THE CURRENT STATUS OF HIGH SCHOOL MATHEMATICS PROGRAMS IN NORTH CENTRAL TEXAS AS RELATED TO SELECTED FACTORS

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THE CURRENT STATUS OF HIGH SCHOOL MATHEMATICS PROGRAMS IN NORTH CENTRAL TEXAS AS RELATED TO SELECTED FACTORS

DISSERTATION

Presented to the Graduate Council of the North Texas State University in Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF EDUCATION

By

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Denton, Texas
June, 1970
# TABLE OF CONTENTS

**LIST OF TABLES** ........................................ iv

**Chapter**

**I. INTRODUCTION** ....................................... 1

- Statement of the Problem
- Purposes of the Study
- Definitions
- Limitations
- Background and Significance of the Study
- Procedures
- Instruments

**II. SURVEY OF THE LITERATURE** ...................... 18

- Introduction
- Literature Related to Teacher Preparation
- Literature Pertaining to High School Mathematics Programs
- Literature Related to Student Achievement and Aptitude

**III. PRESENTATION OF FINDINGS** .................... 50

- Introduction
- Teacher Preparation
- Course Offerings and Course Organization
- Student Aptitude
- Use of Textbooks
- Summary

**IV. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS** ........ 86

- Summary
- Conclusions
- Recommendations
- Recommendations for Further Research

**APPENDIX A** ........................................... 92

**APPENDIX B** ........................................... 99

**BIBLIOGRAPHY** ......................................... 102
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. High School Mathematics Courses Recommended by College Mathematics Teachers for High School Seniors</td>
<td>36</td>
</tr>
<tr>
<td>II. Distribution of Mathematics Teachers in a Selected Sample of Fifty High Schools in North Central Texas</td>
<td>51</td>
</tr>
<tr>
<td>III. Distribution of Types of Bachelor's Degrees Held by 210 Mathematics Teachers in a Selected Sample of Fifty High Schools in North Central Texas</td>
<td>53</td>
</tr>
<tr>
<td>IV. Distribution of Types of Master's Degrees Held by Mathematics Teachers in a Selected Sample of Fifty High Schools in North Central Texas</td>
<td>55</td>
</tr>
<tr>
<td>V. Preparation in Mathematics for 210 Teachers of Mathematics in a Selected Sample of Fifty High Schools in North Central Texas</td>
<td>57</td>
</tr>
<tr>
<td>VI. Course Preparation of 210 Mathematics Teachers in a Selected Sample of Fifty High Schools in North Central Texas</td>
<td>58</td>
</tr>
<tr>
<td>VII. Length of Teaching Experience of 210 Mathematics Teachers in a Selected Sample of Fifty High Schools in North Central Texas</td>
<td>59</td>
</tr>
<tr>
<td>VIII. Availability and Frequency of Course Offerings in a Selected Sample of Fifty High Schools in North Central Texas</td>
<td>61</td>
</tr>
<tr>
<td>IX. Recommended Sequences of Mathematics Courses for Students in a Selected Sample of Twenty-Four Small High Schools in North Central Texas</td>
<td>63</td>
</tr>
<tr>
<td>Table</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>X. Recommended Sequences of Mathematics Courses for Students in a</td>
<td></td>
</tr>
<tr>
<td>Selected Sample of Twelve Medium High Schools in North Central Texas</td>
<td>65</td>
</tr>
<tr>
<td>XI. Recommended Sequences of Mathematics Courses for Students in a</td>
<td></td>
</tr>
<tr>
<td>Selected Sample of Fourteen Large High Schools in North Central</td>
<td>68</td>
</tr>
<tr>
<td>Texas</td>
<td></td>
</tr>
<tr>
<td>XII. Class Sizes in Mathematics in a Selected Sample of Fifty High</td>
<td></td>
</tr>
<tr>
<td>Schools in North Central Texas</td>
<td>69</td>
</tr>
<tr>
<td>XIII. Summary of Students' Scores on Mathematics Section of</td>
<td></td>
</tr>
<tr>
<td>Scholastic Aptitude Test</td>
<td>71</td>
</tr>
<tr>
<td>XIV. Summary of Differences Between Means of Mathematics Scores Made</td>
<td></td>
</tr>
<tr>
<td>By Students From the Three Groups of Schools</td>
<td>72</td>
</tr>
<tr>
<td>XV. Textbooks Adopted by a Selected Sample of Small, Medium, and</td>
<td></td>
</tr>
<tr>
<td>Large High Schools in North Central Texas</td>
<td>73</td>
</tr>
<tr>
<td>XVI. Ratings of State Adopted Textbooks by the Mathematics</td>
<td></td>
</tr>
<tr>
<td>Consultants of the Texas Education Agency</td>
<td>77</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

For many years practices in mathematics have been undergoing an evolutionary change. What first began as a few experimental programs in the early and middle 1950's has now mushroomed into an important and accepted method of presenting mathematics in the public schools and colleges across the country.

The language of mathematics is not the only different change in the construction of contemporary mathematics. The concepts behind the language, the emphasis on discovery and understanding, and the roles of the teacher and the pupil are just a few of the other changes that have taken place. Because mathematics is changing, it is necessary that the high schools' mathematics programs and the teaching practices associated with them change also.

Statement of the Problem

The problem of this study was to investigate and compare the current status of mathematics programs in large, medium, and small high schools in North Central Texas in relation to selected factors.
Purposes of the Study

To further clarify the problem the following purposes were formulated:

1. To compare the mathematics preparation of mathematics teachers in large, medium, and small high schools of North Central Texas.

2. To identify and report the current mathematics programs in North Central Texas high schools of large, medium, and small enrollment.

3. To compare the sizes of mathematics classes of large, medium, and small high schools of North Central Texas.

4. To compare the scores on the mathematics section of the College Entrance Examination Board Scholastic Aptitude Test made by seniors from the large, medium, and small high schools of North Central Texas.

5. To determine which textbooks were being used by the high schools in North Central Texas and the ratings of these textbooks as determined by selected mathematics consultants.

Definitions

High school—in the context of this study, high school includes grades 9-12.

Large high school—a high school that is classified as AAAA by the Texas University Interscholastic League. These schools have enrollments of 1020 or more pupils in grades 9-12.
Medium high school--A high school that is classified as either AAA or AA by the Texas University Interscholastic League. The high schools in these two classifications have enrollments of 225-1020 pupils in grades 9-12.

Small high school--A high school that is classified as either A or B by the Texas University Interscholastic League. The schools in these two classifications have enrollments of 225 or fewer pupils in grades 9-12.

Scholastic Aptitude Test--A test of the College Entrance Examination Board given to candidates for college entrance. The test consists of two parts: (1) verbal aptitude, and (2) mathematical aptitude.

Limitations

1. This study was limited to the high schools that are in the eighteen counties of the Texas Education Service Center, Regions X and XI.

2. In comparing the mathematical aptitude of the students, this study was limited to those students who graduated in 1969 from the schools in the eighteen counties.

Background and Significance of the Study

In the early 1950's, there arose a general discontentment with high school mathematics across the country. Certain local and national committees were formed with the major purpose of all to improve the mathematics program. The University of Illinois Committee on School Mathematics (1) was
one of these national groups. Their primary goal was a more efficient and effective way to teach mathematics. In 1958 the School Mathematics Study Group (2), perhaps the most widely known of all the programs, came into existence. The primary goal of the program was devoted to the improvement of mathematics in high school. The program's primary function was to foster research and development in the teaching of high school mathematics. The research consisted mainly in the development of courses, materials, and teaching methods (2).

Other programs which have influenced the teaching of mathematics in the high schools are the Ball State Teachers Experimental Program, the Commission on Mathematics, The University of Maryland's Mathematics Project, the College Entrance Examination Board's Committee on Examinations, and the Committee on Undergraduate Programs in Mathematics (15, 16, 7).

There have been a number of studies conducted that have compared different aspects of traditional mathematics with modern mathematics. Kinsella (14, pp. 42-43) in a study of the first courses in algebra, found that most of the criticisms were directed toward the teaching methods and learning it involved rather than the topical content. He discovered three frequently cited criticisms: (1) there was too much emphasis on manipulative skill and too little emphasis on understanding; (2) loss of subject matter between high school and college; and (3) the teacher's ignorance of the modern conception of algebra as the study of mathematical structure (13).
Rosenbloom (20), Cassels (5), Bernstein (3), and Payne (17), in individual studies, reported that the experimental groups using textbooks oriented toward the modern mathematics outscored the control groups using conventional textbooks in Algebra I.

Payne (18) summarized his article with the conclusion that studies reported up through May of 1965 pointed overwhelmingly to the fact that modern programs are as effective as traditional programs in developing traditional skills. There was also ample evidence to support the conclusion that modern materials may be appropriate for a wide range of student ability. It was also found that modern materials would improve student achievement in computational skills. The modern programs provide teachers with usable materials that may be utilized with a minimum amount of preparation.

Our teachers on all levels, in primary and secondary schools as well as in colleges, must be competent enough to teach mathematics with an understanding of traditional mathematics and a searching appreciation of the modern point of view; and they must be able to convey to our students a new insight into the mathematical thought and of its role in our culture (10, p. 1).

From the information on the new mathematics with respect to the content, teaching methods, and understanding a teacher must have, it is imperative that the high schools have only the best qualified teachers available teaching mathematics. In the Texas Education Agency's Handbook for Secondary School Principals (13, p. 127), the basic requirement for teaching mathematics full time in a high school in Texas is twenty-four
semester hours of preparation in mathematics. The minimum requirement for teaching mathematics part time in a Texas high school is also twenty-four semester hours of preparation in mathematics. According to the National Education Association (21), the national average for the basic requirement is twenty-one and seven-tenths hours of preparation in mathematics. The national average for the minimum requirement is seventeen and nine-tenths hours of preparation in mathematics. Although the basic and minimum requirements are not met in all Texas high schools, it is evident from the report of the National Education Association that the listed requirements in Texas are among the highest in the nation.

In the fact book *High Schools in the South* (9), which includes eleven states (excluding Texas), the modal number of mathematics courses in grades 9-12 was as listed:

<table>
<thead>
<tr>
<th>Number of Pupils</th>
<th>Number of Courses</th>
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<tbody>
<tr>
<td>99 or fewer</td>
<td>3</td>
</tr>
<tr>
<td>100 - 249</td>
<td>4</td>
</tr>
<tr>
<td>250 - 499</td>
<td>4</td>
</tr>
<tr>
<td>500 - 999</td>
<td>6</td>
</tr>
<tr>
<td>1000 - 1499</td>
<td>7</td>
</tr>
<tr>
<td>1500 - 1999</td>
<td>7</td>
</tr>
<tr>
<td>2000 or more</td>
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These data support the generalization that added depth, expressed in terms of additional course offerings per subject area, is found in the curricular programs of larger schools. A positive relationship was found between the percentage of
teachers with master's degrees and the size of the high school. An inverse relationship was found between the number of teachers who had less than a bachelor's degree and the size of the high school (9).

As stated by the Division of Surveys and Field Services (9), the quality of any program of instruction in a high school is largely determined by the quality of the staff. Investigations have shown that teachers who are properly certified in their respective areas and who have advanced college training are more efficient in their teaching (9, p. 37).

Puett (19) points to the fact that many schools, particularly the small schools, are having a difficult time keeping up with the new developments in all the academic areas. Until improvements have been made in the existing programs, it will be difficult for national, state, and local committees to aid the schools.

Donovan A. Johnson, past president of the National Council of Teachers of Mathematics, reflected on the need for improved programs in mathematics when he said,

The mathematical competence of many of our students is certainly not as high as it could be under optimum conditions. Problems caused by large classes, great differences in aptitude, inadequate materials, unprepared teachers, and unsatisfactory course content need to be solved. The mathematics programs of our schools urgently need to be evaluated and strengthened. The wealth of resources in the form of new texts, new topics, new materials, new emphasis, and new methods need to be put into use in every school (11, p. 1).
This statement was also reflected in another article co-authored by Johnson (12). It was stated that before any group can make specific recommendations or suggestions for revising or developing a curriculum in a particular school or school district, it must survey the current situation in mathematics. It was with this thought in mind that this study was undertaken. It has also been approximately a decade since the mathematics programs in the high schools across the country were thoroughly assessed. Although there have been many schools that continually assessed and updated their mathematics programs, there have been many schools that have failed to do this. For those schools that continually assess their mathematics programs, the results of this study will serve as a much needed secondary source of information. For those schools that have not assessed their mathematics programs within a recent number of years, the results of this study will be a valuable aid and guide to improvement in the mathematics curriculum. It was also hoped that the report would be an incentive to schools and school districts for needed reform and advancement in curriculum planning.

Procedures

In order to obtain the information on the mathematics programs in the high schools of North Central Texas, the following steps were followed:
1. A list of all the high schools in the eighteen counties of the Texas Education Center, Regions X and XI, was compiled from the 1968-1969 edition of the Public School Directory (22).

2. The schools were then divided into three groups according to enrollment. This was done for comparisons among the three groups of schools. The rules book for the Texas University Interscholastic League was used to classify the schools as large, medium, and small.

3. Through the use of stratified random sampling (24, pp. 124-128), the number of schools selected from each category was found by using the general formula

$$n_h = \frac{N_h}{N} \times n$$

where

- $N_h =$ total number of schools in category $h$
- $N =$ number of schools in total population
- $n =$ number of schools in sample

There were 189 high schools in the eighteen counties of North Central Texas. It was decided that a sample of fifty high schools would be representative of all the high schools in the eighteen counties. Through the use of the general formula, the number of large schools selected was

$$\frac{52}{189} \times 50 = 13.7 \text{ or } 14 \text{ schools}$$

The number of medium schools selected was

$$\frac{44}{189} \times 50 = 11.6 \text{ or } 12 \text{ schools}$$
The number of small schools selected was

\[
\frac{23}{189} \times 50 = 24.4 \text{ or 24 schools}
\]

4. The schools in each classification were then listed alphabetically with each school being assigned a number.

5. Through the use of a random number table (23), twenty-four small schools, twelve medium schools, and fourteen large schools were selected. An additional number of schools in each classification was selected as alternates in the event some of the schools preferred not to, or could not, participate. Through the use of the same random number table, twelve small schools, six medium schools, and seven large schools were selected as alternates.

The procedures that were followed in obtaining permission and in visiting the high schools to collect the necessary information were somewhat different for each classification.

For visits to the small schools, a letter of introduction was sent to each superintendent of the school district in which the school was located. The letter contained information about the study and the procedures to be followed when visiting the school. If the superintendent granted permission to visit the high school, he returned a post card which indicated the week that would be the most convenient time to visit the school.

Once the post cards had been returned, a telephone call was placed to the principals of the high schools. An appointment was set up to discuss certain aspects of the mathematics
program. After the information concerning the course offerings, course organization, and class size was obtained, the students' mathematics scores on the Scholastic Aptitude Test were recorded. These scores were obtained from the school records.

The information concerning the professional preparation of the teachers was obtained from their college transcripts. The transcripts were located in the superintendents' offices. In most of the small schools, the high school principal's office and the superintendent's office were in the same building. Each teacher's service record was analyzed to determine the over-all length of teaching experience and the length of teaching experience in the present position.

The same general procedures were followed for visits to the medium schools. The procedure differed when obtaining the students' mathematics scores on the Scholastic Aptitude Test and when obtaining information on the preparation of the teachers. An appointment was made with the counselor of each school so that the students' scores could be recorded. In each of the small and medium schools, all of the students' scores were recorded. In the large schools a random number of scores from each school was selected. A random number table (23) was used to select the first score and then every fifth score thereafter was recorded. To gather information on the professional preparation of teachers, the central administration office had to be visited. Here, the undergraduate
college mathematics courses, type of degree, graduate work, and number of hours in mathematics were obtained.

In the large schools, the information concerning course offerings and course organization was obtained from the mathematics consultants of the school districts in which the schools were located. The class sizes were recorded from records in the central administration offices. The mathematics teachers in the large schools were asked to fill out and return a prepared sheet which contained information about their professional preparation.

To determine the over-all appropriateness of the mathematics textbooks in use by the high schools in the study, the mathematics consultants of the Texas Education Agency were asked to rate the textbooks in each subject. The consultants were asked to rate the textbooks on four points:

1. Modernness
2. Content
3. Presentation of subject matter
4. Appropriateness for high school use

Instruments

The instrument that was used in gathering data was a checklist (See Appendix B) that was completed either through an interview with the heads of the mathematics departments or the principals of the schools. Data pertaining to the schools were also obtained from visits to the Texas Education Agency.
The interview checklist consisted of sections on teacher preparation, course offerings and course organization, and textbooks in use.

The **College Entrance Examination Board Scholastic Aptitude Test** consists of five sections, each with a thirty minute time limit. The first three sections are scored together to make up the verbal subtest. The last two, designated as Arithmetic Reasoning, although they contain considerable algebra and geometry, are scored together as a mathematics subtest.

The two subscores are of adequate reliability to be used separately, the reported reliability being in the vicinity of .90 (8, p. 319). In the college admission situation the validity of a test is usually regarded as practically synonymous with its power to predict success in college. If it predicts with a high degree of accuracy, it has high validity; if it predicts inadequately, it has low validity. The correlation between the mathematics section of the **Scholastic Aptitude Test** and average freshman grades is .37 for men and .37 for women in liberal arts colleges and .59 for engineering students (4, p. 449).

The questions on the mathematics section of the **Scholastic Aptitude Test** are designed to measure abilities related to college-level work in the liberal arts, engineering, and other related fields requiring mathematics. The questions do not require going beyond elementary algebra or the simple geometry concepts taught in junior and senior high school.
Advanced mathematics is not required in the solution or the interpretation of any of the questions (24, p. 23).

According to Dailey (8, p. 319), in a review of the Scholastic Aptitude Test in the fifth edition of the Mental Measurements Yearbook, the test is essentially a conventional, general abstract "intelligence" test at the bright adult level that does an efficient job of estimating liberal arts scholarship.
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CHAPTER II

SURVEY OF THE LITERATURE

Introduction

There was an abundance of material related to the topic under study. In order to enhance the organization, the literature reviewed was divided into the following four categories: (1) literature concerning size of high school; (2) literature related to teacher preparation; (3) literature pertaining to high school mathematics programs; and (4) literature related to student achievement and aptitude.

Literature Concerning Size of High School

Within the past decade there have been numerous studies made concerning the size of high schools and different aspects of their educational processes. One of the earliest reports which included the size of high schools was conducted by Conant (11). He recommended that a high school have a graduating class of at least 100 students in order that the curriculum would be diversified enough to accommodate all the students in the school (11, p. 77). DeGood (14) conducted a study which sought to identify differences which existed in high schools due to the size of the schools. Three assumptions were made concerning the study:
1. High salaries tend to attract abler teachers.

2. Teachers with several years of experience tend to be superior to teachers with limited experience.

3. Teachers with graduate degrees tend to perform better than teachers without graduate degrees.

Although DeGood could not offer a profile to fit all schools, certain distinctions predominated. Some of those distinctions follow. In the small high schools

1. teachers receive lower salaries,

2. teachers have fewer years of experience, and

3. teachers are less likely to hold graduate degrees.

A study undertaken to examine the relationship between size of secondary schools and the quality of the educational program was conducted by Ovaitt (39). His study revealed that high schools with enrollments of less than 600 students tended to have a high percentage of teachers teaching in subject areas in which they did not have a teaching major. It might also be pointed out that another study, conducted by Zinser (55), showed no significant relationships between size of school and teacher morale.

The Western States Small Schools Project (2) and the Texas Small Schools Project (5) were two projects which were designed to improve the quality of education in the small schools. The Texas Small Schools Project was founded in 1959 with the purpose of providing quality and varying educational experiences for students in small schools. During the
1966-67 school year, the Texas Small Schools Project included 116 schools with a total enrollment of 29,675 students. The Project revealed that among the techniques employed for enriching the curricula were multiple classes, supervised correspondence courses, flexible scheduling, team teaching, and student science demonstrations (5).

Closely related to the size of the school is class enrollment. A study reported in the NEA Research Bulletin (32) indicated a number of positive effects small classes had on teachers' behavior. It was found that teachers tended to invent more practices and adopt more readily the newer practices invented by others. It was also found that teachers tended to use practices designed to produce greater understanding of the aptitudes and needs of the individual pupils. Pugh (42) recorded similar findings when working with classes of twenty or less. According to Pugh, the most important observation made concerning small classes was that "individual differences and needs of pupils were better served in classes numbering twenty or fewer pupils" (42, p. 635).

In the state of Texas, there was a slight increase in the average class size of mathematics classes from the 1967-1968 school year to the 1968-1969 school year. According to figures released by the Texas Education Agency (51), the largest gain was made in trigonometry classes where a five per cent increase was reported. The smallest gain was in the
area of Related Mathematics II, where approximately one percent more were enrolled.

In summary, the largest schools have a higher percentage of teachers who are teaching in subject areas in which they have a teaching major. The mathematics teachers in the small schools tend to have fewer years of teaching experience and are less likely to hold graduate degrees. There have been a number of states that have helped improve the curriculum in the small schools through small schools projects.

Literature Related to Teacher Preparation

Much of the interest in high school mathematics programs during the last decade has been concerned with the ability and qualifications of mathematics teachers. One of the major areas of concern is the preparation and qualification of mathematics teachers in the small schools. Lohela (28), in a study of the enrollment characteristics and teacher preparation in Michigan secondary schools, found that mathematics teachers in the smaller schools tended to be less prepared and less experienced than teachers in the larger schools. Torrance (54) found that approximately 18 per cent of the mathematics and science teachers in the smaller high schools are less than twenty-five years old compared with about 5 per cent of the mathematics teachers in the smaller schools reported one or less years of teaching experience while the percentage of mathematics teachers in the larger schools who reported one or less years of teaching experience was eight.
In 1965 Cawelti (10) surveyed high schools in the North Central Association region to determine trends in secondary schools. He found that 8.1 per cent of the teachers were unqualified. Approximately two-thirds of these unqualified teachers had inadequate subject matter preparation. The largest number of these unqualified teachers were in fine arts, science, and mathematics. Of these three groups, the field of mathematics had the largest percentage of unqualified teachers.

In a study which surveyed the preparation of mathematics teachers in high schools of North Central Oklahoma, Necemek (35) reported the following:

1. Eighty per cent of the teachers had earned or were working towards a master's degree, and 5 per cent were working towards a doctorate.

2. Ninety-two per cent had earned either a major or minor in mathematics at the undergraduate level.

3. The median number of hours of preparation in mathematics was twenty-nine.

Brown and Obourn (7) conducted a study in 1959 to determine the qualifications of science and mathematics teachers in Maryland, New Jersey, and Virginia. Their findings indicated that 7.1 per cent of the 779 mathematics teachers had no preparation in college mathematics. For the most part, the course taught by these teachers was general mathematics. The average number of semester hours in mathematics for the
teachers in the different schools ranged from seventeen to twenty-three. It was found that only 61 per cent of the mathematics teachers had taken courses in calculus or beyond.

In a study of the background and academic preparation of mathematics teachers in the public high schools of Kansas, Burger (9) examined the official records of over 1,000 mathematics teachers. The results showed that approximately 33 per cent of the teachers had majored in mathematics on the undergraduate level. Over 50 per cent of the teachers had less than twenty-one hours of preparation in mathematics. Forty-two per cent of the total number of teachers had completed calculus.

Pruitt (41) undertook a study in 1962 to determine the mathematical preparation in college mathematics of teachers in Ohio public schools who had less than eight years of teaching experience. The findings indicated that less than one-third of the mathematics teachers had a major in mathematics. Also, one out of every five teachers had earned less than twenty-seven quarter hours in college mathematics. Five per cent of the teachers had not earned any credit in college mathematics.

Scamman (44) conducted a study to determine whether assigned subject areas of teachers related to their academic preparation. The study also sought to determine the relationship of selected variables to efficiency of course assignment. He defined efficiency ratio as the percentage of assignments
in which the teacher had thirty or more semester hours of preparation in that field. His two major conclusions were (1) efficiency ratio was directly proportional to school enrollment, and (2) academic subjects had lower efficiency ratios than the co-curricular subjects. Mathematics had an efficiency ratio of .49 (44, p. 5832). The ratios ranged from .53 in communicative arts to .38 in social studies.

The preparation of mathematics teachers in high schools of West Virginia was studied by Regula (43) with the purpose of describing the current conditions in the high schools. In this study, eighteen semester hours of college mathematics was selected as a minimum requirement for adequate preparation for mathematics teachers. On the basis of this criterion, 31.7 per cent of the respondents had inadequate preparation in mathematics. Approximately 9 per cent of the teachers had no college mathematics. The median preparation in mathematics of all respondents was twenty-two semester hours.

Only 26 per cent of the respondents in Regula's (43) study had thirty or more semester hours in college mathematics. He also found that 34 per cent of the respondents had earned master's degrees. However, only 11 per cent of the recipients of master's degrees had included graduate mathematics courses in their programs.

In a survey of the secondary mathematics programs in Missouri, with emphasis on the preparation of teachers, Alspaugh (1) reported the following:
1. The mean number of hours of mathematics taken by the teachers was 32.8.

2. All of the teachers in the sample had bachelor's degrees and 28 per cent had master's degrees.

3. Fifty-eight per cent of the teachers had taken an undergraduate methods course in the teaching of mathematics. 

Smith (48), in a survey of the mathematics programs in Illinois for the 1963-1964 school year, found the following:

1. Mathematics teachers in the small high schools spent more time in the classroom and received less pay than those teachers in the larger schools.

2. More beginning teachers were in the small high schools than in the large high schools.

3. One-fourth of the mathematics teachers taught courses other than mathematics.

4. Sixty-two per cent of the mathematics teachers had received credit-hours in mathematics since 1960.

5. The teachers in the larger high schools tended to teach the new materials more than those teachers in the smaller high schools.

There have been a number of studies conducted that have been concerned with the mathematics education programs in colleges and universities and with the preparation of future secondary school mathematics teachers. One such study was conducted by Ford (20) in which the prime objective was the following:
to ascertain the extent to which persons who are preparing for the teaching of secondary mathematics are being provided with experiences in mathematics necessary to understand and to teach content in secondary mathematics programs advocated and promoted by various national committees and organizations (20, p. 543).

Ford reached three main conclusions. The first was that the future teachers of high school mathematics were being provided with experiences which were pertinent to both the traditional program of secondary mathematics courses and the experimental programs recommended by the various national organizations. The second conclusion reached was that the weakest point in the preparation of future mathematics teachers was in the area of geometry. It was in this area that the prospective teacher was not acquiring the experiences in the type of mathematics he would probably be teaching. The third conclusion, and probably the most important, was that there were indications that the person being prepared to teach mathematics in the secondary schools would be unfamiliar with the types of secondary mathematics programs in which he would probably be teaching (20). Johnson (25) was in agreement with Ford when he stated that the present sequence of courses in education and mathematics was not sufficient enough to prepare mathematics teachers for schools of tomorrow.

Sister Mary Matthew Donovan (16) conducted a survey in which she studied and evaluated data in order to draw up a program that would improve the preparation of secondary mathematics teachers. She found that there was a general agreement
on the value of courses in algebra, calculus, trigonometry, and history of mathematics. Her recommendations included a minimum of twenty-four semester hours of mathematics which would include the following: (1) algebra, (2) trigonometry, (3) analytic geometry, (4) calculus, (5) college geometry (with an introduction to non-Euclidean geometry), (6) history of mathematics, (7) theory of numbers, (8) theory of equations, and (9) descriptive geometry. She also recommended a course in applied mathematics rather than pure mathematics.

The Committee on the Undergraduate Program in Mathematics of the American Mathematical Association (30) has proposed the following sequence of mathematics courses as a minimum preparation for high school teachers of mathematics:

1. nine semester hours in analysis (three hours in analytic geometry and six hours in calculus),
2. six hours in abstract algebra,
3. six hours in probability and statistics, and
4. six hours in advanced electives.

In 1959, in a report by the Subcommittee on Teacher Certification, the Cooperative Committee on the Teaching of Science and Mathematics of the American Association for the Advancement of Science (22) made the following recommendations for the preparation of high school mathematics teachers:

1. twelve hours of analysis,
2. three hours of probability and statistics,
3. three hours of abstract algebra,
4. three hours of geometry, and
5. nine hours of applied mathematics.

In 1961 Texas Education Commissioner J. W. Edgar recommended a change in the requirements for certification. The main objective in changing the requirements was to strengthen the requirements in a teacher's academic specialization—the subject matter field. Prior to September 1, 1962, the requirements were as follows:

- Plan I (two teaching fields)—24 and 18 semester hours
- Plan II (one teaching field)—36 semester hours

The new requirements still called for the two plans, but they were arranged as follows:

- Plan I (two teaching fields)—24 and 24 semester hours
- Plan II (one teaching field)—48 semester hours

In a study to determine factors which were present in effective teachers of secondary school mathematics, Nelson contacted a sample of public school administrators in Nebraska and asked them to name outstanding, superior, and above average teachers in their schools. The results indicated that the most capable teachers had undergraduate majors in mathematics. The findings also showed that the most capable teachers had full teaching loads in mathematics and were assigned to teach upper level courses.

In an effort to examine the interrelationships among school enrollment size, organizational pattern, and various factors affecting the program adequacy in secondary schools
in eleven Southern states, Jackson (24) found that a positive relationship existed between enrollment size and professional qualifications of teachers. It was also found that the three year schools had a higher percentage of teachers holding advanced degrees than did schools of other organizational patterns. Crocker (13) also pointed to the fact that in the larger schools the subjects tended to be taught by teachers who had majors in that field. One of the conclusions he drew was that the program of study tended to improve as the size of the enrollment of the school increased.

Although most studies are concerned with the academic preparation of teachers, Douglass (17) notes several sources which lead to inadequacy in the preparation of high school teachers in small schools:

1. Lack of understanding of rural culture.
2. Inexperience resulting from initial experience in smaller schools.
3. Teachers not well prepared by teacher-training institutions to cope with problems of smallness.
4. Impracticability of gaining enough diversified background to qualify for the many demands that would go with a diversified program handled by few people (17, p. 630).

Bedient (4) conducted a study to compare the high school preparation of groups of students who performed at a high level in college mathematics with the preparation of groups of students who performed at a lower level. The study showed
that the high school teachers in schools with more effective programs, as measured by post-performance in collegiate mathematics of their former students, were younger and more recently educated. They also had a better knowledge of the mathematical content of modern instructional material and were more familiar with and made greater use of these materials.

A comparison of the relationship between teacher preparation and the amount of curriculum innovation in a high school was made by Eibler (19). In the Detroit area twenty-six high schools were studied. Five of these schools were high innovating and five were low innovating. It was found that faculties of high innovating schools were academically better prepared. The faculties of low innovating schools were younger and had less over-all teaching experience and less experience in their present building. Douglass (17) concluded that because of the younger ages of teachers in small schools and the fact that they "move on" to larger schools as soon as possible, curriculum innovation undergoes a slowing down process.

Annis (3) sought to determine the applicability of college mathematics courses to the preparation of high school mathematics teachers. In general, the courses for the major in mathematics met the approval of the teachers. Some teachers felt that the more advanced college mathematics courses were not very applicable to the preparation of high
school mathematics teachers. The study also revealed that the teachers who had taken more advanced courses tended to rate a given college mathematics course higher than those teachers who had more elementary material.

Nielson (36), in a study of mathematics instruction in Iowa high schools, found that all the teachers in the sample had a bachelor's degree, and over 80 per cent had taken some work towards the master's. Nearly 50 per cent of the teachers had a major in mathematics, and 30 per cent more had a minor in mathematics.

Because of the emphasis on the "new math," Lyng (29) conducted a study in order to determine the relation of knowledge of contemporary mathematics to other variables for a sample of experienced secondary mathematics teachers. The findings showed that a teacher's knowledge of contemporary mathematics increased as his mathematical depths and understanding increased, and as his experience teaching contemporary mathematics increased.

In an attempt to assess the current status of mathematics programs in secondary schools in the United States, Schaefer (45) selected Catholic secondary schools in a seven state area as the source for information. The study entailed an analysis of the mathematics programs with respect to professional preparation of teachers, instructional organization, content of academic courses, and facilities.
The results of the study by Schaefer (45) showed that all forty teachers participating had at least a bachelor's degree, and eighteen of these teachers held master's degrees. However, only 27.5 per cent of the teachers had an undergraduate major in mathematics. Of the participating teachers, 72.5 per cent had earned a minimum of twenty-four semester hours in mathematics. The mean number of hours of mathematics preparation reported by the teachers was 34.8.

Altimiller, Gascay, Hausken, and Sucher (2) conducted a study to determine the status of schools of the Western Small Schools Project. The findings concerning the professional preparation of teachers were as follows:

1. Only 1.1 per cent of the secondary teachers had no college degree.

2. For the most part, secondary teachers were teaching in their fields of college preparation. An exception to this was mathematics teachers, some of whom were teaching with no college preparation in mathematics.

3. Secondary teachers had from one to seven years of teaching experience above the national average.

In summary, it is evident from the surveys and studies that have been conducted that the majority of better prepared and more qualified mathematics teachers are in the larger high schools. The degree of professional preparation seems to vary from those who have extensive preparation in mathematics to those who have no preparation in college mathematics. From
the reports of the national committees that are concerned with the teaching of high school mathematics, it is stressed that at least thirty semester hours in mathematics are needed to teach mathematics effectively in the high schools.

Literature Pertaining to High School Mathematics Programs

The National Education Association (33, p. 56) surveyed a sample of small high schools in 1962 to determine the availability of different mathematics courses in small high schools. The small high schools were divided into three groups: (1) enrollments under 100, (2) enrollments from 100 to 199, and (3) enrollments from 200 to 299. The sharpest contrasts were found between the smallest and largest of the small high schools. Among the findings of the study were the following:

1. Algebra was offered in every small school. Eight per cent of the schools did not offer it every year.

2. Eighty-one per cent of the small high schools offered geometry every year. Fifteen per cent of the schools offered it every other year.

3. Trigonometry was offered in 60 per cent of all the small high schools. This included 16 per cent that did not offer it every year. A sharp contrast was discovered here between the smallest and largest of the small high schools. In the group of schools classified as the largest, 76 per
cent offered trigonometry. In the group of schools classified as the smallest, 41 per cent offered trigonometry.

A large percentage of the small high schools did not offer any courses in foreign language or advanced courses in science and mathematics. When these courses were offered, they were limited to the number of semesters of study available or in the frequency of availability.

Schaefer (45) conducted a study to determine the current status of mathematics programs in secondary schools of the United States. Her sample was comprised of thirteen Catholic schools in a seven state area. She reported that all of the schools in the study offered the traditional sequence of high school mathematics courses: (1) Algebra I, (2) geometry, (3) Algebra II, and (4) Twelfth-Year Mathematics. The senior course in mathematics was usually composed of a semester of trigonometry and a semester of an advanced mathematics course. For the terminal high school student, Algebra I or General Mathematics I was required. The second mathematics course could be either Algebra I or General Mathematics II.

A significant study was made by Sparks (49) as he compared mathematics programs in Iowa high schools that ranked high and low in mathematical achievement. The study was designed to describe the differences which existed between the mathematics programs in a group of schools whose students made the greatest gains in mathematical achievement and a group of schools whose students made the least gains in
mathematical achievement over a three year period. Scores made on the Iowa Tests of Educational Development were used as the basis for mathematical achievement. From the results of the study, Sparks made the following conclusions:

1. The students in the high schools who made the greatest gains in achievement in mathematics take more mathematics courses than do students in schools showing the least gains.

2. Teachers in the high achievement group of schools had been in their present schools for a longer period of time than teachers in the low achievement group of schools.

3. Teachers in the high achievement group of schools had taken more semester hours of mathematics in college than had teachers in the low achievement group of schools.

The mathematics programs in the Negro high schools in Louisiana were analyzed by Crawford (12) to determine what courses were offered and to determine the extent to which the content of the textbooks reflected the modern viewpoint in mathematics. There were sixty-five schools in the sample.

Crawford found that all schools offered courses in general mathematics, Algebra I, and geometry. Thirty-five per cent of the schools offered a course in advanced mathematics while 14 per cent offered courses in trigonometry. Of the sixty-five schools, none had courses in analytic geometry, calculus, matrix algebra, or probability and statistics. Approximately 94 per cent of the teachers were
certified to teach mathematics. Approximately 82 per cent of the schools had a graduating class of 100 or less in 1966.

There have always been differences in opinions as to what the content of the twelfth-year mathematics course should be. Buchanan (8) surveyed 223 colleges and universities to find out which high school mathematics courses college mathematics department heads preferred high school seniors to take. It was assumed that the first course during the first semester of the year would be a course in elementary analysis as recommended by the Commission on Mathematics of the College Entrance Examination Board. The results obtained by Buchanan are presented in Table I.

<table>
<thead>
<tr>
<th>Course</th>
<th>Percentage of Department Heads in Favor of Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytic Geometry</td>
<td>61</td>
</tr>
<tr>
<td>Additional Elementary Analysis</td>
<td>14</td>
</tr>
<tr>
<td>Probability and Statistics</td>
<td>12</td>
</tr>
<tr>
<td>Matrix Algebra</td>
<td>14</td>
</tr>
<tr>
<td>Calculus</td>
<td>8</td>
</tr>
</tbody>
</table>

In a similar study, differing only in the point that the first semester of the senior year mathematics course would be devoted to trigonometry, thirty-two department heads of
mathematics in college and universities were asked to name the course that should be taken by high school seniors during the second semester (31). The results of the study were very much like the results obtained by Buchanan. Fifty-three percent of the respondents indicated that analytic geometry should be taken. Sixteen percent thought that the second semester course should be probability and statistics. Sixty-nine percent of the respondents did not favor the inclusion of a course in calculus in high school.

In *Principles and Standards for Accrediting Elementary and Secondary Schools*, the Texas Education Agency states: "The curriculum should offer a wide range of courses suitable for the variety of individual differences found in the school's enrollment" (50, p. 169). Students who would like to continue their education in college should take as many of the following mathematics courses as possible in high school: (1) Algebra I, (2) Algebra II, (3) geometry, (4) trigonometry, (5) elementary analysis, (6) analytic geometry, and (7) probability and statistics. For those high school students who do not plan on entering college after graduation, the curriculum should include Related Mathematics I, Related Mathematics II, and consumer mathematics.

Orr (38) reports that the large city schools tend to be able to provide more diversified curricula and also to make better provisions for special groups. He also states that
the larger city schools tend to have the most teachers, the best prepared teachers, and the largest class sizes.

In a study of mathematics instruction in Iowa high schools, Nielson (36) found that the number and nature of courses provided in the mathematics curriculum were comparable to those of other states. In another study which was designed to look at the mathematics curriculum in the small high schools, Iwamoto (23) found that although only one-third of the students went to college, the programs were chiefly designed for the college bound.

In summary, there was general agreement as to the courses which should be offered in the ninth, tenth, and eleventh grades. These courses were Algebra I, geometry, and Algebra II. For the terminal student, related mathematics may be taken in the ninth and tenth grades. There were differences of opinion as to what should constitute the content of the senior course. Trigonometry, elementary analysis, analytic geometry, and probability and statistics were a few of the courses that were favored by a number of college mathematics department heads.

Literature Related to Student Achievement and Aptitude

Leonhardt (27) designed and conducted a study in order to describe the relationship of selected factors to achievement in mathematics in high school. Forty-five schools were selected with fifteen in each classification according to
enrollment—small, medium, and large. Five factors were considered in the study: (1) teacher preparation, (2) years of service, (3) years at present position, (4) size of school, and (5) mathematics course offerings. The findings showed a significant difference in mean scores on the mathematics test between the schools with the smallest enrollment and the other two groups of schools. Other results from Leonhardt’s study were the following:

1. More often than not, the mathematics teachers of the high ranking schools had their majors on the undergraduate level in mathematics.

2. The mathematics teachers of the high ranking schools had taught more years in their present position.

3. The teachers of high ranking schools had more courses in mathematics on both undergraduate and graduate degrees.

4. Teachers of low ranking schools had more years of teaching experience.

5. Relatively little difference was noted in the textbooks that were used.

Leonhardt concluded his study by stating that “Although the evidence regarding the relationship of selected factors to achievement in mathematics is not too substantial, the study does point out the fact that the subject matter preparation of teachers is important” (27, p. 3689).

A study was developed by Smith (47) in which he used the hypothesis that the measured language, reading, and
mathematical achievement of students from the relatively large high schools would be better than the achievement in these areas for students who graduated from relatively small high schools. It was hypothesized that the difference would remain stable throughout one year of college. The instrument used to measure achievement in these areas was the California Achievement Test Complete Battery, Advanced Form X, 1957. It was found that students from the larger schools outscored their opponents from the other two groups of schools in all areas but mathematics. The students from the middle size schools outscored the students from the larger schools in this area. Although the students from the larger schools tended to have the highest scores, the difference between the high and low scores in each area was not significant.

In another area of college testing, the Economic Research Service (18) found that the students from the small high schools fell considerably below the average in the college entrance examinations at Iowa University. The study was conducted in 1962.

Norris (37) undertook a study to find the relationship of student achievement in mathematics to teacher in-service work. The findings indicated that pupils learn more from a teacher who has a thorough, intensive exposure to the subject area to be taught. His conclusion was that the exposure to the concepts enabled the teachers to better convey the ideas to the pupils and thus achieve a greater quality of instruction.
There have been a number of studies which have sought to determine the relationship between student achievement in college mathematics and the mathematics preparation in high school. One such study was conducted by Lamberty (26) as he sought to compare the college achievement of students in relation to the school from which they graduated. There were five sizes of high schools. His study offered the following results:

1. There were no significant differences among the mental ability test scores of the students from the various groups of schools.

2. The group of high schools with the smallest enrollment had the greatest percentage of students enrolled in mathematics courses designed for those students with limited mathematics training in high school. This same group of high schools had no pupils enrolled in the highest accelerated course. The group of high schools with the largest enrollment had the greatest percentage of students enrolled in the highest college mathematics course.

3. There were no significant differences in first semester grades in mathematics of students from any group of schools.

Shimizer (46), in a study similar to Lamberty's, sought to determine the correlation of grades in high school advanced mathematics courses with grades in first year college mathematics. The grades for calculus in high school correlated
highest with the first course in calculus in college. Significant correlations were found between grades in college mathematics courses and grades in advanced high school mathematics courses. There were no significant correlations between the grades of students who had taken advanced mathematics in high school and those who had not taken advanced mathematics in high school.

Blanton (6) conducted a study to determine if there was any correlation between the sequence of high school mathematics courses and success in college mathematics. The general conclusion reached by Blanton was that the more advanced high school programs better prepared the students for college algebra on the freshman level but not for freshman business mathematics. More specifically, the results indicated the necessity for at least second-year algebra and the desirability for more advanced courses for success in college mathematics.

To determine the relationship between students' achievement in college and the size of high school from which they graduated was the objective of a study by Pabst (40). His findings showed that the size of the high school from which the students graduated was not related to academic success in college. From the findings, he concluded that by 'increasing the size of the high school enrollment will not increase the chance for academic success in college of students graduated from such high schools' (40, p. 331).
Dibble (15) designed a study which would determine the relationship of certain factors to academic achievement. High school students of Fairfax County, Virginia, were his population. He concluded that such factors as residence, parent's status, family size, mother's education, and mobility have little influence on achievement.

Friebel (21) undertook a comparative study of achievement and understanding of measurement that involved students enrolled in traditional and modern mathematics programs. The students in the experimental group were taught mathematics using the School Mathematics Study Group textbooks. The control group was taught mathematics using traditional textbooks. The results were as follows:

1. Significant differences in arithmetic reasoning favored the experimental group.

2. Children taught in a program of modern school mathematics achieved as high or higher mean scores in mathematics than those students in traditional mathematics programs.

3. In learnings associated with measurement, modern school mathematics is more effective.

In summary, research on achievement and aptitude in mathematics showed that the more advanced high school programs better prepared the students for college mathematics. On aptitude tests in mathematics among students from varying high school enrollments, the scores were found to be not
significant. Although the research is conflicting as to the significance of differences in achievement scores, the students from the larger schools tended to score higher.


45. Schaefer, Sister Mary Geralda, "Revision of Secondary Mathematics in a Selected Number of Schools," The Mathematics Teacher, LX (February, 1968), 157-161.


CHAPTER III

PRESENTATION OF FINDINGS

Introduction

The purpose of the study was to assess the current status of mathematics programs in high schools of North Central Texas. The findings concerning teacher preparation, course offerings and course organization, class size, student aptitude, and textbooks in use are presented through comparisons among the three classifications of schools. The results are presented in tabular form with a discussion of the results of each table included.

Throughout the chapter, those high schools referred to as small had enrollments of 224 or fewer pupils in grades 9-12. The high schools classified as medium had enrollments of 225-1020 pupils in grades 9-12. Those high schools referred to as large had enrollments of 1021 or more pupils in grades 9-12. The rules book of the University Interscholastic League was used as the source for the enrollment figures.

Teacher Preparation

There were thirty-nine teachers who taught at least one mathematics class in grades 9-12 in the twenty-four small schools as indicated in Table II. In 41.7 per cent of the
small schools, there was only one mathematics teacher in high school. In the small schools, 54.2 per cent of the schools had two mathematics teachers in high school while only one school had three mathematics teachers, none of whom taught mathematics full time.

**TABLE II**

**DISTRIBUTION OF MATHEMATICS TEACHERS IN A SELECTED SAMPLE OF FIFTY HIGH SCHOOLS IN NORTH CENTRAL TEXAS**

<table>
<thead>
<tr>
<th></th>
<th>24 Small Schools</th>
<th>12 Medium Schools</th>
<th>14 Large Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of faculty teaching at least one high school mathematics course</td>
<td>39</td>
<td>51</td>
<td>120</td>
</tr>
<tr>
<td>Per cent of full time mathematics teachers in grades 9-12</td>
<td>25.6</td>
<td>74.5</td>
<td>84.2</td>
</tr>
<tr>
<td>Per cent of teachers certified to teach mathematics in high school</td>
<td>87.2</td>
<td>96.1</td>
<td>98.3</td>
</tr>
</tbody>
</table>

The twelve medium schools had an average of 4.3 mathematics teachers assigned at least one high school mathematics course. Three medium schools had six mathematics teachers while another three schools had five mathematics teachers. There were also two schools, each with four teachers; two schools, each with three teachers; and two schools, each with two teachers.
There were 120 mathematics teachers in the fourteen large schools, an average of 8.6 mathematics teachers per school. The number of mathematics teachers in a given school ranged from thirteen to six. In the large schools, 28.6 per cent of the schools had nine mathematics teachers each.

In the small schools, 25.6 per cent of the mathematics teachers taught mathematics full time in grades 9-12. An additional five teachers taught mathematics full time in grades 7-12. A total of 41 per cent of the mathematics teachers in the small schools taught mathematics full time.

Of the fifty-one mathematics teachers in the medium schools, thirty-eight taught mathematics full time, a percentage of 74.5. In addition to thirty-eight full-time mathematics teachers in grades 9-12, two more taught mathematics full time in grades 7-12. Overall, 78.4 per cent of the mathematics teachers in the medium schools taught mathematics full time.

Of the 120 mathematics teachers in the large schools, 84.2 per cent taught mathematics full time. Each of the full-time mathematics teachers taught mathematics in grades 10-12.

The study revealed that 87.2 per cent of the mathematics teachers in the small schools were certified to teach mathematics while 96.1 per cent of the mathematics teachers in the medium schools were certified to teach mathematics. The percentage of teachers in the large schools that were certified to teach mathematics was 98.3.
An examination of Table III reveals that, for the most part, the degrees earned by the mathematics teachers were in the field of education. It was found that each of the 210 mathematics teachers in the sample had at least a bachelor's degree. In the small schools, 21.6 per cent of the teachers had a bachelor's degree in education with the first teaching field in mathematics. Another 27 per cent of the mathematics teachers had their second teaching field in mathematics. Three of the thirty-nine mathematics teachers in the small schools had their undergraduate degrees in mathematics. An additional 5.4 per cent of the mathematics teachers had degrees in fields other than education.

TABLE III

DISTRIBUTION OF TYPES OF BACHELOR'S DEGREES HELD BY
210 MATHEMATICS TEACHERS IN A SELECTED SAMPLE OF
FIFTY HIGH SCHOOLS IN NORTH CENTRAL TEXAS

<table>
<thead>
<tr>
<th>Types of Degrees</th>
<th>Percentage of Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Schools</td>
</tr>
<tr>
<td></td>
<td>39 Teachers</td>
</tr>
<tr>
<td>Bachelor's Degree</td>
<td>100</td>
</tr>
<tr>
<td>Bachelor's Degree in Education, Major in Mathematics</td>
<td>21.6</td>
</tr>
<tr>
<td>Bachelor's Degree in Education, Minor in Mathematics</td>
<td>27.0</td>
</tr>
<tr>
<td>Bachelor's Degree in Fields Other Than Education</td>
<td>8.1</td>
</tr>
</tbody>
</table>
Of the thirty-nine teachers in the small schools whose transcripts were available, 48.6 per cent had either their first or second teaching fields in mathematics. One teacher had a bachelor's degree in mathematics while another had a bachelor's degree in mechanical engineering.

In the medium schools, 45.8 per cent of the mathematics teachers had a bachelor's degree in education with the first teaching field in mathematics. An additional 29.2 per cent of the mathematics teachers had their second teaching field in mathematics. The fields that contributed the 6.3 per cent of the teachers with bachelor's degrees in areas other than education were business administration and mathematics. Of the forty-eight teachers in the medium schools whose transcripts were available, 77.1 per cent had backgrounds in mathematics.

For the teachers in the large schools, 85.7 per cent had their undergraduate degrees in education with either the first or second teaching field in mathematics. There were 7.8 per cent of the teachers with bachelor's degrees in the areas of business administration, mathematics, and physics.

Of the thirty-nine mathematics teachers in the small schools, 35.9 per cent had master's degrees. Thirty-three per cent of the teachers in the medium schools had master's degrees while 50.6 per cent of the mathematics teachers in the large schools had earned the master's degree. Of the mathematics teachers in the small schools who had earned the
master's degree, 23.1 per cent had earned credit in mathematics courses for their degree. Sixty-two and five-tenths per cent of the mathematics teachers in the medium schools had received credits in mathematics on their master's, as pointed out in Table IV, while 69.2 per cent of the mathematics teachers in the large schools had mathematics courses at the master's level.

### TABLE IV

**DISTRIBUTION OF TYPES OF MASTER'S DEGREES HELD BY MATHEMATICS TEACHERS IN A SELECTED SAMPLE OF FIFTY HIGH SCHOOLS IN NORTH CENTRAL TEXAS**

<table>
<thead>
<tr>
<th>Types of Degrees</th>
<th>Percentage of Teachers With Master's Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Schools 14 Teachers</td>
</tr>
<tr>
<td>Master's Degree in Education, With Courses in Math.</td>
<td>23.1</td>
</tr>
<tr>
<td>Master's Degree in Education, Without Courses in Math.</td>
<td>61.5</td>
</tr>
<tr>
<td>Master's Degree in Fields Other Than Ed.</td>
<td>15.4</td>
</tr>
</tbody>
</table>

In the small schools, 41.6 per cent of the mathematics teachers who did not have the master's degree were pursuing one. Twenty-eight per cent of the teachers in the medium schools were working towards the master's while 36.3 per cent
of the mathematics teachers in the large schools not possessing the master's degree were engaged in work for the completion of such degree.

Within the past five years, 38.5 per cent of the mathematics teachers in the small schools had attended a mathematics institute or workshop. The percentage of mathematics teachers in the medium schools who had attended a workshop or institute within the past five years was 46.9. The largest percentage was found for teachers in the large schools where 59.1 per cent of the teachers had attended a workshop or institute with the past five years.

While there were no principals in the medium or large schools who taught mathematics classes, there were eight principals in the small schools who taught at least one mathematics class. In two of the small schools, all of the high school mathematics classes were taught by principals.

Although there was very little difference in the average amount of preparation for teachers in the small and medium schools, as indicated by Table V, the teachers in the large schools appear to have a much more extensive background in mathematics preparation.

The range in the number of hours of preparation in mathematics is greatest for teachers in the large schools with the highest number of hours in mathematics being 108 and the lowest number of hours being eight. The range in the number of hours in mathematics for teachers in the
medium schools was sixty-three to nine while the range in hours for teachers in the small schools was eighty-four to zero.

TABLE V

PREPARATION IN MATHEMATICS FOR 210 TEACHERS OF MATHEMATICS IN A SELECTED SAMPLE OF FIFTY HIGH SCHOOLS IN NORTH CENTRAL TEXAS

<table>
<thead>
<tr>
<th>Mathematics Preparation</th>
<th>Small Schools 39 Teachers</th>
<th>Medium Schools 51 Teachers</th>
<th>Large Schools 120 Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average number of hours of preparation in mathematics</td>
<td>28.4</td>
<td>28.7</td>
<td>43.9</td>
</tr>
</tbody>
</table>

In the small schools, 51.4 per cent of the mathematics teachers had twenty-eight or fewer hours of preparation in mathematics compared with 56.3 per cent of the teachers in the medium schools. The large schools had 14.3 per cent of the mathematics teachers with twenty-eight or fewer hours of preparation in mathematics.

The large schools had the largest percentage of teachers with credit in the courses listed in Table VI. The courses in Table VI are those courses for which at least 20 per cent of the teachers in any one group had credit.

There was a larger percentage of teachers in the small schools than in the medium or large schools with credit in mathematics structures, fundamental concepts of mathematics,
TABLE VI
COURSE PREPARATION OF 210 MATHEMATICS TEACHERS
IN A SELECTED SAMPLE OF FIFTY HIGH SCHOOLS
IN NORTH CENTRAL TEXAS

<table>
<thead>
<tr>
<th>Courses</th>
<th>Percentage of Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Schools 39 Teachers</td>
</tr>
<tr>
<td>College Algebra</td>
<td>85.7</td>
</tr>
<tr>
<td>Trigonometry</td>
<td>82.9</td>
</tr>
<tr>
<td>Analytic Geometry</td>
<td>68.6</td>
</tr>
<tr>
<td>Calculus</td>
<td>74.3</td>
</tr>
<tr>
<td>Methods of Teaching High School Maths</td>
<td>42.9</td>
</tr>
<tr>
<td>College Geometry</td>
<td>42.9</td>
</tr>
<tr>
<td>Mathematics of Finance</td>
<td>22.8</td>
</tr>
<tr>
<td>Theory of Equations</td>
<td>17.1</td>
</tr>
<tr>
<td>Differential Equations</td>
<td>14.3</td>
</tr>
<tr>
<td>Statistics</td>
<td>17.1</td>
</tr>
<tr>
<td>Modern Algebra</td>
<td>25.7</td>
</tr>
<tr>
<td>Number Theory</td>
<td>5.7</td>
</tr>
<tr>
<td>Linear Algebra</td>
<td>2.9</td>
</tr>
<tr>
<td>Abstract Algebra</td>
<td>5.7</td>
</tr>
</tbody>
</table>
and history of mathematics. The mathematics teachers in the small schools had an average of 6.3 hours in calculus while the mathematics teachers in the medium schools had an average of 7.4 hours in calculus. The average number of hours in calculus for teachers in the large schools was 9.9.

As indicated in Table VII, there was little difference in the average number of years of teaching experience between mathematics teachers in the small and medium schools.

**TABLE VII**

**LENGTH OF TEACHING EXPERIENCE OF 210 MATHEMATICS TEACHERS IN A SELECTED SAMPLE OF FIFTY HIGH SCHOOLS IN NORTH CENTRAL TEXAS**

<table>
<thead>
<tr>
<th>Teaching Experience</th>
<th>Small Schools 39 Teachers</th>
<th>Medium Schools 51 Teachers</th>
<th>Large Schools 120 Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average number of years of teaching experience</td>
<td>10.8</td>
<td>9.6</td>
<td>13.1</td>
</tr>
<tr>
<td>Median number of years of teaching experience</td>
<td>8.4</td>
<td>7.1</td>
<td>7.1</td>
</tr>
<tr>
<td>Average number of years in present position</td>
<td>6.9</td>
<td>4.3</td>
<td>4.1</td>
</tr>
</tbody>
</table>

In the small schools, the range in the number of years of teaching experience was from one to thirty. The range in the number of years of teaching experience for teachers in the medium schools was from one to forty-three while the range of
years of teaching experience for teachers in the large schools was the same as the range for teachers in the medium schools.

Course Offerings and Course Organization

After the data concerning the course offerings in the high schools were accumulated, it was found that the availability and frequency of course offerings in the large schools were much more varied than in the other two groups of schools. An examination of Table VIII reveals that each medium and large school offered the listed courses each year. Although 91.6 per cent of the small schools offered Related Mathematics I, less than 50 per cent offered Related Mathematics II. Algebra I and Algebra II were offered either each year or every other year in over 90 per cent of the small schools. In 54.2 per cent of the small schools, geometry was offered as the most advanced mathematics course that could be taken by the students. The fourth year of mathematics was offered in only 45.8 per cent of the small schools. Only eight of the twenty-four small schools offered the fourth year of high school mathematics each year.

There were no small schools and only one medium school that offered a fifth year of mathematics. The fifth year included Elementary Analysis II and Pre-Calculus. In order to pursue this fifth year course, a student was required to take geometry and Algebra II in the tenth grade.
TABLE VIII

AVAILABILITY AND FREQUENCY OF COURSE OFFERINGS IN A SELECTED SAMPLE OF FIFTY HIGH SCHOOLS IN NORTH CENTRAL TEXAS

<table>
<thead>
<tr>
<th>Course</th>
<th>% of Schools That Offer Course Every Year</th>
<th>% of Schools That Offer Course Every Other Year</th>
<th>% of Schools That Do Not Offer Course</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 Small Schools</td>
<td>12 Medium Schools</td>
<td>14 Large Schools</td>
</tr>
<tr>
<td>Related Mathematics I</td>
<td>83.3</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Related Mathematics II</td>
<td>41.7</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Algebra I</td>
<td>87.5</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Algebra II</td>
<td>66.7</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Geometry</td>
<td>62.5</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Trigonometry</td>
<td>33.3</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Advanced Mathematics</td>
<td>20.8</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
All of the large and medium high schools in the study and 45.8 per cent of the small schools offered a fourth year of mathematics. The fourth year course was usually composed of a semester of trigonometry and a semester of analysis or advanced mathematics. In the small schools the analysis courses were either college algebra, analytic geometry, or advanced mathematics. In the medium schools the analysis courses were either pre-calculus, analytic geometry, or college algebra.

The large schools had more diversified programs in mathematics. Each of the courses listed in Table VIII was offered in each of the fourteen large schools. In addition to those courses listed, the following courses were offered either as regular courses or as honors courses: college algebra, analytic geometry, pre-calculus, probability and statistics, and calculus.

The study revealed that 71.4 per cent of the large schools offered calculus. Probability and statistics was offered in only one large school.

In the three groups of schools, the course organization was basically the same for the weak and average-to-above-average students. The small schools had no type of formal provisions for the accelerated students while only two medium schools had provisions for the accelerated. The course organization in mathematics is indicated in Table IX for the small schools.
TABLE IX

RECOMMENDED SEQUENCES OF MATHEMATICS COURSES FOR STUDENTS IN A
SELECTED SAMPLE OF TWENTY-FOUR SMALL HIGH SCHOOLS
IN NORTH CENTRAL TEXAS

<table>
<thead>
<tr>
<th></th>
<th>Grade 9</th>
<th>Grade 10</th>
<th>Grade 11</th>
<th>Grade 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak students</td>
<td>Related Mathematics I</td>
<td>Related Mathematics II</td>
<td>Algebra I</td>
<td></td>
</tr>
<tr>
<td>Average and above average students*</td>
<td>Algebra I</td>
<td>Geometry or Algebra II</td>
<td>Algebra II or Geometry</td>
<td>Trigonometry and Elementary Analysis</td>
</tr>
</tbody>
</table>

*There were no schools in Group I that offered an accelerated sequence of courses for students.
In the small schools, the low ability terminal high school student was recommended to take Related Mathematics I in the ninth grade and Related Mathematics II in the tenth grade. For the terminal student with ability, Related Mathematics I and Algebra I were recommended in 45.8 per cent of the small schools. Sixteen per cent of the small schools recommended that the terminal student take three years of mathematics.

Because of the availability and frequency of course offerings in the small schools, the general sequence of mathematics courses was Algebra I, geometry, Algebra II, and trigonometry. In 45.8 per cent of the small schools, geometry could be taken in either the tenth or eleventh grades.

There were two small schools that belonged to the Texas Small Schools Project. Both had senior courses that were combined in multiple classes with Algebra II.

The general sequence of course organization in the medium schools followed the traditional pattern of Algebra I, geometry, Algebra II, and trigonometry, as indicated in Table X. For the terminal student, Related Mathematics I and II or Related Mathematics I and Algebra I were recommended.

One medium school had begun an accelerated program in mathematics in 1967-1968. In this program, accelerated students took Algebra I in the eighth grade and geometry in the ninth grade. They are presently taking Algebra II in the tenth grade and will take trigonometry and Analysis I in the eleventh grade. Analytic geometry will be required
TABLE X
RECOMMENDED SEQUENCES OF MATHEMATICS COURSES FOR STUDENTS
IN A SELECTED SAMPLE OF TWELVE MEDIUM HIGH SCHOOLS
IN NORTH CENTRAL TEXAS

<table>
<thead>
<tr>
<th></th>
<th>Grade 9</th>
<th>Grade 10</th>
<th>Grade 11</th>
<th>Grade 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak students</td>
<td>Related Math</td>
<td>Related Math</td>
<td>Algebra I</td>
<td></td>
</tr>
<tr>
<td>Average and</td>
<td>Algebra I</td>
<td>Geometry</td>
<td>Algebra II</td>
<td>Trigonometry and</td>
</tr>
<tr>
<td>above average</td>
<td></td>
<td></td>
<td></td>
<td>Analysis I</td>
</tr>
<tr>
<td>students*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accelerated*</td>
<td>Algebra</td>
<td>Geometry and</td>
<td>Trigonometry and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Algebra II</td>
<td>Analysis I</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Analysis II</td>
<td>Pre-Calculus</td>
</tr>
</tbody>
</table>

*Only one school with this sequence of courses.
in the twelfth grade. Only two of the medium schools in the study had provisions for the accelerated student.

An experimental program in mathematics was conducted in one medium school from 1966 to 1969. The program, which combined Algebra II with trigonometry, was dissolved at the end of the 1969 school year because of the reluctance of colleges and universities to recognize and accept the high school credit in trigonometry. The students, upon entering college, had to make up the trigonometry course for which they did not receive credit in high school.

In the large schools, 92.9 per cent of the schools provided for a fifth year of mathematics. Algebra I was offered in the eighth grade in 85.7 per cent of the school districts in which the high schools were located. Although the remaining 14.3 per cent of the large schools did not have an honors program per se, there were provisions for the fifth year of mathematics in one of the schools.

The only classification of schools that offered a course in solid geometry was the large schools group. The course was a one-half credit course with 57.1 per cent of large schools offering it. The 1968-1969 school year was the last year in which the course was offered.

The fifth year course in mathematics for the large schools ranged in content from a full year in calculus to one semester in analytics and one semester in pre-calculus. The content of the calculus course in 90.9 per cent of the schools that
offered calculus was closely aligned with the content recommended by the College Entrance Examination Board. The general organizational pattern for mathematics courses in the large schools is presented in Table XI.

By examining the results of Table XII, it was discovered that the medium schools had larger classes in the areas of related mathematics, algebra, and geometry than did the small or large schools. The average class sizes in the medium schools were slightly above the state averages while the class sizes in the large schools were slightly below the state averages. In the small schools, the class sizes were considerably below the state class size averages.

The ranges in class sizes were much more pronounced in the small schools than in either the medium or large schools. In the small schools, the class sizes in Related Mathematics I ranged from thirty-six to ten. For the medium schools, the class sizes in Related Mathematics I ranged from thirty-six to fifteen. The range in class size in Related Mathematics II for the small schools was from thirty-six to fifteen while the range in the same course for the medium schools was from thirty-seven to nineteen. The range in class size in Algebra I for the small schools was from thirty-six to eight; in the medium schools, the range was from thirty-six to nineteen. The range in Algebra II for the small schools was from twenty-five to eight; in the medium schools, the range was from thirty-six to twelve.
<table>
<thead>
<tr>
<th></th>
<th>Grade 8</th>
<th>Grade 9</th>
<th>Grade 10</th>
<th>Grade 11</th>
<th>Grade 12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weak</strong></td>
<td></td>
<td>Related Math. I</td>
<td>Related Math. II</td>
<td>Algebra I</td>
<td></td>
</tr>
<tr>
<td><strong>Average and above</strong></td>
<td>Algebra I</td>
<td>Geometry</td>
<td>Algebra II</td>
<td>Trigonometry and Analysis</td>
<td></td>
</tr>
<tr>
<td><strong>Advanced</strong></td>
<td>Algebra I</td>
<td>Geometry</td>
<td>Trigonometry and Algebra II</td>
<td>Analysis</td>
<td></td>
</tr>
<tr>
<td><strong>Honors</strong></td>
<td>Algebra I</td>
<td>Geometry</td>
<td>Algebra II</td>
<td>Trigonometry and Analysis</td>
<td>Analysis Pre-Calculus Prob. and Stat. Calculus</td>
</tr>
</tbody>
</table>
TABLE XII
CLASS SIZES IN MATHEMATICS IN A SELECTED SAMPLE OF FIFTY HIGH SCHOOLS IN NORTH CENTRAL TEXAS

<table>
<thead>
<tr>
<th>Course</th>
<th>24 Small Schools</th>
<th>12 Medium Schools</th>
<th>14 Large Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related Mathematics I</td>
<td>24.5</td>
<td>27.9</td>
<td>26.3*</td>
</tr>
<tr>
<td>Related Mathematics II</td>
<td>22.1</td>
<td>26.3</td>
<td>23.5</td>
</tr>
<tr>
<td>Algebra I</td>
<td>20.8</td>
<td>28.2</td>
<td>25.2</td>
</tr>
<tr>
<td>Algebra II</td>
<td>14.8</td>
<td>24.3</td>
<td>24.3</td>
</tr>
<tr>
<td>Geometry</td>
<td>17.2</td>
<td>27.3</td>
<td>22.3</td>
</tr>
<tr>
<td>Trigonometry and Analysis</td>
<td>8.3**</td>
<td>17.8</td>
<td>18.7</td>
</tr>
<tr>
<td>Advanced Algebra II</td>
<td>....</td>
<td>....</td>
<td>17.1</td>
</tr>
<tr>
<td>Advanced Geometry</td>
<td>....</td>
<td>....</td>
<td>22.1</td>
</tr>
<tr>
<td>Advanced Analysis (eleventh grade)</td>
<td>....</td>
<td>....</td>
<td>19.4</td>
</tr>
<tr>
<td>Advanced Analysis (twelfth grade)</td>
<td>....</td>
<td>14.0</td>
<td>13.3</td>
</tr>
</tbody>
</table>

*Related Mathematics I was offered in only two large schools.

**Twelve of the twenty-four small schools offered trigonometry and six of the twenty-four small schools offered analysis.
The trigonometry classes in the small schools ranged in size from fifteen to three while the range in the medium schools was from thirty-five to nine. The fifth year course, which was offered by one medium school, had fourteen students enrolled. The smallest class in any course in the three groups of schools was found in geometry. There were two students enrolled in a geometry class in a small school.

The class sizes for mathematics courses in the large schools did not fluctuate as much as the class sizes for courses in the small and medium schools except in the honors programs. Because of the great differences in enrollments among the large schools, the ranges in each of the advanced courses were also great. The range in the class sizes in advanced geometry was from twenty-six to five while the range in class sizes in advanced Algebra II was from thirty-one to four. The advanced analysis course (grade twelve) had a range in enrollment of seventeen to four.

Because Algebra I was offered in all the school districts in which the large schools were located, the Algebra I classes were relatively smaller. Solid geometry was offered in 42.9 per cent of the large schools with an average class size of 20.9. The 1968-1969 school year was the last year in which solid geometry was offered.

Student Aptitude

Because of the differences in enrollments of the schools in the three classifications of schools, there were many more
students from the large schools who took the Scholastic Aptitude Test. Location also helped determine which college entrance test a student took. A large percentage of the small schools were located in an area in which the colleges did not require the Scholastic Aptitude Test. A summary of the mean scores on the mathematics section of the Scholastic Aptitude Test is given in Table XIII.

**TABLE XIII**
SUMMARY OF STUDENTS' SCORES ON MATHEMATICS SECTION OF SCHOLASTIC APTITUDE TEST

<table>
<thead>
<tr>
<th></th>
<th>Small Schools</th>
<th>Medium Schools</th>
<th>Large Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>70</td>
<td>218</td>
<td>785</td>
</tr>
<tr>
<td>Mean</td>
<td>449.1</td>
<td>470.0</td>
<td>468.1</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>87.3</td>
<td>101.0</td>
<td>113.9</td>
</tr>
</tbody>
</table>

When the means were compared, using the t technique for differences between independent means, significant differences were noted between the scores of the students from the small schools and the scores of the students from the large schools. A significant difference was also found between the scores of the students from the medium schools and the scores of the students from the large schools. A summary of the differences in scores is presented in Table XIV.
TABLE XIV

SUMMARY OF DIFFERENCES BETWEEN MEANS OF MATHEMATICS SCORES MADE BY STUDENTS FROM THE THREE GROUPS OF SCHOOLS

<table>
<thead>
<tr>
<th>Students From Small Schools and Students From Medium Schools</th>
<th>Students From Small Schools and Students From Large Schools</th>
<th>Students From Medium Schools and Students From Large Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>t-score</td>
<td>1.69</td>
<td>3.43*</td>
</tr>
</tbody>
</table>

*Significant at .001 level.

**Significant at .05 level.

A study of Table XIV reveals that the mean mathematics scores on the Scholastic Aptitude Test between students from the small schools and students from the large schools were significantly different at the .001 level. The mean scores between students from the medium and large schools were significantly different at the .05 level.

Use of Textbooks

Table XV contains the number and per cent of schools in each group that utilized the state adopted textbooks. The small and medium schools utilized Skeen's Modern Basic Mathematics more than did the large schools while the large schools used Lancaster's Foundations of Algebra more than did the other two groups. Additional study of Table XV reveals that Modern Algebra by Dolciani was used considerably more
TABLE XV
TEXTBOOKS ADOPTED BY A SELECTED SAMPLE OF SMALL, MEDIUM, AND LARGE HIGH SCHOOLS IN NORTH CENTRAL TEXAS

<table>
<thead>
<tr>
<th>Textbook</th>
<th>Author</th>
<th>Number of High Schools in Each Group Using Texts</th>
<th>% of High Schools in Each Group Using Texts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>24 Small Schools</td>
<td>12 Medium Schools</td>
</tr>
<tr>
<td>Related Mathematics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foundations of Algebra (I)</td>
<td>Lancaster</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Foundations of Algebra (II)</td>
<td>Lancaster</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Modern Basic Mathematics (I)</td>
<td>Skeen</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Modern Basic Mathematics (II)</td>
<td>Skeen</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Fundamentals of Mathematics</td>
<td>Stein</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Foundations of Mathematics</td>
<td>Wiebe</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics, A Modern Approach(I)</td>
<td>Wilcox</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics, A Modern Approach(II)</td>
<td>Wilcox</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Algebra I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modern Algebra (I)</td>
<td>Dolciani</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>Modern Algebra - First Course</td>
<td>Johnson</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Modern Elementary Algebra</td>
<td>Nichols</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>A Modern Course in Algebra</td>
<td>Vannatta</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Book I, Algebra</td>
<td>Welchons</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Textbooks</td>
<td>Author</td>
<td>Number of High Schools in Each Group Using Texts</td>
<td>% of High Schools in Each Group Using Texts</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------</td>
<td>-------------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 Small Schools</td>
<td>12 Medium Schools</td>
</tr>
<tr>
<td>Algebra II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modern Algebra and Trigonometry</td>
<td>Dolciani</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>Contemporary Algebra</td>
<td>Griswold</td>
<td>..</td>
<td>1</td>
</tr>
<tr>
<td>Modern Algebra, First Course</td>
<td>Johnson</td>
<td>..</td>
<td>3</td>
</tr>
<tr>
<td>Algebra II, A Modern Course</td>
<td>Vannatta</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Book II, Algebra</td>
<td>Welchons</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Geometry*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geometry, Plane and Solid</td>
<td>Brown</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Geometry, A Unified Course</td>
<td>Goodwin</td>
<td>..</td>
<td>1</td>
</tr>
<tr>
<td>First Course in Geometry</td>
<td>Mallory</td>
<td>1</td>
<td>..</td>
</tr>
<tr>
<td>Geometry, Plane-Solid-Coordinate</td>
<td>Morgan</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>A Course in Geometry</td>
<td>Weeks</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

*The 1968-1969 school year was the last year in which these textbooks were used.*
<table>
<thead>
<tr>
<th>Textbook</th>
<th>Author</th>
<th>Number of High Schools in Each Group Using Texts</th>
<th>Percentage of High Schools Using Texts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>24 Small Schools</td>
<td>12 Medium Schools</td>
</tr>
<tr>
<td>Geometry</td>
<td>Anderson</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Modern School Mathematics</td>
<td>Jurgenson</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>Geometry</td>
<td>Keedy</td>
<td>1</td>
<td>...</td>
</tr>
<tr>
<td>Geometry</td>
<td>Moise</td>
<td>...</td>
<td>1</td>
</tr>
<tr>
<td>Geometry</td>
<td>Rosenberg</td>
<td>...</td>
<td>1</td>
</tr>
</tbody>
</table>

| Trigonometry                   |          | 1                | 1                | ...              | 4.2   | 8.3    | ...   |
| Trigonometry                   | Rees     | 1                | ...              | 1                | ...   | ...    | 7.1   |
| Plane Trigonometry             | Rickey   | 1                | ...              | 1                | 4.2   | ...    | 7.1   |
| Modern Trigonometry            | Wooten   | 5                | 4                | 8                | 20.9  | 33.3   | 57.1  |
| Modern Trigonometry            | Welchons | 7                | 4                | 5                | 29.2  | 33.3   | 35.7  |
| Plane Trigonometry             | Spitzbart| 1                | 2                | ...              | 4.2   | 16.7   | ...   |

*These are the textbooks the high schools are using in the 1969-1970 school year.
<table>
<thead>
<tr>
<th>Textbooks</th>
<th>Author</th>
<th>Number of High Schools in Each Group Using Texts</th>
<th>% of High Schools in Each Group Using Texts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>24 Small Schools</td>
<td>12 Medium Schools</td>
</tr>
<tr>
<td>Advanced Mathematics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modern Introductory Analysis</td>
<td>Dolciani</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Fundamentals for Advanced Mathematics</td>
<td>Glicksman</td>
<td>..</td>
<td>1</td>
</tr>
<tr>
<td>Principles for Advanced Mathematics</td>
<td>Meserve</td>
<td>1</td>
<td>..</td>
</tr>
<tr>
<td>Analytic Geometry</td>
<td>Murdock</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Pre-Calculus Mathematics</td>
<td>Shanks</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
than any other textbook. Over 58 per cent of the small schools, 35.7 per cent of the medium schools, and 71.4 per cent of the large schools used the textbook by Dolciani.

The same situation existed in the use of textbooks for Algebra II. Dolciani's *Modern Algebra and Trigonometry* was used by 58.4 per cent of the small schools, 35.7 per cent of the medium schools, and 71.4 per cent of the large schools. Welchon's *Book II, Algebra* was the second most popular textbook, being used by nearly a third of the schools in each group.

Of the geometry textbooks that were used prior to and during the 1968-1969 school year, Morgan's *Geometry, Plane-Solid-Coordinate* was predominately preferred by the small and medium schools while the textbook used more often by the large schools was Week's *A Course in Geometry*.

There was a wide variation in the use of the geometry textbooks adopted for the 1969-1970 school year. The small and medium schools adopted Jurgenson's *Modern School Mathematics-Geometry* on a wider basis than did the large schools. In 83.4 per cent of the small schools and 58.3 per cent of the medium schools, Jurgenson's *Modern School Mathematics-Geometry* was used. Moise's *Geometry* was by far the most popular textbook in the large schools, being used by 78.5 per cent of the schools. *Modern Trigonometry* by Welchons and *Modern Trigonometry* by Wooten were the two textbooks used by a majority of the small, medium, and large schools. Wooten's textbook was preferred by 20.9 per cent of the small schools, 33.3 per cent of the medium
schools, and 57.1 per cent of the large schools. The per cent of small, medium, and large schools that adopted Welchon’s *Modern Trigonometry* was 29.2, 33.3, and 25.7 respectively.

For the advanced mathematics course, Dolciani’s *Modern Introductory Analysis* was used by 25 per cent of the small schools, 50 per cent of the medium schools, and 14.2 per cent of the large schools. In the large schools, 64.3 per cent of the schools used *Principles for Advanced Mathematics*, the textbook by Meserve.

The mathematics consultants of the Texas Education Agency were asked to rate the mathematics textbooks with respect to modernness, content, presentation of subject matter, and appropriateness for high school use. The highest rating a textbook could receive in any one category was one. The lowest rating a textbook could receive was ten. The rating scale was from one (excellent) to ten (poor). Because the textbooks were state adopted, the quality of the textbooks was very nearly the same in many courses. The listing of textbooks and the ratings afforded them are presented in Table XVI.

In comparing the results of Tables XV and XVI, Lancaster’s *Foundations of Algebra* received the highest rating in each category of all textbooks in that area. The textbooks by Lancaster were used predominately by the large schools while the majority of the medium and small schools used Skeen’s *Modern Basic Mathematics*. 
<table>
<thead>
<tr>
<th>Author</th>
<th>Textbook</th>
<th>$M^1$</th>
<th>$C^2$</th>
<th>$P^3$</th>
<th>$A^4$</th>
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<td>2</td>
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<tr>
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<td>4</td>
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<tr>
<td>Welchons</td>
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<tr>
<td>Dolciani</td>
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<tr>
<td>Griswold</td>
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<td>Vannatta</td>
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<td>Jurgenson</td>
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<td>3</td>
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<td>Moise</td>
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<td>Rosenberg</td>
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TABLE XVI—Continued

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<td>Trigonometry</td>
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<td>Rickey,</td>
<td>Plane Trigonometry</td>
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<td>Wooten,</td>
<td>Modern Trigonometry</td>
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<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
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<tr>
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<td>Plane Trigonometry</td>
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<td><strong>Advanced Mathematics</strong></td>
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<td>Dolciani,</td>
<td>Modern Introductory Analysis</td>
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<td>Glicksman,</td>
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<td>Shanks,</td>
<td>Pre-Calculus Mathematics</td>
<td>1</td>
<td>1</td>
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<td>1</td>
</tr>
</tbody>
</table>

1. Modernness.
2. Content.
3. Presentation of subject matter.
4. Appropriateness for high school use.

Twenty-nine of the fifty high schools in the sample adopted Dolciani's Modern Algebra (I) and Modern Algebra and Trigonometry for Algebra I and Algebra II. Both of the textbooks by Dolciani received ratings of one in each category. The second most popular textbooks for Algebra I and Algebra II, Welchon's Book I, Algebra and Book II, Algebra, received ratings of one to three in the four categories.
There were two geometry textbooks, adopted for the 1969-1970 school year, that received a rating of one in all categories. These textbooks were Anderson's *Geometry* and Moise's *Geometry*. The textbook by Moise closely parallels the School Mathematics Study Group series in geometry. In the large schools, 78.5 per cent of the schools adopted Moise's *Geometry* while there were no small schools and only one medium school that adopted it. Twenty-seven of the thirty-six small and medium schools adopted Jurgenson's *Modern School Mathematics-Geometry*. This textbook received ratings of one in each category except presentation of subject matter.

Wooten's *Modern Trigonometry* was accorded a one in each category. It was used by 20.9 per cent of the small schools, 33.3 per cent of the medium schools, and 57.1 per cent of the large schools. The second textbook that was used extensively by the schools was Welchons' *Modern Trigonometry*. Welchons' *Modern Trigonometry* received ratings of one to three. A study of Table XV reveals that 29.2 per cent of the small schools, 33.3 per cent of the medium schools, and 35.7 per cent of the large schools adopted the textbook by Welchons.

In advanced mathematics, Meserve's *Principles for Advanced Mathematics* was used by 64.3 per cent of the large schools while Dolciani's *Modern Introductory Analysis* was adopted by 25 per cent of the small schools and 50 per cent of the medium schools. Both of these textbooks received ratings of one in each category except modernness. The
textbook by Shanks, *Pre-Calculus Mathematics*, received ratings of one in every category. It was adopted by one small school, one medium school, and two large schools.

**Summary**

A comparison of the mathematics programs in the small, medium, and large high schools of North Central Texas resulted in the following findings:

1. There were thirty-nine mathematics teachers in the small schools, fifty-one mathematics teachers in the medium schools, and 120 mathematics teachers in the large schools. The percentage of full-time mathematics teachers in the small schools was 41 while 78.4 per cent of the mathematics teachers in the medium schools taught mathematics full time. The largest percentage of full-time mathematics teachers was found in the large schools where 84.2 per cent of the teachers taught mathematics full time. Thirty-four of the thirty-nine mathematics teachers in the small schools were certified to teach mathematics while forty-nine of the fifty-one mathematics teachers in the medium schools were certified to teach mathematics. In the large schools, 118 of the 120 mathematics teachers were certified to teach mathematics.

2. Each of the 210 mathematics teachers in the sample had at least a bachelor's degree. Approximately 92 per cent of the teachers in the small schools, 94 per cent of the teachers in the medium schools, and 92 per cent of the
mathematics teachers in the large schools had earned the bachelor's degree in education.

Fourteen of the thirty-nine mathematics teachers in the small schools had earned the master's degree. The percentage of mathematics teachers in the medium and large schools who had earned the master's degree were 33 and 50.6 respectively.

3. The percentage of mathematics teachers who had attended a mathematics workshop or institute within the past five years was greater for teachers in the large schools than for teachers in the small or medium schools. The percentage was also greater for teachers in the medium schools than for teachers in the small schools.

4. The average number of hours of preparation in mathematics was much greater for teachers in the large schools. The average number of hours of preparation in mathematics for teachers in the large schools was 43.9 while the average number of hours of preparation in mathematics for teachers in the small and medium schools was 28.4 and 28.7 respectively.

5. The mathematics teachers in the large schools had an average of 13.1 years of teaching experience compared with 10.8 years of experience for teachers in the small schools and 9.6 years of teaching experience for teachers in the medium schools. The average number of years in the present position was approximately even for teachers in the three groups.
6. The course organizations in the small and medium schools were almost identical. The traditional subjects of Algebra I, geometry, and Algebra II were organized in the same manner in each group of schools. The large schools were the only schools in which Algebra I was offered in the eighth grade. In the large schools, more subjects were offered on a wider basis. Over 90 per cent of the large schools had provisions for the fifth year of mathematics. Calculus was offered only in the large schools. There were no small schools and only two medium schools that offered the fifth year of mathematics. In the small schools, 54.2 per cent of the schools did not offer the fourth year of mathematics.

7. Students from the large schools scored significantly higher on the mathematics section of the Scholastic Aptitude Test than did students from the medium or small schools. There was no significant difference between the scores of students from the small schools and the scores of students from the medium schools. The means of the mathematics aptitude scores of students from the small, medium, and large schools were 449.1, 470.0, and 488.1 respectively.

8. There were eight state adopted textbooks that received a rating of one in every category. These textbooks are Foundations of Algebra (I and II) by Lancaster, Modern Algebra (I) by Dolciani, Modern Algebra and Trigonometry by Dolciani, Anderson’s Geometry, Moise’s Geometry, Modern Trigonometry by Wooten, and Pre-Calculus Mathematics by
Shanks. The textbooks mentioned above were adopted by a larger percentage of large schools than by either of the other two groups of schools. The widest variations in textbook use were in the areas of related mathematics, geometry, and advanced mathematics.

9. The mathematics class sizes in the large and medium schools were closer to the state averages than the class sizes in the small schools. The class sizes in the small schools were below the state averages in all subjects, particularly in the advanced courses.
CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to determine the current status of mathematics programs in high schools in North Central Texas as related to teacher preparation, course offerings and course organization, student aptitude in mathematics, and mathematics textbooks in use. The study encompassed 189 high schools in eighteen counties. Of these 189 high schools, fifty were randomly selected as an appropriate sample. Through the use of stratified sampling, the selected high schools were divided into the following three categories: small, medium, and large high schools. Twenty-four small schools, twelve medium schools, and fourteen large schools were selected.

An interview checklist was designed in order to facilitate the gathering of information from each of the schools. The checklist contained items on undergraduate training in mathematics, graduate work in mathematics, length of teaching experience, degrees held, course offerings, organization of course offerings, and textbooks in use by the schools.

After permission was obtained from the superintendents to visit the high schools, the principals or the heads of the mathematics departments in each school were interviewed.
Students' scores on the mathematics section of the Scholastic Aptitude Test were obtained from either the permanent records of the students or from the records of the counselors in each of the schools.

The information pertaining to the textbooks used by the high schools in the sample was collected through visits to the Texas Education Agency. The mathematics consultants of the Texas Education Agency ranked the textbooks in each subject area with respect to modernness, content, presentation of subject matter, and appropriateness for high school use.

The literature surveyed for the study, and reported in Chapter II, was divided into the following four sections: (1) literature concerning size of high school, (2) literature related to teacher preparation, (3) literature pertaining to high school mathematics programs, and (4) literature related to student achievement and aptitude in mathematics. Chapter III was devoted to the presentation of findings. Tables were also included to facilitate the presentation of the findings. After the data were collected, comparisons were made among the three groups of schools concerning the factors under study.

The remainder of the present chapter is devoted to the following three sections: (1) conclusions derived from the findings, (2) implications and recommendations for the improvement of mathematics programs in high schools in North Central Texas, and (3) recommendations for further research.
Conclusions

An analysis of the data in the study led to the following conclusions:

1. Large schools have been more successful in securing mathematics teachers who have more extensive preparation in mathematics than either medium or small schools. The preparation of the teachers employed by the large schools was more extensive with respect to breadth and depth of courses taken, number of hours in mathematics, graduate work, and more recent work in mathematics institutes and workshops.

2. In regard to teachers in the schools, the number of years of experience and the length of tenure in a teaching position seemed to have no relationship to the organizational pattern of mathematics programs in schools of various sizes.

3. Teaching assignments outside the field of mathematics were more prevalent among mathematics teachers in the small schools than in the large or medium schools.

4. The mathematics programs in schools of all sizes followed the typical sequence of high school mathematics. Because of accelerated, or fifth year programs, the mathematics course offerings in the large schools were more diversified than offerings in the medium or small schools. The medium schools had diversified offerings for the four years of high school mathematics; however, no formal provisions were made for the accelerated student. The availability of
mathematics course offerings in the small schools were limited, particularly for the accelerated student.

5. Significantly higher scores on the mathematics section of the Scholastic Aptitude Test by students from large schools cannot specifically be concluded to be as a result of any one factor under study; however, the variables of more extensive teacher preparation, more course offerings, and more advanced courses offered in the large schools appear to be related to their scores on this instrument.

6. Because the quality of the textbooks in each subject area was much the same, the use of different textbooks by the schools did not appear to have an effect on the types of mathematics programs in the schools.

Recommendations

On the basis of the findings and conclusions, the following recommendations were made for improving the mathematics programs in high schools in North Central Texas:

1. Because of more course offerings in the large and medium schools, the desirability of assigning mathematics teachers full teaching loads in mathematics should be studied. In small schools that are not able to offer a wide range of mathematics courses and more advanced courses, the possibility of two or more schools sharing a well qualified mathematics teacher should be investigated by local school authorities.

2. For small schools that do not offer advanced mathematics programs, the possibility of utilizing techniques
such as correspondence courses, supervised independent study, programmed instruction, and multiple classes should be investigated.

3. It is suggested that small schools that do not belong to the Texas Small Schools Project give consideration to becoming members. The Texas Small Schools Project offers a means of providing students in the small schools with programs that could not be provided otherwise.

4. High Schools that have a sufficient number of students and a competent mathematics staff should study the advisability of offering a fifth year of mathematics to meet the needs of advanced students.

5. Because there are schools that may profit from conducting experimental programs in mathematics, a closer cooperation between high schools and colleges needs to be encouraged. A closer cooperation could be developed in the areas of programs approved by the colleges, high school credits accepted, and consultant services offered to the high schools by the colleges.

6. It is suggested that the requirements for a teaching certificate in mathematics as advocated by various national committees in mathematics such as the Committee on the Undergraduate Program in Mathematics be studied thoroughly by institutions of higher learning and state certification agencies. The purpose of such a study may lead to the certification of better prepared mathematics teachers for the future.
Recommendations for Further Research

Although the recommendations suggested in the previous section may be the basis for further research in the improvement of high school mathematics, the following may also prove valuable research projects:

1. Pilot studies in programs which stress various concepts adopted by national experimental programs need to be encouraged to determine additional advantages which would benefit the student in the comprehension of mathematics.

2. The needs of high schools with respect to such factors as facilities, equipment, materials, and audiovisuals should be determined in order to improve the mathematics programs.

3. Research into the relationship between teacher preparation and teacher effectiveness should be undertaken.

4. A study of the teaching practices and teaching methods utilized by mathematics teachers should be examined to determine if they are in vogue with the practices and methods recommended by college mathematics teachers, authorities in mathematics, and leaders in the advancement of high school mathematics.
 sampLe letter to superIntendents

as a part of my doctoral work at north texas state university, i am conducting a study to investigate the status of high school mathematics programs in north central texas. the purpose of this study is not to evaluate any one school's mathematics program but to determine the current status of mathematics programs in the high schools of texas.

four major areas will be included: (1) teacher preparation, (2) course offerings and course organization, (3) textbooks in use, and (4) student aptitude in mathematics.

to obtain the necessary information, i would like to make a personal visit to your school and arrange an interview with the principal or the head of the mathematics department in the high school. this study will be conducted in a professional manner and in no way will the school, names of students, or names of teachers be identified.

upon completion of the study, the results will be available to the participating schools. i am sure the results will be helpful to you in maintaining a quality mathematics program in your high school.

i sincerely solicit your cooperation and am enclosing a post card for you to indicate a convenient time for me to visit your school. if none of the dates are appropriate, please indicate another date.

this study has been approved by the doctoral advisory committee at north texas state university. your cooperation will be greatly appreciated.

sincerely,

edward j. miller

walter s. sandefur
associate professor of education
chairman, doctoral committee
INTERVIEW CHECKLIST

Teacher Preparation

1. Number of faculty teaching at least one high school mathematics course ________.
2. Number of teachers teaching mathematics full time in high school ________.
3. Number of teachers certified to teach mathematics in high school ________.
4. Number of teachers who have a bachelor's degree in Education with a major in mathematics ________.
5. Number of teachers who have a master's degree in Education with a major in mathematics ________.
6. Number of teachers who have a bachelor's degree in Education with a minor in mathematics ________.
7. Number of teachers who have a master's degree in Education with a minor in mathematics ________.
8. Number of teachers who have attended a mathematics workshop during the summer within the past five years ________.
9. Number of teachers who have attended a mathematics workshop within the past ten years ________.
10. Please indicate the number of years each teacher has been teaching mathematics:

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

11. Please indicate the length of time each teacher has been teaching mathematics in present position:

<table>
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<th>Teacher</th>
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<tbody>
<tr>
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</table>

12. Please indicate the number of hours of preparation in mathematics for each teacher:

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<tr>
<th>Teacher</th>
<th>Number of Hours</th>
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</thead>
<tbody>
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</tr>
</tbody>
</table>
Course Offerings and Course Organization

Directions--Place an "X" in the proper space if the course is offered each year. Place a check mark (✓) in the proper space if the course is offered every other year.

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<thead>
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<th>Number of credits</th>
<th>Grade level</th>
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<tr>
<td>Algebra II</td>
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<td>Solid Geometry</td>
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<td>Elementary Analysis</td>
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<td>Probability and Statistics</td>
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<td>Calculus</td>
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<td>Consumer Mathematics</td>
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<td></td>
</tr>
<tr>
<td>Business Mathematics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Does the school provide a sequence of mathematics courses for non-college bound students? yes\___, no\___

2. If the answer to 1 is yes, what are the recommended courses?
   grade 9 _________
   grade 10 _________
   grade 11 _________
   grade 12 _________
3. Does the school provide a sequence of courses in mathematics for the college bound student? yes___, no___

4. If the answer to 3 is yes, what are the recommended courses:
   grade 9 ______
   grade 10 ______
   grade 11 ______
   grade 12 ______

5. Please indicate the average class size of each of the following mathematics courses:

<table>
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<tr>
<th>course</th>
<th>average class size</th>
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<tbody>
<tr>
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<td>______</td>
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<tr>
<td>Related Mathematics II</td>
<td>______</td>
</tr>
<tr>
<td>Algebra I</td>
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<td>______</td>
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<tr>
<td>Plane Geometry</td>
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<tr>
<td>Solid Geometry</td>
<td>______</td>
</tr>
<tr>
<td>Unified Geometry</td>
<td>______</td>
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<tr>
<td>Trigonometry</td>
<td>______</td>
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<tr>
<td>Elementary Analysis</td>
<td>______</td>
</tr>
<tr>
<td>Probability and Statistics</td>
<td>______</td>
</tr>
<tr>
<td>Calculus</td>
<td>______</td>
</tr>
</tbody>
</table>
1. Bachelor's degree:
   Year __________
   Area __________________________
   First Teaching Field ___________
   Second Teaching Field __________

2. Master's degree:
   Year __________
   Area __________________________

3. Please place a check mark by the courses that were taken on the undergraduate degree. Place an "X" by those courses that have been taken beyond the Bachelor's. Indicate the number of hours in each area.

<table>
<thead>
<tr>
<th>Course</th>
<th>Number of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>( ) College Algebra</td>
<td></td>
</tr>
<tr>
<td>( ) Modern Algebra</td>
<td></td>
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<tr>
<td>( ) Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>( ) Abstract Algebra</td>
<td></td>
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<tr>
<td>( ) Trigonometry</td>
<td></td>
</tr>
<tr>
<td>( ) Geometry (All Courses)</td>
<td></td>
</tr>
<tr>
<td>( ) Calculus (All Courses)</td>
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<tr>
<td>( ) Differential Equations</td>
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<tr>
<td>( ) Probability &amp; Statistics</td>
<td></td>
</tr>
<tr>
<td>( ) Theory of Equations</td>
<td></td>
</tr>
<tr>
<td>( ) Number Theory</td>
<td></td>
</tr>
<tr>
<td>( ) Math of Finance</td>
<td></td>
</tr>
<tr>
<td>( ) Methods of Teaching High School Mathematics</td>
<td></td>
</tr>
</tbody>
</table>

List other courses that are not included in the above:

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

List any mathematics workshops or institutes attended within the past 5 years:
___________________________________________________________________________
___________________________________________________________________________

Length of teaching experience: __________________________
Number of years in present position: ___________________
Number of hours beyond the Master's: ___________________
Textbooks

Directions - Please indicate the textbooks that are used in the mathematics courses in the high school by placing a check mark by the appropriate textbooks:

Related Mathematics

( ) Lancaster; Foundations of Algebra, Book I (1965, Webster)
( ) Lancaster; Foundations of Algebra, Book II (1965, Webster)
( ) Skeen; Modern Basic Mathematics, Book I (1964, Singer)
( ) Skeen; Modern Basic Mathematics, Book II (1965, Singer)
( ) Stein; Fundamentals of Mathematics (1964, Allyn)
( ) Wiebe; Foundations of Mathematics (1962, Holt)
( ) Wilcox; Mathematics, A Modern Approach, First Grades (1963, Addison)
( ) Wilcox; Mathematics, A Modern Approach, Secondary Grades (1966, Addison)

Algebra I

( ) Dolciani; Modern Algebra, Book I (1962, Houghton)
( ) Johnson; Modern Algebra, First Course (1961, Addison)
( ) Nichols; Modern Elementary Algebra (1961, Holt)
( ) Vannatta; Algebra One, A Modern Course (1962, Merrill)
( ) Welchons; Book I, Algebra (1962, Ginn)

Algebra II

( ) Dolciani; Modern Algebra and Trigonometry (1963, Houghton)
( ) Griswold; Contemporary Algebra and Trigonometry (1963, Holt)
( ) Johnson; Modern Algebra, Second Course (1962, Addison)
( ) Vannatta; Algebra II, A Modern Course (1962, Merrill)
( ) Welchons; Book II, Algebra (1962, Ginn)

Geometry

( ) Anderson; Geometry (1969, Houghton)
( ) Jurgenson; Modern School Mathematics - Geometry (1969, Houghton)
( ) Keedy; Exploring Geometry (1967, Holt)
( ) Moise; Geometry (1967, Addison)
( ) Rosenberg; Geometry, Dimensional Approach (1968, Macmillan)
Trigonometry

( ) Rees; Trigonometry (1965, Prentice)
( ) Rickey; Plane Trigonometry (1964, Holt)
( ) Spitzbart; Plane Trigonometry (1964, Addison)
( ) Welchons; Modern Trigonometry (1962, Ginn)
( ) Wooten; Modern Trigonometry (1966, Houghton)

Advanced Mathematics

( ) Dolciani; Modern Introductory Analysis (1964, Houghton)
( ) Glicksman; Fundamentals for Advanced Mathematics
(1964, Holt)
( ) Meserve; Principles for Advanced Mathematics
(1964, Singer)
( ) Murdock; Analytic Geometry (1966, Wiley)
( ) Shanks; Pre-Calculus Mathematics (1965, Addison)
BIBLIOGRAPHY

Books


Division of Surveys and Field Services, *High Schools in the South*, Nashville, Tennessee, George Peabody College for Teachers, 1966.


Articles


Mathematical Association of America, "Recommendations of the Mathematical Association of America for the Training of Teachers of Mathematics," The Mathematics Teacher, LIII (December, 1960), 632-638.


Norris, Fletcher R., "Student Mathematics Achievement As Related to Teacher In-Service Work," The Mathematics Teacher, LXII (April, 1969), 321-327.


Puett, Ida B., "How to Get From Where We are to Where We Should Be," The Mathematics Teacher, LII (January, 1959), 44-45.


Schaefer, Sister Mary Geralda, "Revision of Secondary Mathematics in a Selected Number of Schools," The Mathematics Teacher, LX (February, 1968), 157-161.


Sparks, Jack Norman, "A Comparison of Iowa High Schools Ranking High and Low in Mathematical Achievement," Dissertation Abstracts, XXI (1960), 1481-1482.


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Reports


Public Documents


Publications of Learned Organizations


Unpublished Materials
