra First Course	Mayor	Prentice-Hall	1956
Elementary Algebra	Shute	American	1956
Algebra and Its Use	Grove	American	1956
Algebra, Book One	Welchons	Ginn	1956
Mallory First Algebra	Mallory	Singer	1956
First Year Algebra	Hart	Heath	1957
Algebra, Course I	Fehr	Heath	1955
Algebra One	Smith	World	1955
Algebra for Problem Solving	Freilich	Houghton-Mifflin	1957
Elementary Algebra	Edgerton	Allyn and Bacon	1957
First Course in Algebra	Lennes	Macmillan	1957
Algebra, Its Big Ideas and Basic Skills, Book I	Aiken	McGraw-Hill	1957
ALGEBRA II			
Algebra for Problem Solving, Book II	Freilich	Houghton-Mifflin	1957
Intermediate Algebra	Shute	American	1956
Algebra II	Smith	Row-Peterson	1954
Algebra, Second Course	Mayor	Prentice-Hall	1957
Algebra, Book II	Welchons	Ginn	1957
Second Algebra	Mallory	Singer	1952
Algebra, Course Two	Fehr	Heath	1955
Algebra II	Smith	World	1955
Second Year Algebra	Hart	Heath	1957
Algebra and Its Use	Grove	American	1956
A Second Course in Algebra	Lennes	Macmillan	1957
Intermediate Algebra	Edgerton	Allyn and Bacon	1957
Algebra, Its Big Ideas and Basic Skills, Book II	Aiken	McGraw-Hill	1957

TABLE II (continued)

APPROVED MATHEMATICS TEXTBOOKS 1959-60

Title of Book	Author	Publisher	Copy-right
GENERAL MATHEMATICS			
Mathematics in Daily Use	Hart	Heath	1958
Arithmetic in Life and Work	Lasley	Prentice-Hall	1952
The New Applied Mathematics	Lasley	Prentice-Hall	1958
Going Places with Mathematics	Peters	Prentice-Hall	1956
Mathematics for Daily Needs	Osborn	Webster	1954
Basic Ideas of Mathematics	Lankford	World	1953
Everyday General Mathematics, Book One	Betz	Ginn	1956
Arithmetic for High Schools	Butler	Heath	1953
Mathematics for Everyday Affairs	Mallory	Singer	1956
General Mathematics	Mallory	Singer	1951
Your Mathematics	Hawkins	Scott Foresman	1953
Using Mathematics	Henderson	McGraw-Hill	1955
BUSINESS MATHEMATICS			
The Arithmetic of Better Business	McMackin	Ginn	1955
Business Arithmetic	McNelly	Prentice-Hall	1953
Applied Business Arithmetic	Curry	South-western	1953
Applied Business Arithmetic, Abridged	Curry	South-western	1953
Commercial Arithmetic	Mallory	Signer	1956
Essentials of Business Mathematics	Rosenberg	Gregg	1951
Business Mathematics, Principles and Practice	Rosenberg	Gregg	1953
Mathematics for the Consumer	Lankford	World	1953
Applied General Mathematics	Piper	South-western	1954
Making Mathematics Work	Nelson	Houghton-Mifflin	1955

> The College Entrance Examination Board, as established, consisted of a president or an authorized representative of each college or university in the middle states and Maryland, which had an entering class of not less than fifty students, and five representatives of the secondary schools in the middle states and Maryland, to be chosen annually by the Association of Colleges and Preparatory Schools, or in such manner as the Association may direct.[5]

The Commission on Mathematics. The Commission on Mathematics of the C.E.E.B. was appointed in 1955. The commission was formed to consider broadly the secondary-school college preparatory curriculum and to make recommendations looking towards the modernization, modification, and improvement. It hopes to secure an introduction in American secondary schools a mathematics program oriented to the needs of the second half of the twentieth century. The traditional secondary-school program in mathematics, made up of elementary algebra, plane geometry, intermediate algebra, solid geometry, trigonometry and advanced algebra, consists almost entirely of mathematics developed over 300 years ago, gradually introduced into the schools over the past 150

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[5]Leslie, Harper Whitecraft, Some Influences of the Requirements and Examinations of the College Entrance Examination Board on Mathematics in Secondary Schools of the United States, Teachers College of Columbia University, 1933, p. 15.

years and crystallized into essentially its present form approximately 60 years ago.[6]

School Mathematics Study Group. In the spring of 1958, after consulting with the Presidents of the National Council of Mathematics and the Mathematical Association of America, the President of the American Mathematical Society appointed a small committee of educators and university mathematicians to organize a School Mathematics Study Group whose objective would be the improvement of the teaching of mathematics in the schools. In addition, the organizing committee appointed an Advisory Committee, consisting of college and university mathematicians, high school teachers of mathematics, experts in education, and representatives of science and technology, to work with the director. The National Science Foundation, with an initial grant of $100,000 in the spring of 1958 and a further grant of $1,200,000 later that year, has provided the financial support for the work of the SMSG.[7] The SMSG has prepared a series of sample textbooks for grades 9 through 12. For the

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[6]Albert E. Meder, Jr., "Proposals of the Commission on Mathematics of the College Entrance Examination Board," National Association of Secondary School Principals Bulletin, May 1959, p. 19.

[7]School Mathematics Study Group, Newsletter No. 1, March 1959, Yale University, p. 3.

most part the topics discussed in these textbooks do not differ markedly from those included in the present-day high school courses for these grades. However, the organization and presentation of these topics is different. Important mathematical skills and facts are stressed, but equal attention is paid to the basic concepts and mathematical structures which give meaning to these skills. Preliminary versions of these texts were prepared at a writing session held at the University of Colorado in the summer of 1959, using detailed outlines which had been prepared at the Yale writing session in the summer of 1958.[8]

In 1903, regulations permitted representatives on the Board of any college or university in the United States with an enrollment of more than fifty.[9]

In 1923 the Board approved some new requirements in mathematics which were presented by a committee designated by this Board.

> The Committee of Review of the Board was authorized to appoint a commission to consider the revision of the definition of the requirements in mathematics. In 1922 this commission submitted to the Committee of Review two reports, one in algebra and trigonometry, the other in plane and solid geometry. In 1923 the new definition of

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[8]School Mathematics Study Group, Newsletter No. 4, March 1960, Yale University, p. 6.

[9]Whitecraft, loc. cit.

the requirements in mathematics was approved by the College Entrance Examination Board.

The new requirements in algebra eliminated much of the obsolete work in algebra.

In geometry, the number of required theorems for examination was greatly decreased. It provided a syllabus for a year's work in plane and solid geometry to be allowed instead of a single course in plane geometry. It provided a certain amount of work in mensuration of a type frequently met in various types of industry.[10]

The Committee of Fifteen. In 1909, the National Education Association authorized the Committee of Fifteen, which had previously been appointed by the American Federation of Teachers in the Mathematical and Natural Sciences, to proceed with its work.[11] The most important work accomplished by this committee was the compilation of a list of geometry theorems and of other work which should be included in a course of geometry in the secondary school. Some of the suggestions and recommendations of this committee are:

To provide for preliminary work in geometry in the elementary grades.

To precede the work in plane geometry by some definite work in geometric drawing.

To unite geometry and algebra, or geometry and trigonometry. This committee does not feel that the experiments along this line, which have been made in only a few schools, have been sufficient to determine whether or not geometry should run parallel with algebra in the ninth, tenth, and eleventh school years.

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[10] Whitecraft, loc. cit. [11] Whitecraft, op. cit. p. 15.

> That plane geometry be assigned not less than one year nor more than one and one-half years in the curriculum, being preceded by at least one year of algebra except where the individual teacher desires to carry it along with algebra.
>
> That a judicious fusion of theoretical and applied work, a fusion dictated by common-sense and free from radicalism in either direction, is necessary.[12]

The committee seemed to think that to set up a list of theorems for college entrance examinations that would meet the approval of the people would be an impossibility, and that if such a list did meet their approval it would not be best for the interests of geometry.[13]

The Committee for the Reorganization of Mathematics in Secondary Education. The organization, purpose, and duties of the Committee for the Reorganization of Mathematics in Secondary Education are given in the preface to its report which was published in 1923.

> The National Committee on Mathematical Requirements was organized in the late summer of 1916 under the auspices of the Mathematical Association of America for the purpose of giving national expression to the movement for reform in the teaching of mathematics. This committee was instructed to add to its membership so as to secure adequate representation of secondary school leaders, and then undertake a comprehensive study of the whole problem concerned with the improvement of mathematical education, and to cover the field of

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[12]Final Report of the National Committee of Fifteen on Geometry Syllabus, 1912, p. 10.

[13]Ibid., p. 45.

> secondary and collegiate mathematics. Due to delay in securing funds, the membership being spread throughout the United States, and delay in publication, the final report was not published until 1923.[14]

The report contained criticisms of the mathematics courses in secondary education, suggestions and recommendations in plane and solid geometry, and a discussion of the College Entrance Requirements.

The committee made many unfavorable criticisms concerning the College Entrance Requirements, particularly in regard to their influence on the program of the secondary schools. The requirements were causing the program to be one-sided so that the student in the secondary schools could get instruction for college entrance only. The committee stated, "The separation of prospective college students from others in the early years of the secondary school is neither feasible nor desirable."[15]

According to the committee textbook authors had been influenced to a great extent by the College Entrance Requirements.

> Moreover, it must be noted that authors and publishers of textbooks are under strong pressure to make their content and distribution of emphasis conform to the prevailing type of entrance examination. Teachers, in turn, are too often unable to rise above the

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[14]Report of the National Committee on the Reorganization of Mathematics in Secondary Education, 1923, p. vii.

[15]Ibid., p. 43.

> textbook. An improvement in the examinations in this respect will cause a corresponding improvement in textbooks and in teaching.[16]

Suggestions were made to decrease the number of theorems listed by the Harvard Committee or the Committee of Fifteen, and that more attention might be given to the function concept and problems in motion.

> If the great basal theorems are selected and effectively organized into a logical system, a considerable reduction (from 30 to 40 per cent) can be made in the number of theorems given either in the Harvard list or in the report of the Committee of Fifteen.[17]

These three committees, by their influence on the writers of textbooks used in Kansas, altered the mathematics program in the state.

State and national organizations. The mathematics program in Kansas has been profoundly affected by organizations such as the Kansas Association of Mathematics Teachers, which publishes a quarterly bulletin; the Mathematics Round Tables under the auspices of the Kansas State Teachers Association, which publishes the Kansas Teacher; the Kansas Section of the Mathematical Association of America, which publishes the American Mathematics Monthly; and the National Council of Teachers of Mathematics, which publishes the Mathematics Teacher, issued monthly. The National Council

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[16] Ibid., p. 51. [17] Ibid., p. 35.

also publishes the Yearbooks of the National Council, of which twenty-four have appeared to date. These yearbooks, together with the periodicals mentioned above, have had great influence upon the teaching of mathematics in Kansas high schools. The Secondary School curriculum committee of the National Council of Teachers of Mathematics; the University of Illinois Committee on School Mathematics; and the Commission on Mathematics of the College Entrance Examination Board have had a profound affect in recent years.

Classification of schools. According to the Kansas Secondary Handbook the system of classifying high schools as A, B, or C, first developed about forty-three years ago when most secondary school programs were limited strictly to academic courses, is no longer realistic.[18] The revised standards provide for designating high schools in three categories largely on the basis of offerings, and also provide a system of rating the schools within each category.

> Purposes of the revision are to provide a more realistic system of accrediting and rating high schools, to encourage all schools to upgrade instructional programs to stimulate development of guidance and counseling activities for all students to the end they may fully develop their interests and abilities, to reawaken an interest in scholarship, and, in behalf

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[18] Kansas Secondary School Handbook, 1959, p. 1.

of national security, to promote study in fields that have not been receiving the attention they merit.[19]

Standards for accrediting secondary schools. The standards for accrediting or rating a school largely determine the quality of instruction. Therefore, those standards that affect mathematics instruction are included:

Standard 1. Policies, Administration, and Finance.

(A) The policies of the board of education, which shall be in writing are such as to attract and retain the services of well qualified and competent teachers. It is the policy of the board of education under which schools operate to employ, promote, demote, the discharge teachers only upon the recommendation of the administrative head of the system. The working relationships between the board of education and the administrative head of the system and the principal of the secondary school are such as to insure the efficient and successful administration of the school.

(B) The administration is such as to insure a well organized and well disciplined school efficiently and intelligently supervised. Permanency of organization and of the teaching staff, attitude and support of the community are matters which will be taken into consideration in determining whether the school is eligible for accreditation.

(C) The financial condition of the school district or governing board is such that it is possible for the school to maintain its eligibility to be accredited by the state department of public instruction.

Standard 2. The Staff.

(A) The Administrator: The administrator of any secondary school shall hold an administrator's certificate. This requirement will not apply to administrators of high schools and junior high schools

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[19] Ibid., p. 2.

classified as "C" in 1951-52 provided they continuously serve in the same administrative position in such a school from that date.

. . .

(B) The Teacher:

1. Teachers should be employed by the board of education upon recommendation of the administrative head of the school system.

2. The minimum preparation of any teacher, librarian, study hall teacher-librarian, study hall teacher, or supervisor shall be graduation from an accredited institution of college rank requiring the completion of four-year courses of at least 120 semester hours.

3. The teacher must hold a Kansas Certificate valid for teaching in secondary schools and meet subject and field requirements as provided in Kansas Certificate Handbook 1959.[20]

. . . . . .

Standard 3. Supervision and Administration.

(A) Supervision: In order that the teaching staff may function with the highest degree of efficiency a definite program for the improvement of instruction should be planned. It is recommended that twenty to forty per cent of the administrator's time be devoted to supervision.

(B) Organization and Administration:

1. A fully qualified principal must be in charge of every school.

2. Each member of the teaching staff should be assigned duties according to his particular interests and abilities.

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[20] Ibid., p. 14.

3. In academic subjects a pupil teacher ratio of 150 pupil periods a day to each teacher should be regarded as a maximum teaching load with no class in such subjects enrolling more than 35 pupils.

4. The normal work load for any student in any semester is five subjects with five class periods each week and a reasonable activity program.

. . . . . .[21]

Standard 4. The Program of Studies Grades 9-12.

To simplify organizing the secondary program of studies curricular areas are arranged in the following groups: English, mathematics, social studies, science, foreign language, business education, fine arts, practical arts and vocational education, health, physical education and safety.[22]

> Mathematics courses should be of two kinds--those that provide for the functional mathematics everyone will need, and those for the special needs of some. Arithmetic, General Mathematics, Business and Consumer Mathematics, in general, belong in the first category. Algebra, Geometry, and Advanced Mathematics are usually college preparatory.[23]

. . . . . .

Standard 6. Furnishings and Equipment.

The classrooms should be attractive, hygienic, and conveniently and comfortably arranged.

Furniture:

1. Desks or tables properly finished and adjusted to the comfort of the pupil should be provided.

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[21] Ibid., p. 14. [22] Ibid., p. 17. [23] Loc. cit.

2. A suitable desk with ample drawer space should be provided for every teacher.

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5. Good chalkboard should be provided.[24]

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Standard 9. Promotion and Graduation.

Admission: Students should be admitted to the high school only on completion of the course of study in accredited elementary schools. Any high school accepting students directly from unaccredited elementary schools will be regarded as lowering its own standards unless such pupils have validated their work as required by the state department of public instruction.[25]

. . . . . .

Requirements for all four-year courses.

1. Three units of language arts.
2. Two units of social studies which shall include one unit of American history and one-half unit of government including constitution of the U.S.
3. One unit of science as a laboratory course.
4. One unit of mathematics.
5. One unit of health and physical education.
6. The remaining nine units may be selected from any one or more of the nine groups to meet requirements of the chosen course.

It is recommended that all standard and comprehensive high schools, beginning with the school year 1960-61, provide an orientation program in the 9th grade designed to acquaint each student with the content of the various courses and to explore his interests in each. This

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[24] Ibid., p. 19. [25] Ibid., p. 20

program should be carried on under direction of the school counselor who should evaluate the student's aptitudes, interests, and special talents as determined by tests, individual conferences with teachers, parents, and the pupils themselves.[26]

Procedures for Designating and Rating Schools. Accredited high schools will be designated in three categories as comprehensive, standard and approved schools. Rating of schools within each of the above categories will be determined on the basis of teachers, their qualifications, curricular offerings, and general quality of the instructional program.

(A) Comprehensive School.

An accredited comprehensive high school must:

1. Offer and provide instruction each year in all of the nine curricular areas listed in Standard 4. It is suggested that the number of units indicated below be offered: . . . Mathematics 5 units . . .

2. Offer complete courses in all curricular areas.

3. Employ only teachers meeting standard field and subject requirements in all subjects taught.

. . . . . .

(B) Standard School.

An accredited standard school must:

1. Offer and provide instruction each year in at least eight of the curricular areas listed in Standard 4. It is suggested that the number of units indicated below be offered: . . . Mathematics (including algebra, geometry and advanced mathematics) 4 units . . .

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[26] Ibid., p. 23.

2. Employ only teachers meeting standard field and subject requirements in all subjects taught.[27]

(C) Approved School.

An accredited approved school must:

1. Provide instruction in at least six of the curricular areas listed in Standard 4 as follows: . . . Mathematics 2 units . . .

2. Employ a minimum of four full-time teachers, or the equivalent thereof, with at least two teachers meeting standard field and subject requirements in one subject matter area taught by each.

In order to be rated as meeting superior standards of excellence an approved high school must maintain an average daily attendance of at least 35 students, employ a minimum of five teachers with all teachers meeting standard field and subject requirements in all subjects taught and conduct a self-evaluation under direction of the state department of public instruction the results of which indicate that the school qualifies for such recognition.[28]

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[27] Ibid., p. 26. [28] Ibid., p. 27.

CHAPTER IV

PREPARATION OF MATHEMATICS TEACHERS

Since the teacher has a tremendous influence on the results, this study is an attempt to find out if the mathematics teachers are prepared for good instruction and subject appeal. The apparent decrease in the interest in mathematics until a few years ago was possibly due in part to the quality of instruction and the preparation of teachers. The National Science Foundation is making a determined effort to improve this situation by providing Summer, Academic Year and In-Service Institutes. In the Academic Year and Summer Institutes the NSF pays the college tuition and fees and gives the teacher a stipend, usually, $75 per week, together with an allowance of $15 per week for each dependent, up to a maximum of four dependents, plus travel allowance to and from the college. Of course the NSF has to approve the proposed course of study of the teachers selected to participate in these institutes. The In-Service Institutes are for teachers approximately one hundred miles or less from a college or university which has been granted the Institute. These classes usually meet in the evening or on Saturday morning, with the NSF paying the tuition, fees, and a travel allowance.

The mathematics teacher cannot teach with competence unless he has a clear perspective of modern mathematics and an adequate background of mathematical knowledge. In order to teach modern secondary mathematics, the teacher should have captured the spirit of modern mathematics, which is "learning with understanding," or "learning by discovery." Also, the teacher of modern secondary mathematics should have knowledge of: (1) modern analysis, including the contemporary concepts of variable, function, sentences, and inequalities; (2) modern algebra, including the basic theory of sets, groups, rings, fields, matrices, linear algebra, and vector space; (3) modern geometry, including the basic structure and elements of projective, affine, euclidean and non-euclidean geometries.[1]

In 1952, according to Table IV, 21 per cent of the teachers held a Masters Degree. In 1957, Burger found that approximately 40 per cent of the teachers had obtained a Masters Degree.[2] However, in 1959 only 34 per cent of the teachers in the schools selected for this study held a

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[1]Howard F. Fehr, "The Mathematics Curriculum for the High School of the Future," Teachers College Record, 59: 258-67, February, 1958.

[2]John M. Burger. Unpublished data collected in the preparation of "Background and Academic Preparation of the Mathematics Teachers in the Public High Schools of Kansas 1957-58," The Emporia State Research Studies, Vol. 7, 1959.

TABLE III

NUMBER OF MATHEMATICS TEACHERS

HOLDING INDICATED DEGREES

Year	BACHELORS				MASTERS			
	Group I	Group II	Group III	Total	Group I	Group II	Group III	Total
1952-53	6	46	24	76	7	10	9	27
1957-58*				1037				337
1959-60	19	49	19	87	6	26	13	45

*A study of all the schools by John M. Burger.

TABLE IV

PER CENT OF TEACHERS HOLDING INDICATED DEGREES

Year	BACHELORS				MASTERS			
	Group I	Group II	Group III	Total	Group I	Group II	Group III	Total
1952-53	100	100	100	100	54	18	27	21
1957-58*				99.9				39.5
1959-60	100	100	100	100	24	35	41	34

*A study of all the schools by John M. Burger.

Masters Degree; this represented an increase of 13 per cent during the last six years. The small schools, Group III, have better prepared teachers with 41 per cent holding a Masters Degree while only 35 per cent of the Group II and 24 per cent of Group I schools have Masters Degrees. During the last six years, Group I has dropped from 54 per cent, with a Masters to only 24 per cent.

According to Table VI the teachers in the small, Group III schools do not, in general, have the equivalent of a mathematics major of 25 hours. In 1959, 41 per cent of the Group III had less than fifteen college hours in mathematics compared to 9 per cent in Group II and 12 per cent in Group I. Both Group II and Group III have increased the per cent with less than fifteen college hours in mathematics. Group I increased from 8 per cent in 1952 to 12 per cent in 1959 and Group III from 35 per cent in 1952 to 41 per cent in 1959. Group II has shown a definite improvement with a decrease from 28 per cent in 1952 to 9 per cent in 1959. Group I has the largest per cent with twenty-five or more college hours in mathematics. However, Group I has shown a decrease of 25 per cent since 1952 while Group II and Group III have both increased their per cent in the twenty-five or over category. Group II has increased 11 per cent and Group III 2 per cent.

Group I ranks best in the number of teaching assignments with only 8 per cent teaching in more than two fields. Group II has 11 per cent and Group III has 13 per cent teaching in more than two fields. However, Group I has one teacher, of the twenty-five, teaching in more than three fields and Group II and Group III have no one teaching in more than three fields. Thirty-nine per cent of the mathematics teachers of this study were teaching in more than two fields in 1952, by 1959 this was reduced to 11 per cent.

TABLE V

COLLEGE HOURS IN MATHEMATICS
(Number of Teachers)

College hours (year)	Group I 52	Group I 59	Group II 52	Group II 59	Group III 52	Group III 59	Total 52	Total 59	Burger* 57
Less than 15	1	3	17	7	11	13	29	23	310
Fifteen and more but less than 25	3	11	26	37	11	9	39	57	306
Twenty-five and over	9	11	18	31	9	10	37	52	404

NOTE: Year 52 means school year 1952-53 and 59 means school year 1959-60.

*School year 1957-58.

TABLE VI

PER CENT OF TEACHERS WITH SPECIFIED COLLEGE HOURS IN MATHEMATICS

College hours	Group I		Group II		Group III		Total		Burger*
	52	59	52	59	52	59	52	59	
Less than 15	8	12	28	9	35	41	27	17	30.4
Fifteen and more but less than 25	23	44	43	49	35	28	37	42	29.8
Twenty-five and over	69	44	30	41	29	31	35	39	39.8

NOTE: Year 52 means school year of 1952-53 and year 59 means school year of 1959-60.

*John M. Burger's study was for the school year 1957-58.

TABLE VII

NUMBER OF TEACHERS TEACHING IN INDICATED NUMBER OF FIELDS

Fields	Group I		Group II		Group III		Total	
	52*	59	52	59	52	59	52	59
One	11	9	3	21	1	4	15	34
Two	2	14	32	46	14	24	48	84
Three	-	1	23	8	13	4	36	13
Four	-	1	3	-	2	-	5	1
Five	-	-	-	-	1	-	1	-

*52 means school year of 1952-53 and 59 means school year of 1959-60.

TABLE VIII

PER CENT OF TEACHERS TEACHING IN NUMBER OF FIELDS

Fields	Group I		Group II		Group III		Total	
	52*	59	52	59	52	59	52	59
One	85	36	5	28	3	13	14	26
Two	15	56	53	61	45	75	46	64
Three	-	4	38	11	42	13	34	10
Four	-	4	5	-	7	-	5	1

*52 means school year of 1952-53 and 59 means school year of 1959-60.

CHAPTER V

MATHEMATICS IN KANSAS SECONDARY SCHOOLS

The school program in a changing society cannot remain fixed. The mathematics program, especially, must be in a continuous process of adjustment to the needs of youth and society. Sociological and economic trends, as well as the changing population in the secondary school, point to a probable need for modification in the school program.

Mathematics enrollment in Kansas is apparently on the increase. In 1952, 43 per cent of all the students were enrolled in mathematics courses, by 1959 51 per cent of the student-body were enrolled in mathematics. Group I, with 38 per cent in 1952, and 55 per cent, in 1959, showed the greatest increase and the largest per cent of the students enrolled in mathematics. There seems to be more interest in the courses plane geometry, intermediate algebra, solid geometry, and trigonometry, while general mathematics and elementary algebra showed a decrease of 2 per cent in their enrollments. Group III, with an increase from 19 per cent, in 1952, to 22 per cent in 1959, was the only Group showing an increase in either general mathematics or elementary algebra.

There has been an increase in the per cent of schools offering all branches of mathematics. According to Table

TABLE IX

NUMBER OF STUDENTS ENROLLED IN MATHEMATICS COURSES

Courses (year)	Group I 52	Group I 59	Group II 52	Group II 59	Group III 52	Group III 59	Total 52	Total 59	1957-58*
General Mathematics	279	246	432	340	141	91	852	677	14693
Elementary Algebra	682	640	1175	1084	234	277	2091	2001	24625
Plane Geometry	295	487	486	599	125	153	906	1239	13874
Intermediate Algebra	92	220	60	399	-	42	152	661	5287
Solid Geometry	80	101	45	34	4	4	129	139	1044
Trigonometry	-	63	-	106	4	25	4	194	1116
Senior Mathematics**	-	37	-	11	-	-	-	56	
Total	1428	1757	2198	2562	508	592	4138	4911	60639

NOTE: Year 52 means school year 1952-53 and year 59 means school year 1959-60.

*John M. Burger. Unpublished data collected in the preparation of "Background and Academic Preparation of the Mathematics Teachers in the Public High Schools of Kansas 1957-58," The Emporia State Research Studies, Vol. 7, 1959. This is based on all public high schools in Kansas.

**Senior Mathematics included college algebra, analytic geometry, etc.

TABLE X

PER CENT OF STUDENTS ENROLLED IN MATHEMATICS

Courses (year)	Group I 52	Group I 59	Group II 52	Group II 59	Group III 52	Group III 59	Total 52	Total 59	1957-58*
General Mathematics	8	8	9	6	12	8	9	7	15.6
Elementary Algebra	20	20	22	20	19	25	22	20	26.2
Plane Geometry	6	15	9	11	10	14	10	12	14.7
Intermediate Algebra	2	7	1	7	-	4	2	6	5.6
Solid Geometry	2	3	-	3	-	3	-	2	1.1
Trigonometry	-	2	-	3	-	2	-	4	1.2
Senior Mathematics**									
Total	38	55	41	50	41	56	43	51	64.4

NOTE: Year 52 means school year of 1952-53 and 59 means school year of 1959-60

*John M. Burger. Unpublished data collected in the preparation of "Background and Academic Preparation of the Mathematics Teachers in the Public High Schools of Kansas 1957-58," The Emporia State Research Studies, Vol. 7, 1959.

**Senior Mathematics included college algebra, analytic geometry, etc.

XII in 1952, 38 per cent of the schools were teaching general mathematics. By 1959, this had increased to 47 per cent. Group II showed the greatest increase in general mathematics, going from 33 per cent in 1952, to 50 per cent in 1959. In elementary algebra, Group III increased from 68 per cent in 1952, to 89 per cent in 1959. Group II increased from 93 to 100 per cent in 1959. Group I had 100 per cent in 1952 and 1959. Plane geometry increased from 65 per cent in 1952 to 85 per cent in 1959. One hundred per cent of Group I offered plane geometry in 1952 and 1959. The greatest change in course offerings was made in solid geometry and trigonometry. Solid geometry increased from 10 per cent in 1952, to 80 per cent in 1959. However, none of the Group II or Group III schools offered solid geometry in 1952 or 1959. The per cent of schools offering trigonometry increased in Group II from fifteen, in 1952, to thirty-three, in 1959, but Group I and Group III decreased, Group I from seventy to sixty and Group III from twelve to eleven. One of the Group I schools was offering college algebra and analytic geometry in 1959.

TABLE XI

NUMBER OF SCHOOLS OFFERING INDICATED MATHEMATICS COURSES

Courses	Group I 52*	Group I 59*	Group II 52	Group II 59	Group III 52	Group III 59	Total 52	Total 59
General Mathematics	7	8	18	27	13	12	38	47
Elementary Algebra	10	10	51	54	23	24	84	88
Plane Geometry	10	10	36	46	13	14	59	70
Intermediate Algebra	9	9	10	40	-	14	19	63
Solid Geometry	1	8	-	10	2	2	3	20
Trigonometry	7	8	8	18	4	7	19	33
Senior Mathematics**	-	1	-	-	-	-	-	1

*NOTE: 52 means school year 1952-53 and 59 means school year 1959-60.

**Senior Mathematics included college algebra, analytic geometry, etc.

TABLE XII

PER CENT OF SCHOOLS OFFERING INDICATED MATHEMATICS COURSES

Courses	Group I		Group II		Group III		Total	
	52*	59*	52	59	52	59	52	59
General Mathematics	70	80	33	50	38	44	38	47
Elementary Algebra	100	100	93	100	68	89	85	89
Plane Geometry	100	100	65	85	44	52	60	70
Intermediate Algebra	90	90	18	74	-	52	20	63
Solid Geometry	10	80	-	-	-	-	3	20
Trigonometry	70	60	15	33	12	11	19	33
Senior Mathematics**	-	10	-	-	-	-	-	1

*NOTE: 52 means school year 1952-53 and 59 means school year 1959-60.

**Senior Mathematics included College Algebra, Analytic Geometry, etc.

CHAPTER VI

SUMMARY

This study indicates that between 1952-53 and 1959-60 there has been a reversal in the trend in Kansas, which existed for a number of years, of declining proportion of high school students enrolled in mathematics courses. It is interesting to note here the similar results of a state survey in Michigan made by Lohela, curriculum director of the Escanaba, Michigan public schools, and presented at the 1957 meeting of the Michigan Schoolmasters Club. Approximately 53 per cent of all students enrolled in Michigan high schools the previous year were taking mathematics courses compared to about 61 per cent in 1925-26 and 47 per cent in 1950.[1]

Forty-three per cent of the High School students were enrolled in mathematics in 1952-53, 51 per cent in 1959. Eighty-five per cent of the schools offered elementary algebra in 1952, and 89 per cent in 1959-60. Plane geometry increased from 60 per cent in 1952-53 to 70 per cent in 1959-60. The most noticable change was in the offerings of the small schools, none offered intermediate algebra in

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[1]Arvo E. Lohela, "Upward Trend Noted in Mathematics Enrollments," National Association of Secondary School Principals Bulletin, Vol. 41, December 1957, p. 37.

1952-53 and 52 per cent in 1959-60. The large schools made a noticeable change in solid geometry, increasing from 10 per cent to 80 per cent in 1959-60.

If twenty-five college hours of mathematics is taken as a criterion for "well prepared" teachers, then 59 per cent of the teachers were not well prepared in 1959.

The teachers teach in more than two fields in 8 per cent of the large schools, 11 per cent of the intermediate size schools, 13 per cent in the small schools. This is an improvement, compared to 1952, when the numbers yielded none, 43 per cent and 49 per cent respectively.

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