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Suburban Public School District Characteristics And Teacher Preparation And Their Relationship To The Quality Of The Senior High School Mathematics Curriculum

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SUBURBAN PUBLIC SCHOOL DISTRICT CHARACTERISTICS AND TEACHER PREPARATION AND THEIR RELATIONSHIP TO THE QUALITY OF THE SENIOR HIGH SCHOOL MATHEMATICS CURRICULUM

BY

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B.C.E., College of the City of New York, 1950

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DISSERTATION

Submitted in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Philosophy in Education:
Curriculum and Instruction
The University of New Mexico
Albuquerque, New Mexico
December, 1979

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The Problem

Demographically, the growth of America is now taking place in the suburbs rather than in the central cities. It is estimated that by the turn of the century 49.5 percent of our total population will be concentrated in suburbia.

In view of the growing importance of suburbia this study was designed to gather data concerning suburban public senior high school districts. It sought to determine the relationships between selected district characteristics; to determine the extent of the preparation of senior high school mathematics teachers; and to ascertain whether significant relationships existed between the evaluation of the senior high school mathematics curriculum and the selected district characteristics as well as between the evaluation and teacher preparation.

Procedures

Sixteen suburban senior high school districts from the public school districts of Nassau County, New York, were randomly selected and studied. The major source of data concerning district characteristics

was published information collected by the Department of Education of the State of New York. These characteristics included property wealth per pupil, expenditure per pupil, district enrollment, and percentage of graduates going on to college. Data related to school size, pupil-mathematics teacher ratio, preparation of teachers, and the evaluation of the senior high school mathematics curriculum were obtained from 16 department chairmen and 124 mathematics teachers by means of questionnaires utilizing criteria of the National Council of Teachers of Mathematics and Evaluative Criteria for the Evaluation of Secondary Schools by the National Study of Secondary School Evaluation.

Nineteen null hypotheses were developed and tested which dealt with factors that might be related to the evaluation of the senior high school mathematics curriculum by the department chairman. To test the relationships and null hypotheses of the study four statistical tests were used: the Spearman Rank Order Correlation Coefficient, Partial Correlation, the Chi-Square, and the t-test.

Conclusions

1. College oriented suburban public senior high school districts tended to have higher property wealth per pupil, have higher expenditures per pupil, be better staffed, and have a higher quality senior high school mathematics curriculum.

2. A significant positive correlation existed between district property wealth per pupil and expenditure per pupil. The quality of the senior high school mathematics curriculum was not an important

consideration affecting the relationship.

3. A significant positive correlation existed between district property wealth per pupil and the quality of the senior high school mathematics curriculum. District expenditure per pupil was not an important consideration affecting the relationship.

4. District expenditure per pupil showed no significant correlation to the quality of the senior high school mathematics curriculum if the district property wealth per pupil was held constant. The findings did not support the view that increased expenditures result in increased quality of secondary mathematics education.

5. The district enrollment, size of the school, and the pupil-mathematics teacher ratio all appeared to have no significant correlation to the quality of the senior high school mathematics curriculum.

6. Suburban public senior high school mathematics teachers were well qualified. They did not, however, meet the specific course recommendations of the National Council of Teachers of Mathematics.

7. Differences in teacher preparation between suburban districts was not an important consideration affecting the quality of the senior high school mathematics curriculum.

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CHAPTER I

THE PROBLEM AND HYPOTHESES

Introduction

Whenever a discipline is singled out for attention and given the emphasis which mathematics has received in the last twenty years, there is every reason to expect that changes will occur. Changes in curricula, however, are usually subtle and difficult to detect, particularly when no criteria for measurement have been established and when it becomes necessary to rely on a retrospective view or on a historical perspective. It is therefore imperative to record significant elements as they occur. This can be and usually is accomplished by schools through the self evaluation of their curricula.

Donovan A. Johnson, past president of the National Council of Teachers of Mathematics, reflected on the need for evaluation and improvement in mathematics education when he said:

> The mathematics competence of many of our present 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.[1]

Some - if not most - educators have presumed, however, that more money spent for education equates with higher quality of education. Foremost among them was Dr. Paul Mort of Teachers College, Columbia University. Mort's position on the importance of financing levels in public schools was highly influential in the development of public and educator acceptance of a significant relationship between per pupil expenditure and quality of education. Thus, when Mort wrote in 1960, that

> Today it can be said, with considerable assurance, that communities spending more for education get more of what promises results desired by people in general. Expenditure level is one of the highly important factors in achieving good education.[2]

it was not surprising that educators were quick to accept this premise as a basic truth underlying American education.

Mort's regard for the importance of money was unequivocal. He wrote:

> ...we have every right to expect a high relationship between expenditure level and quality of schools. Money is not put into the schools for purposes other than for the production of education. Either the money spent was well spent and thus produced the quality hoped for, or it was poorly spent. Deviations from a one-to-one relationship between expenditure and quality would thus be laid to other conditions, such as errors in measurement and differences in efficiency of administration.[3]

The concepts set forth by Mort have since been challenged. In a special issue of the I|D|E|A REPORTER in 1971, it was reported that the per pupil expenditure for innovating school systems in a 1966 study was 507 dollars less than the national average. "Innovation," quoted the report, "did not depend on dollars, it depended on the ingenuity with which a school district's dollars were deployed."[4]

In Dr. James Coleman's study, Equality of Educational Opportunity,[5] which used student achievement as the measure of educational quality, he concluded that per pupil expenditures, books in the library, and a host of other facilities and curriculum measures show virtually no relation to achievement if the "social" environment of the school -- the educational backgrounds of other students and teachers -- is held constant.

In 1970 James Guthrie,[6] in a survey of school effectiveness, reported that the belief had become increasingly pervasive that formal education did not or could not make a difference in what a student learned. He concluded that performance was molded by social and economic conditions outside of the school.

All too often, the determinants of quality of education have been assumed to be such features as expenditure per pupil, size of the school, innovation, teacher preparation, pupil-teacher ratios, physical facilities, instructional materials, or student achievement. Rarely has educational quality been determined by the overall evaluation of the quality of the curriculum of a specific discipline.

Demographically, the population growth of America is now taking place in the suburbs rather than in the central cities. A phenomenon of the 20th century, suburban growth and development is a direct result of the technological advances in automotive transportation, which has permitted an exodus of factories, homes, and stores to areas surrounding the older core cities. It is estimated that by the year 2000, 49.5 percent of our total population will be concentrated in suburbia with 23.3 percent and 27.2 percent in the rural areas and central cities, respectively.[7]

In view of the growing importance of suburbia, the importance of mathematics education to our educational system and the conflicting views regarding the importance of various factors determining educational quality, it is imperative that several questions be answered:

1. In what ways are selected suburban public senior high school district characteristics related?

2. How well prepared are senior high school mathematics teachers in suburban public school districts?

3. In what ways are district characteristics and teacher preparation related to the quality of the senior high school mathematics curriculum in suburban public school districts?

This study attempted to provide objective data to help answer the questions which have been raised.

Statement of the Problem

The purpose of this study was to analyze selected suburban public school district characteristics and teacher preparation and to determine their relationship to the quality of the senior high school mathematics curriculum.

Limitations and Assumptions

Inasmuch as the population composing the base for this study consists of suburban senior high schools in public school districts, the conclusions which issue from this study are limited in specific implication to suburban public senior high school districts. Only to the extent that the schools and districts used in this study are like others nationally may the conclusions be applied generally.

Since greater control over the consistency of the data seemed possible by limiting the study to a single county, Nassau County, New York, was selected for the study.

The data relating to the district were obtained from the published records of the Department of Education of the State of New York. The data relating to the schools, teachers, and the mathematics curriculum were collected from teachers and department chairmen by means of questionnaires.

Admittedly, the use of questionnaires introduces the possibilities of bias and deficiency from the following sources: (1) failure of some respondents to return the questionnaire, (2) tendency of respondents to modify a reply to give the investigator what they perceive he wants, and (3) inaccuracy and incompleteness of the responses. These are legitimate concerns. They do operate and could influence the results. This study's questionnaires, however, elicited an approximate 75 percent return. The effect of biases was addressed by (1) preliminary testing of the questionnaires in order to minimize opportunities for ambiguity and misunderstanding, and (2) cross-checking between respondents in the same school in order to establish validity of the data.

It was assumed in this study that the department chairman could evaluate the quality of the mathematics curriculum based on his total experience in the school and would make the best judgments possible on the basis of that experience.

Definitions of Terms

To clarify the meaning of the terms used in this study the following definitions are given:

Curriculum: a group of courses and planned experiences which a student has under the guidance of the school.[8]

District enrollment: the number of students in terms of weighted average daily attendance for each school district. For state aid purposes, a kindergarten pupil is counted as .5 of a child, an elementary student is counted as 1, and a secondary student as 1.25.[9]

Expenditure per pupil: cost to educate each resident statistically weighted pupil for a school year. It includes the money needed for direct educational services and does not include expenditures for transportation or debt service.[10]

Outcome: change in behavior resulting from learning; not to be confused with objective, which is a desired result.[11]

Population: any group of individuals that have one or more characteristics in common that are of interest to the researcher. The population may be all the individuals of a particular type or a more restricted part of that group.[12]

Property wealth per pupil: the amount of full-value real estate in a school district divided by the number of statistically weighted pupils.[13]

Pupil-mathematics teacher ratio: the ratio of the number of pupils in a given school to the number of mathematics teachers.

Sample: a small proportion of a population selected for analysis.[14]

Senior high school: a secondary school composed of the three upper high school grades, usually grades 10 to 12.[15]

Formulation of Hypotheses

To research the problem involved, a series of null hypotheses were developed and tested which dealt with factors which might be related to the evaluation of the senior high school mathematics curriculum by the department chairman. These hypotheses are as follows:

H_1: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the school district property wealth per pupil.

H_2: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the school district expenditure per pupil.

H_3: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and school district enrollment.

H_4: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the size of the high school.

H_5: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the pupil-mathematics teacher ratio.

H_6: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the percentage of graduates going on to college.

H_7: There is no significant difference in the mean property wealth per pupil in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

H_8: There is no significant difference in the mean expenditure per pupil in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

H_9: There is no significant correlation between school district expenditure per pupil and school district property wealth per pupil in school districts with the same evaluation of the senior high school mathematics curriculum.

H_{10}: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and school district property wealth per pupil in school districts with the same expenditure per pupil.

H_{11}: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and school district expenditures per pupil in school districts with the same property wealth per pupil.

H_{12}: There is no significant difference in the mean evaluation of the mathematics curriculum organization in school districts rated high or low in property wealth per pupil.

H_{13}: There is no significant difference in the mean evaluation of the nature of mathematics offerings in school districts rated high or low in property wealth per pupil.

H_{14}: There is no significant difference in the mean evaluation of physical facilities in school districts rated high or low in property wealth per pupil.

H_{15}: There is no significant difference in the mean evaluation of mathematics instructional activities in school districts rated high or low in property wealth per pupil.

H_{16}: There is no significant difference in the mean evaluation of mathematics instructional materials in school districts rated high or low in property wealth per pupil.

H_{17}: There is no significant difference in the mean evaluation of methods of evaluation in school districts rated high or low in property wealth per pupil.

H_{18}: There is no significant difference in the mean evaluation of mathematics outcomes in school districts rated high or low in property wealth per pupil.

H_{19}: There is no significant difference in the preparation of senior high school mathematics teachers in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

Summary

The need for the evaluation of educational curricula is universally accepted by educators. The problem arises in the determination of the factors which influence the quality of education. Many educators have long presumed that more money spent for education equates with higher quality of education. Others believe that the quality of education is due to factors other than those related to expenditures.

This study of relationships between selected suburban school district characteristics, teacher preparation, and evaluation of the senior high school mathematics curriculum might provide objective data to help solve the problem.

Certain assumptions and limitations were inherent in the study. A fundamental assumption was that the department chairman would make the best judgments possible regarding the evaluation of the quality of the mathematics curriculum based on his total experience in the school.

A review of the literature pertinent to the study will be found in Chapter II. Chapter III describes the design of the study. Chapter IV presents the findings of the study. Chapter V consists of the study's summary, conclusions, implications and recommendations.

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CHAPTER II

REVIEW OF RELATED LITERATURE

A review of the literature indicates that there is a paucity of information dealing directly with the problem. There are, however, a number of related studies. These include studies related to financial resources, enrollment, and teacher preparation.

Literature Related to Financial Resources

Considerable interest has been expressed in recent years by educators, legislators, and judicial figures regarding equalization of financial resources of school districts. The presumption upon which resource equalization is based is that equal spending will yield equal results in educational quality from one district to another. In an early study in 1949, Woollatt[1] found a high positive correlation between expenditure per pupil and educational quality in the New York metropolitan area. Four facets were correlated in the study: the teaching of skills in a real or realistic fashion and the teaching of a wider range of skills; the teaching of areas of knowledge realistically; the discovery and development of special aptitudes of individuals through test and trial, and the development of gross behavior patterns, such as citizenship, character and thinking.

In 1954, the New York State Educational Conference Board evaluated 126 elementary schools throughout New York State. Standardized tests were used in reading vocabulary, reading comprehension, and arithmetic. The schools that ranked highest in mastery of the basic skills generally had the most comprehensive programs, including more curricular offerings and more support services. The schools which reported the highest mastery of basic skills and which had the most comprehensive programs had the highest expenditures. [2]

Studies published in the Sixties revealed conflicting findings regarding the impact of expenditure levels upon achievement, "quality", or other characteristics of the school program. Unfortunately, all too frequently the terms "quality" and "good education" were poorly defined.

Furno's work on the ability to project school quality on the basis of major features, such as expenditure levels, led to the development of some sophisticated and complex formulas. Paul Mort and Orlando Furno, for example, collaborated on a formula they called a Sequential Simplex. [3] A series of concentric spheres represented wealth in terms of the per pupil tax, expenditures in terms of board policy, and professional salaries as allocation of resources and a characteristic of the school itself. Moving in a cumulative line through the spheres were community characteristics viewed over a ten-year period: educational climate of the community, such as educational level and willingness to support schools; a system-wide policy with emphasis on budgetary allotments, and characteristics of the school itself. To each of the sub parts, numerical values were arbitrarily attached. These values were subject to revision each year. The accumulation of these values led to an index figure for a school district which served as a basis of comparison with other districts.

Arbitrary assignment of values to some of the dimensions of a school district determined the appraisal of "quality" education. This remains statistically unacceptable as an objective evaluation of educational quality. On the other hand, it was an ambitious effort to deal with the many elusive variables which go into the composition of an educational program.

In 1962, Osborn[4] studied the effect of expenditure per pupil and size of school upon the quality of education in secondary schools in Mississippi. His study embraced 63 white public schools, which were broken down into three size categories and three expenditure levels. Osborn reported a positive correlation between quality and both size and expenditures. Quality was measured by a self-appraisal technique.

In 1968, Lott[5] replicated Osborn's study using selected Texas high schools. In this study he reported that, regardless of expenditure levels, the size of the school is the primary factor in governing educational quality.

Dethy[6] studied in Ohio the relationship between education program characteristics and such factors as expenditure level and school size. The educational program characteristics included instructional materials, pupil-teacher ratio, and teacher salaries. Although he found that quantitative educational returns were higher from higher expenditure level districts, the differences were not as great as he had anticipated.

In 1966, Swantusch[7] studied the relationship between academic progress and per pupil expenditure for instruction in western Pennsylvania. He compared the scores of sixth grade students on the Iowa Tests of Basic Skills to instructional supplies, pupil-teacher ratio, staff stability, size of elementary enrollment, the classroom teacher's average salary, amount of teacher preparation, and amount of resources. He found no significant correlation between the test scores and these seven features.

In a similar study, Puran Lal Rojal[8] found that in Iowa public schools instructional expenditure had a positive significant correlation with composite scores on the Iowa Tests of Educational Development for students in grades kindergarten to twelve. Instructional expenditure for grades ten to twelve had a positive significant correlation with selected measures of the qualifications of the teaching staff.

The monumental study in education during the Sixties was the Coleman Report commissioned by the U. S. Congress under Section 402 of the Civil Rights Act of 1964. Its purpose was to conduct a survey and make a report to the President and the Congress regarding the extent of equal educational opportunities for individuals by reason of race, color, religion, or national origin in public educational institutions. More than 645,000 pupils in grades three, six, nine, and twelve, and the teachers, principals, and superintendents from 4000 public schools participated.[9]

The authors of Equality of Educational Opportunity compared many features that would seem to influence educational achievement.

Achievement, as a determinant of the effectiveness of schooling, was measured on the basis of the student's score on a vocabulary test measuring verbal skills.[10]

Coleman tried to identify the factors which produced variations in achievement from one school to another. Attempts were made to isolate many of these factors and treat them statistically independently and according to interrelationships. Such factors included expenditure, number of volumes in libraries, number of extracurricular activities, extent of accelerated programs, comprehensiveness of programs, promotion strictness, grouping or tracking, movement between tracks, size, guidance service, and degree of urbanization.[11]

Coleman also recognized, but did not treat statistically, such other factors affecting achievement as the pupil's ability and motivation, family interest and background, school characteristics, attitudes of the pupil's peers, his alertness on the day of the test, and community attitudes which support education.

Characteristics such as expenditure, volumes in libraries, number of laboratories, number of extracurricular activities, extent of accelerated programs, comprehensiveness of programs, promotion strictness, grouping or tracking, size, and guidance services were called facilities and curricular measures. When these measures were compared to student achievement several relationships were observed. For schools attended in the South by Negroes, high per pupil expenditures was associated with higher achievement. This was true of Negroes only. When student body characteristics, such as the racial and ethnic composition of the enrollment, were taken into account, the variance accounted for by a facilities measure, which included per pupil expenditure, was very small. Coleman reported:

> Differences in school facilities and curriculum, which are the major variables by which attempts are made to improve schools, are so little related to differences in achievement levels of students that, with few exceptions, their effects fail to appear even in a survey of this magnitude.[12]

Coleman states that schools are remarkably similar in the way they relate to the achievement of their pupils when the socio-economic background of the students is taken into account. It is known that socio-economic factors bear a strong relation to academic achievement. When these factors are statistically controlled, however, it appears that differences between schools account for only a small fraction of differences in pupil achievement.

On the other hand the schools do differ in their relation to the various racial and ethnic groups. The average white student's achievement seems to be less affected by the strength or weakness of his school's facilities, curriculums, and teachers than is the average minority pupil's. To put it another way, the achievement of minority pupils depends more on the schools they attend than does the achievement of majority pupils. Thus, 20 percent of the achievement of Negroes in the South is associated with the particular schools they go to whereas only 10 percent of the achievement of whites in the South is.

It appears that variations in the facilities and curriculums of the schools account for relatively little variation in pupil achievement insofar as this is measured by standard tests. Again, it is for majority whites that the variation make the least difference; for minorities they make somewhat more difference. Among the facilities that show some relationship to achievement are several for which minority pupils' schools are less well equipped relative to whites. For example, the existence of science laboratories showed a small but consistent relationship to achievement. Minorities, especially Negroes in the South, are in schools with fewer of these laboratories. Also for schools attended by Negroes in the South, only 69 percent of the pupils had a sufficient number of textbooks as compared to 97 percent for majority whites.

The conclusions reached by the Coleman Report are as follows:

1. Minority children have a serious educational deficiency at the start of school, which is obviously not a result of school.

2. They have an even more serious deficiency at the end of school, which is obviously in part a result of school.

3. Family background differences account for much more variation in achievement than do school differences.

4. Per pupil expenditures, books in the library, and a host of other facilities and curriculum measures show virtually no relation to achievement if the "social" environment of the school -- the educational backgrounds of other students and teachers -- is held constant.

But even as the first reverberations of the Coleman Report were being felt throughout institutionalized education, research studies continued to be conducted and published.

In 1967 Finch[13] contended that the best predictor of educational quality was total expenditure less capital outlay and transportation. Finch amassed data from 1055 city districts (3, 000 to 1, 000, 000 pupils) in 48 states. He identified numerous factors, such as the amount spent per pupil for instructional materials, the number of teachers, librarians, counselors, clerks and secretaries, teachers with master's degrees per 1, 000 students, and minimum, maximum, and average teacher salaries. Obviously, however, the size of the payroll would correlate highly with per pupil expenditure inasmuch as salary costs account for more than three-fourths of most school budgets.

James Guthrie[14] in a survey of school effectiveness studies reported in 1970 that since publication of the Coleman Report, the belief had become increasingly pervasive that formal education did not or could not make a difference in what a student learns. He concluded that performance was molded by social and economic conditions outside the school. This conclusion, representing a comprehensive review and analysis of 19 school effectiveness studies, supported and endorsed the Coleman Report.

In recent years educational disestablishmentarians have appeared to challenge the value of the traditional school in modern society. George Dennison, for example argued for alternative schools. Others, such as Ivan Illich, spoke of deschooling society. In 1972, Jencks[15] in his book, Inequality: A Reassessment of the Effect of Family and Schooling in America, asserted that schools do almost nothing to close the gap between rich and poor, and that the quality of the education furnished public elementary and high school students had little effect on their future income. To be noted is that Jencks was not saying that schools make no difference; rather, he attempted to document that differences in schools seem to make no difference.

In 1973 the Report of the National Commission on the Reform of Secondary Education quoted a Ford Foundation Report (Foundation Goes to School, New York; Ford Foundation, 1972, p. 3):

> The Ford analysis concluded that the foundation had invested $30 million in school innovation without any lasting or significant results..... Money alone seemed not to be decisive in innovative improvement.[16]

Stock[17] sought to determine the relationship between per pupil expenditure and standardized achievement test scores among selected Ohio school districts in 1974. He concluded that educational achievement expressed in terms of mastery of the basic skills of reading and mathematics for fifth grade students appeared to be a function of the nature of the clientele (the students) and not the number of dollars being invested in the operation of the schools.

A number of studies have been conducted on the ability of school districts to support public education. In 1972 Fisher[18] conducted such a study to determine if relationships existed between two measures of financial ability, for the support of public education, in twenty-eight selected Standard Metropolitan Statistical Areas. The measures of financial ability used were adjusted personal income per pupil and equalized assessed property valuation per pupil. His findings indicated that more than half of the central cities were better able to support public education than all of their suburban county school districts using adjusted gross personal income per pupil as the measure of ability. Using equalized assessed property valuation per pupil as a wealth measure, thirteen of the twenty-eight central cities ranked higher than all their suburban county school districts. His study demonstrated that there is some justification for the questioning of property valuation as a valid measure of local fiscal ability.

In a similar study conducted in 1975 Lewis[19] concluded that the central city school district of Houston, Texas had more wealth to support education than did the combined suburban districts.

Swett[20] conducted a study in 1976 to determine the relationship between effort, based upon median family income and equalized school tax rate and the spending policies of local school districs in New Jersey. He found higher effort districts tended to have low expenditures for teaching supplies, less professional staff members per 1,000 weighted pupils, lower median salaries for teachers and generally spent less for current expenditures per pupil than lower effort districts. School districts in the study which had higher measures of wealth as indicated by high median family incomes and high equalized valuations per pupil tended to spend more per pupil on current expenses than lower wealth districts. This was accomplished while making less effort. Higher wealth districts tended to have a larger number of professional staff per 1,000 weighted pupils than lower wealth districts. No relation was found between equalized school tax rate and current expenses costs per pupil.

Downie[21] in 1978 summarized the views of current authors and commission reports in Ontario, Canada, dealing with the financing of public elementary and secondary education. There was a consensus that taxes on real property should be continued as a source of revenue for the financing of public elementary and secondary education; market value assessment should be the basis for the levying of property tax; residences should be taxed at 50 percent of market value; all presently exempt property, except residences, be taxed at 100 percent of market value; school boards should share in the revenue from grants in lieu of taxation on the same basis as they share other taxable revenue; all governments, municipal, provincial and federal, should contribute to the financing of public elementary and secondary education.

School finance experts have long known that the large disparities in spending for education between school districts was primarily caused by the great variation in taxable wealth between the districts. Attempts to equalize spending differentials between school districts through the legislative process have historically failed. Those seeking changes in the present school finance system have been forced to use the courts to fight the inequities in state finance systems. Several studies have been conducted dealing with the effects of the decisions of Serrano v. Priest in 1971 and Rodriguez v. San Antonio in 1973.

Warner[22] concluded in 1973 that whether or not the Serrano principle is victorious in the Supreme Court, educators cannot assume that the courts or state legislatures are going to deal with the real issue -- equity in treatment of children. Equity in the distribution of school revenue is an essential first step toward the attainment of improved educational quality for poor and minority students, but it is only a beginning.

In Kansas in 1977 Hurn[23] concluded that there is a need to redefine district wealth before future attempts can be made at equal opportunity for students based on a more equal expenditure per pupil among school districts.

Coullard[24] stated in 1978 that the courts have avoided dictating alternatives to the historic method of utilizing property tax as the method of funding education. They have also disagreed with one another directly on specific interpretation, and also disagreed on the finer points of legal distinctions among the state constitutions, thus complicating the value of legal precedents.

In summary, the literature has highlighted the controversy which has existed in the area of the importance of financial resources for the quality of education. What long had been an accepted position for years, the one-to-one correspondence of expenditure and quality, was seriously undermined by the Coleman Report and, more recently, by Jencks. Especially when educational quality is defined as student achievement does the literature reveal discrepancies in correlation between expenditure and quality of education.

In view of the conflicting reports regarding the importance of financial resources for educational quality, this study was designed as an investigation to narrow the range of plausible hypotheses in accounting for the data. Thus three aspects of a district's financial resources were studied: property wealth per pupil, expenditure per pupil, and percentage of graduates going on to college.

Literature Related to Enrollment

In the past quarter of a century numerous studies have been conducted that relate to the size of the school and to various aspects of their educational processes. One of the earliest studies to include the size of high schools was conducted by Conant.[25] He recommended that a high school have a graduating class of at least 100 students to enable the curriculum to become diversified enough to accommodate all the students in the school.

In an early study of enrollment characteristics and teacher preparation conducted in Michigan secondary schools Lohela[26] found that mathematics teachers in the smaller schools tended to be less prepared and less experienced than those in the larger schools.

DeGood[27] conducted a study which sought to identify differences which existed in high schools due to the size of the schools. Three assumptions were made in the study:

1. High salaries tend to attract better teachers.

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

3. Teachers with graduate degrees tend to perform better than teachers lacking graduate degrees.

Although DeGood could not offer a profile to fit all schools, certain distinctions came to light. In small schools, teachers received lower salaries, had fewer years of experience, and were less likely to hold graduate degrees.

In 1960 Crocker[28] 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.

Leonhardt[29] designed and conducted a study which would describe the relationship of selected factors to achievement in high school mathematics. His findings showed the mean scores on a mathematics test to be significantly lower in schools with the smallest enrollment.

In a survey of the mathematics programs for the 1963-1964 school year in Illinois, Smith[30] found the following:

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

2. More beginning teachers were to be found in the smaller high schools than in the larger.

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

The primary purpose of Jackson's[31] study, conducted in secondary schools in eleven southern states, was to examine the interrelationships among school enrollment, type of organizational pattern, and various factors affecting program adequacy. His findings were as follows:

1. A strong positive relationship existed between school enrollment and number of courses offered.

2. The number of courses offered per grade level increased as

enrollments increased and as organizational patterns approached the three-year structure.

3. A positive relationship existed between enrollment and professional qualifications of teachers.

4. Three-year schools had a higher percentage of teachers holding advanced degrees than did schools of other organizational patterns.

5. Little variation in class size, pupil-teacher ratio, and daily teacher load was noted as enrollment exceeded 1,000 pupils.

Seeking to determine whether there was an optimum size for the high school, Ovaitt[32] in Michigan in 1966 examined the relationship of secondary school size to per pupil cost and the quality of the educational program. He reached the twofold conclusion that per pupil cost was inversely related to the size of the high school as size increased up to and including the 800-999 enrollment interval for three and four year high schools, and that the quality of the educational program was directly related to the size of the high school as size increased up to and including the 1,000-1,199 enrollment interval for both three and four year high schools. Beyond these enrollment intervals, size did not appear to have any consistent relationship to either per pupil cost or the quality of the educational program.

In 1967 Orr[33] reported that schools in large cities tend to be able to provide more diversified curricula and also to make better provisions for special groups. He also stated that the larger city schools tend to have both the best prepared teachers and the largest class sizes.

Miller[34] in 1970 sought to determine the status of high school mathematics programs in north central Texas. He concluded that the preparation of teachers in 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. He also concluded that the significantly higher scoring on the mathematics section of the Scholastic Aptitude Test by students from large schools appears to be related to the variables of more extensive teacher preparation, more course offerings, and more advanced courses offered.

Closely related to enrollment is pupil-teacher ratio. A study reported in the NEA Research Bulletin[35] indicated a number of positive effects that small classes had on teachers' behavior. It was found that teachers tended to invent more practices and to adopt more readily 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 pupil.

Pugh[36] conducted a study to investigate the pupil-teacher ratio with specific reference to the kind of teaching and learning activities that occur in small classes (20 and fewer pupils) compared to that of large classes (30 or more pupils).

The study produced the following major findings:

1. A greater number of learning activities were recorded in small classes.

2. A greater percentage of individual and small group activities

were found in small classes.

3. A greater percentage of mass type instruction was found in large classes.

4. Many teachers depended primarily on four learning activities in attempting to promote learning -- listening, reading, recalling, and observing.

5. In small classes, 48 of the 90 teachers made some arrangements for the individualization of instruction. In large classes, only 26 of the 90 teachers made the same type of arrangements.

6. A greater variety of activities was to be seen within a given period of time in small classes as compared to large classes.

Catania[37] sought to ascertain whether or not per pupil expenditure and size of community had a significant influence upon programs provided exceptional children in the public schools of the State of Connecticut. In 1976 a survey instrument was mailed to one elementary and secondary principal randomly selected from every public school district. His general conclusion was that the size of community and per pupil expenditure did have an influence upon variables related to personnel but did not upon variables related to program activity.

In summary, the literature reveals the importance of enrollment for the quality of secondary education. It is evident that the school must be large enough to offer a diversified curriculum and to meet the various needs of its students. The larger secondary schools, moreover, tended to offer more courses and achieve better programs. Their teachers tended to have higher degrees, to be better prepared, and to have more experience. Teachers in smaller classes tended to be more innovative, to provide more individualization of instruction, and to offer a greater variety of activities.

In this study three aspects of enrollment were studied: district enrollment, school size, and pupil-mathematics teacher ratio.

Literature Related to Teacher Preparation

One of the most important factors in the improvement of secondary school mathematics education is well-educated teachers who not only have the best possible subject-matter preparation but also know how to teach. No mathematics program can be better than the competence of its teachers. A number of organizations and studies have been concerned with recommendations for the preparation of secondary school mathematics teachers.

In an early study Syer[38] compiled information on the training of mathematics teachers from past reports and articles and gave a summary of past recommendations. His own recommendations for a new four-year plan comprised 120 semester hours, consisting of 50 semester hours of general education, 40 hours of mathematics education, and the remaining 30 given over to professional education.

In 1956, 300 teachers of secondary school mathematics and 200 secondary school administrators and college professors in Texas were surveyed by Sister Mary Matthew Donovan.[39] She found general agreement that a minimum of 70 semester hours in general education, 24 in mathematics, and 24 in professional courses should be included in teacher preparation programs. Her recommendations in mathematics included algebra, trigonometry, analytic geometry, the calculus, college geometry (with an introduction to non-Euclidean geometry), history of mathematics, theory of numbers, theory of equations, and descriptive geometry. She also recommended that professional courses be given during the junior and senior years and that student teaching should cover one year.

The Commission on Mathematics of the College Entrance Examination Board (CEEB)[40] recommended in 1959 that a sound teacher-education program be developed around a major of 24 semester hours beyond the calculus. It recommended that the major be earned by selections from the following courses: differential equations, probability and statistics, modern algebra, geometry (other than Euclidean), advanced calculus, logic, history of mathematics, and theory of numbers. In addition to courses in pure mathematics, the Commission considered it desirable for the secondary school mathematics teacher to have a strong minor in at least one field that uses mathematical methods extensively.

The CEEB also advised that the value of courses in psychology and education not be overlooked. It suggested that all mathematics majors take courses in such subjects as psychology, foundations of education, methods of teaching mathematics, and student teaching. It also recommended a course dealing specifically with the teaching of mathematics in the secondary school as well as a graduate seminar in the problems of secondary education and the teaching of mathematics.

The Secondary School Curriculum Committee of the National Council of Teachers of Mathematics (NCTM), [41] has recommended that the professional preparation of secondary school mathematics teachers be based on a strong program of general education. In view of current curriculum demands it recommended that teachers of mathematics also acquire competence in (1) analysis-trigonometry, plane and solid analytic geometry, and the calculus; (2) foundations of mathematics - theory of sets, mathematical or symbolic logic, postulation systems, and real and complex number systems; (3) algebra- matrices and determinants, theory of numbers, theory of equations, and structure of algebra; (4) geometry - Euclidean and non-Euclidean, metric and projective, synthetic and analytic; (5) statistics - probability and statistical inference, and (6) applications - mechanics, theory of games, linear programming, and operational research.

The NCTM further asserted that, ideally, every teacher of secondary mathematics should have completed successfully a five-year program emphasizing the above areas and culminating in a master's degree. As a minimum, teachers of mathematics in grades nine through twelve should have completed successfully a program of at least 24 semester hours, including a full-year program in the calculus, in courses from the above areas.

The NCTM has also recommended that mathematics be supplemented by a basic program in education and psychology. As a minimum, a teacher should have completed 18 semester hours, including student teaching in mathematics, in such courses as methods in the teaching of mathematics, psychology of learning (with particular reference to adolescents), psychology of adjustments (mental hygiene), and tests and measurements.

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[42] made the following recommendations for the preparation of high school mathematics teachers:

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

The Committee on the Undergraduate Program in Mathematics of the American Mathematical Association[43] has proposed the following sequence of mathematics courses as a minimal preparation for high school teachers of mathematics:

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

In 1974 McMaster[44] sought to determine the current status of mathematics teaching in a suburban community as reflected by the opinions held by a selected population of parents, pupils and staff served by or serving the school community. He found that a majority of pupils, parents and school staff believed teachers of mathematics were well prepared to perform their job but agreed all teachers of mathematics should be required to take at least one course appropriate to mathematics within each six year period.

The purpose of a study conducted by Johnson[45] in 1975 was to examine the status of the preparation of pre-service secondary school mathematics teachers in institutions of higher learning in the United States. Responses to a questionnaire were received from 418 institutions of higher learning who held membership in the American Association of Colleges for Teacher Education.

Johnson found that the mean number of semester hours of mathematics required specifically for a pre-service senior high program was 33.28 semester hours. There was, however, a pronounced lack in meeting the course requirements as recommended by the CUPM Level III in the area of probability and statistics. It was also noted that the CUPM Level III course recommendations were not being met in algebra, applications, computer science, and geometry.

Although numerous recommendations have been made concerning the preparation of secondary school mathematics teachers, relatively few studies have been made comparing the specific requirements for the certification of these teachers. To rectify that deficiency Montague[46] conducted such a study in 1970.

As a rule, she found, state certification requirements are divided into three categories: general education, professional education, and specialized education. Most states are in accord that prospective teachers in all subjects should have a bachelor's degree with a distribution of hours in general education (English, language, history, etc.), a certain number of hours in professional education (educational psychology, methods of teaching, student teaching, etc.), and credit hours in specialized education (mathematics, science, etc.).

There are also three basic types of certification: temporary or provisional, standard, and professional. The standard certification usually requires some teaching experience and evidence of professional growth or study beyond the bachelor's degree. The professional certificate requires, in most cases, a master's degree and teaching experience. It is sometimes called a permanent certificate.

Some states have adopted the view that the preparing institution should decide the specific requirements for teacher preparation. The institution is given maximum freedom in setting up its programs, but final approval of the program is a state function. Certification by the state is automatic when a student is recommended by an institution with an approved program. The state sets no minimum number of required hours in specialized education that every institution has to meet nor does it mandate specific courses in mathematics. States operating in this manner are called "approved program states" in that they require that the applicant's program must be approved either by the state or the preparing institution or both.

Another approach to certification is for a state to require a minimum number of hours in mathematics together with certain required courses or else a certain proportion of upper-level courses. Twenty-one states operate in this manner: Arkansas, California, Delaware, Florida, Georgia, Idaho, Indiana, Kansas, Minnesota, Mississippi, Missouri, Ohio, Oklahoma, Oregon, South Carolina, Tennessee, Texas, Utah, Virginia, West Virginia and Wyoming.

The last type of approach to certification that Montague describes is to specify a minimal number of hours in mathematics, with no particular course demands. Besides the District of Columbia (30 hours for Junior High, Master's for Senior High), the following states fall into this category: Arizona (18), Connecticut (18), Florida (21), Maine (30), Maryland (24), Michigan (30 hour major), Montana (30 hour major), New York (18), and Rhode Island (18).

An analysis of the above indicates a spread of requirements from a 12-hour minimum to a 40-hour maximum in mathematics courses.

In a 1978 study on certified personnel, Evans[47] analyzed the professional preparation levels of Indiana public school personnel from 1965-1966 through 1974-1975 for discernable trends. He found a strong increase in the percentage of master's or higher degrees with an accompanying decrease in the percentage of personnel with bachelor's degrees. He concluded that state-mandated professional improvement had resulted in increased preparation levels of certified personnel.

The effect of teacher in-service work has been the subject of several studies. In 1962 Connellan[48] compared the content of mathematics courses taught by graduates of academic year institutes with the content of those taught by a matched group of 17 teachers who did not attend year institutes. She found that the institute programs had led more teachers to enrich their course content, to place less dependence on the textbook, to be aware of their efforts to reorganize the mathematics curriculum, and to be aware of the importance of professional organizations in keeping abreast of developments in mathematics. Similar outcomes were found to have occurred from attendance at summer institutes sponsored by the National Science Foundation (NSF).

Wiersma[49] conducted a study to determine the reactions of mathematics teachers to NSF Institute programs. The results of the participants' questionnaire showed that the institute increased the participants' understanding and knowledge of mathematics in moderate or greater degree. The participants also reported a gain in confidence as regards the presentation of mathematics.

Norris[50] undertook a study to determine the relationship of student achievement in mathematics to teacher in-service work. The findings indicated that pupils learn more from a teacher who has had a thorough and intensive exposure to the subject area to be taught. His conclusion was that exposure to the concepts enabled the teachers to convey the ideas better to pupils and thereby achieve a greater quality of instruction.

In another study on the impact of NSF Institutes on mathematics teachers Corbet[51] in 1975 concluded that NSF participants were more likely to introduce new topics in existing courses than were non-participants. He recommended that NSF Institute mathematics content courses be continued and computer science and application courses continuously updated.

In 1977 Benson[52] explored the relationship of several school variables and their effect on cost and quality of public education. The variables included teacher salary, student achievement, teacher experience, level of teacher education, size of school, per pupil valuation, and economic background of students from 43 Oklahoma independent public schools. He found only student economic background and level of teacher education to have a significant relationship with student achievement when influences of the other variables were considered.

In summary, the literature discloses that numerous national committees and studies have been concerned with the preparation of secondary school mathematics teachers. They have recommended approximately 30 semester hours in mathematics as a minimum and a minimum of 18 to 24 semester hours in professional education courses, including student teaching, for the effective teaching of mathematics.

State certification requirements vary widely in the minimum number of hours of mathematics required for the certification of secondary school mathematics teachers. Most states are agreed that prospective teachers have, as a minimum, a bachelor's degree and, for permanent certification, a master's degree.

The literature indicates that teacher in-service work, including NSF Institute programs and workshops, has been an effective means of increasing understanding and knowledge of mathematics on the part of secondary school mathematics teachers.

In view of the above, this study was designed to investigate five aspects of teacher preparation utilizing criteria of the NCTM: highest degree obtained, mathematics courses completed, education courses completed, certification by the state department of education, and attendance at NSF Institutes.

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CHAPTER III

DESIGN OF THE STUDY

The purpose of this study was to analyze selected suburban public school district characteristics and teacher preparation and to determine their relationship to the overall quality of the senior high school mathematics curriculum. Several questions immediately presented themselves as to methods and procedures. What would constitute a representative sample? What characteristics of the various school districts should be studied? What would constitute a good instrument for the evaluation of the senior high school mathematics curriculum? What criteria should be used concerning the preparation of the mathematics teachers? Where could data be found and how could it be secured? And, finally, what tests should be used and what level of significance should be used to evaluate the relationships which exist between the variables investigated in this study?

This chapter seeks to provide the answers to these questions and presents the general procedure that was followed for collecting and evaluating the data.

Population Sampled

The population sampled consisted of suburban public senior high school districts. Since greater control over the consistency of the data appeared possible by limiting the study to a segment of a suburban area, a single county, Nassau County, New York, was selected for the study.

Nassau County has 56 school districts providing elementary education, 54 of which provide secondary education as well. Many of these districts are the result of consolidating smaller units in an attempt to gain efficiency and improved education. School districts are headed by publicly elected school boards which appoint superintendents and supervising principals to operate the school system. Each school district has its assessed value of property, a figure furnished by the County Department of Assessment, and a rate of local property taxation, the proceeds from which, combined with State aid, provide the sums needed to meet its annual budget. School taxes are collected by the towns, as are all local taxes, except those levied by villages.[1]

A listing of senior high schools in Nassau County consisting of grades ten through twelve was compiled from the Directory of Public Schools.[2] Through the use of stratified random sampling 16 districts were selected as the sample.[3] Table 1 presents the distribution of school districts according to property wealth per pupil for both Nassau County and the sample.

Sources of Data

The writer turned first to the Nassau Educational Resource Center and the New York State Teachers Association to obtain data relative to the status of mathematics education in Nassau County. Both organizations were candid in admitting that at the present time their records were minimal and would not yield sufficient or accurate data to provide a true picture. The inadequacy of Nassau County records made it necessary to go directly to the schools and the teachers.

Table 1

Distribution of School Districts
According to Property Wealth per Pupil

Property Wealth per Pupil	Number of Senior High School Districts in Nassau County	Number of Senior High School Districts in Sample
up to $30,000	3	2
$31,000-$70,000	18	11
$71,000-$110,000	5	3
Total	26	16

The major source of data concerning district characteristics for this study was published information collected by the Department of Education of the State of New York.[4] These characteristics included property wealth per pupil, expenditure per pupil, district enrollment, and percentage of graduates going on to college. Data related to school size, pupil-mathematics teacher ratio, preparation of teachers, and the evaluation of the senior high school mathematics curriculum were obtained from department chairmen and mathematics teachers by means of questionnaires.

Instruments Employed

The principal instruments employed in the study were questionnaires. The mathematics department chairmen of 16 suburban senior high school districts of Nassau County, New York, were asked to evaluate the mathematics curriculum of their respective schools with respect to curriculum organization, nature of offerings, physical facilities, instructional activities, instructional materials, methods of evaluation, and outcomes.

In order to assure validity and reliability of the questionnaire the writer made use of Evaluative Criteria for the Evaluation of Secondary Schools by the National Study of Secondary School Evaluation.

The National Study of Secondary School Evaluation and the antecedent Cooperative Study of Secondary School Standards have been unceasingly engaged in ascertaining significant characteristics of good secondary schools and with developing means for evaluating schools that progressively improve accreditation procedures. The goal has been to develop instruments that can be used widely to achieve sound appraisals of the quality of schools and to encourage staffs to seek better materials and procedures. Since 1940, Evaluative Criteria has been used in thousands of schools throughout the United States.[5] It attempts to provide measures of the effectiveness of a school and to stimulate a school and community toward establishing a planned program of continuous growth with school betterment as the ultimate objective.

Data concerning the preparation of the senior high school mathematics teachers were obtained by means of a questionnaire utilizing criteria of the Secondary School Curriculum Committee of the National Council of Teachers of Mathematics. All the mathematics teachers of the participating schools were requested to supply data concerning the highest degree obtained, mathematics courses completed, education courses completed, certification, and attendance at NSF Institutes.

Procedures Employed

Administration of Questionnaires

In order to secure the data from the department chairmen and mathematics teachers of the various school districts, permission first had to be obtained from the Nassau County Superintendents' Screening Committee to contact superintendents regarding participation in the study. Permission was then obtained from each superintendent to conduct the study in his school district. Each mathematics department chairman was also contacted to insure completeness and accuracy of the data and to maximize the number of returns.

Questionnaires were then submitted to each department chairman and each mathematics teacher who had taught mathematics classes in the participating schools. In the case where a school district had more than one senior high school, only one high school was randomly selected for the study.

One hundred percent of the department chairmen of the 16 school districts participating in the study responded to the questionnaire. Approximately 72 percent, or 124, mathematics teachers returned usable questionnaires.

Methods of Data Analysis

To test the relationships and null hypotheses of this study four statistical tests were used: the Spearman Rank Order Correlation Coefficient, Partial Correlation, the Chi-Square, and the t-test.

The Spearman Rank Order Correlation Coefficient was used to test null hypotheses 1, 2, 3, 4, 5, and 6 for significant relationships between the evaluation of the senior high school mathematics curriculum and various district characteristics. The Spearman Rank Order Correlation Coefficient and Partial Correlation were used to test null hypotheses 9, 10, and 11 which involved the relationship between two variables while controlling the effect of a third. Null hypotheses 7, 8, 12, 13, 14, 15, 16, 17, and 18 were tested utilizing the t-test to determine significant differences in the mean of two groups. The Chi-Square test was used to test null hypothesis 19 for significant differences between observed frequencies and expected frequencies. The total evaluation of the senior high school mathematics program was obtained by determining the mean of the evaluations of the particular school.

In order to facilitate the testing of null hypotheses 7, 8, and 19 the school districts were divided into two categories according to evaluation: high (8 schools) and low (8 schools). School districts were also separated into three categories according to property wealth per pupil: high (5 schools), medium (6 schools), and low (5 schools) in testing of null hypotheses 12, 13, 14, 15, 16, 17, and 18.

The Spearman Rank Order Correlation Coefficient was used to determine the relationships between the district characteristics.

The .05 level of confidence was adopted as the criterion of acceptance or rejection of all null hypotheses and the evaluation of relationships in the study.

In evaluating the preparation of teachers, five aspects of preparation were studied utilizing criteria of the National Council of Teachers of Mathematics: highest degree obtained, mathematics courses completed, education courses completed, certification by the state department of education, and attendance at NSF Institutes.

Summary

This study was designed to gather data concerning suburban public senior high school districts. The researcher sought to determine the relationships between selected district characteristics; to determine the extent of the preparation of senior high school mathematics teachers; and to ascertain whether significant relationships existed between the evaluation of the senior high school mathematics curriculum and the selected district characteristics as well as between the evaluation and teacher preparation.

The data comprised published information of the Department of Education of the State of New York and the responses of 124 mathematics teachers and 16 department chairmen of 16 public senior high school districts of Nassau County, New York.

The findings of the study were based on the data collected and treated as described in this chapter. These findings follow in Chapter IV.

REFERENCES

1. Long Island Association of Commerce & Industry, Long Island Facts Book of Nassau-Suffolk Counties, 1965, p. 5.

2. Nassau County Association of Chief School Administrators, Directory of Public Schools, 1973-74.

3. W. James Popham, Educational Statistics (New York: Harper & Row, 1967), p. 47.

4. Martin Buskin, "Giving Marks to L.I. Schools," Newsday (Long Island, N.Y.), June 19, 1975, pp. 4A-5A.

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CHAPTER IV

FINDINGS

This study sought answers to the questions: (1) In what ways are suburban public senior high school district characteristics related? (2) How well prepared are senior high school mathematics teachers in suburban public school districts? (3) In what ways are district characteristics and teacher preparation related to the quality of the senior high school mathematics curriculum in suburban public school districts? In order to pursue answers to these questions 16 suburban senior high school districts from the public school districts of Nassau County, New York, were selected and studied. One hundred percent of the department chairmen responded to the questionnaire, whereas 72 percent, or a total of 124, mathematics teachers returned usable questionnaires.

This chapter is divided into three sections. Section one is devoted to the tabulation and analysis of data related to district characteristics. Section two lists the 18 null hypotheses related to district characteristics and the test results. Section three pertains to the tabulation and analysis of data related to teacher preparation and the testing of null hypothesis 19.

District Characteristics

Table 2 presents a tabulation of district characteristics. They

Table 2

Summary of District Characteristics

District Code No.	Property Wealth per Pupil	Expenditure per Pupil	District Enrollment	School Size	Pupil-Math Teacher Ratio	Percentage of Graduates Going on to College
1	$ 64,648	$ 2,110	8,244	2,230	131	81.1
2	51,874	1,589	13,659	1,825	183	64.8
3	103,288	2,846	9,017	1,142	114	91.7
4	84,100	2,048	5,194	1,454	121	89.2
5	49,138	1,953	5,606	1,550	141	82.1
6	64,191	2,201	4,202	990	124	70.3
7	69,840	2,147	5,722	1,420	203	79.0
8	72,346	2,071	7,588	1,930	138	81.4
9	62,726	1,857	4,525	1,058	132	76.5
10	34,473	1,748	5,271	1,425	130	70.8
11	32,977	1,683	13,533	2,309	178	58.0
12	58,586	1,871	7,213	1,797	163	63.3
13	51,361	1,697	7,954	1,831	166	61.0
14	26,471	1,672	15,050	1,571	143	65.2
15	46,527	2,047	9,658	1,247	125	82.1
16	29,304	1,654	4,719	1,169	167	63.7

comprise property wealth per pupil, expenditure per pupil, district enrollment, school size, pupil-mathematics teacher ratio, and percentage of graduates going on to college. The rankings of these district characteristics are presented in Table 4 and were used in the determination of the Spearman Rank Order Coefficient between the variables as indicated in Table 5.

An analysis of Table 5 indicates significant positive correlations existed between property wealth per pupil and expenditure per pupil, property wealth per pupil and percentage of graduates going on to college, expenditure per pupil and percentage of graduates going on to college, district enrollment and school size, and school size and pupil-mathematics teacher ratio. Significant negative correlations existed between expenditure per pupil and pupil-mathematics teacher ratio, and pupil-mathematics teacher ratio and percentage of graduates going on to college.

Tests of Null Hypotheses Related to District Characteristics

In Chapter I, 18 null hypotheses were listed which were to be tested for significance. This part of Chapter IV presents each null hypothesis, the results of its statistical test, and how the results were determined.

Sixteen mathematics department chairmen were asked to evaluate the mathematics curriculum of their respective schools with respect to curriculum organizations, nature of offerings, physical facilities, instructional activities, instructional materials, methods of evaluation,

Table 3

Summary of the Evaluation of the Senior High School Mathematics Curriculum

District Code No.	Organization	Nature of Offerings	Physical Facilities	Instructional Activities	Instructional Materials	Methods of Evaluation	Outcomes	Total Evaluation
1	4.00	4.00	3.20	3.50	3.25	3.33	3.60	3.50
2	4.00	4.00	2.80	3.50	3.75	3.00	3.20	3.38
3	4.00	3.33	3.00	3.50	3.50	3.33	3.00	3.29
4	3.50	4.00	3.40	4.00	3.00	2.67	2.80	3.25
5	4.00	4.00	3.00	3.50	3.00	3.00	2.80	3.21
6	3.50	4.00	2.80	3.50	3.25	3.00	2.80	3.17
7	3.00	3.33	3.60	3.50	3.00	2.33	2.60	3.04
8	3.50	3.00	3.20	3.00	3.00	3.00	2.80	3.04
9	3.50	3.00	2.40	4.00	3.00	3.00	3.00	3.00
10	4.00	3.33	3.20	3.00	2.50	3.00	2.40	2.96
11	3.50	3.00	3.20	3.00	2.25	3.00	2.80	2.92
12	3.00	3.00	2.80	3.00	2.50	3.33	2.80	2.88
13	3.00	3.00	2.40	3.00	3.00	2.67	2.80	2.79
14	3.50	3.33	2.40	3.00	2.25	2.67	2.40	2.67
15	3.50	2.67	2.40	2.50	2.25	3.00	2.40	2.58
16	3.00	2.67	2.00	3.00	1.75	3.00	2.40	2.42

Table 4

Summary of Rankings of District Characteristics and Evaluation of Curriculum

District Code No.	Total Evaluation of Curriculum	Property Wealth per Pupil	Expenditure per Pupil	District Enrollment	School Size	Pupil-Math Teacher Ratio	Percentage of Graduates Going on to College
1	1	5	4	6	2	11	6
2	2	9	16	2	5	2	12
3	3	1	1	5	14	16	1
4	4	2	6	13	9	15	2
5	5	11	8	11	8	8	3.5
6	6	6	2	16	16	14	10
7	7.5	4	3	10	11	1	7
8	7.5	3	5	8	3	9	5
9	9	7	10	15	15	10	8
10	10	13	11	12	10	12	9
11	11	14	13	3	1	3	16
12	12	8	9	9	6	6	14
13	13	10	12	7	4	5	15
14	14	16	14	1	7	7	11
15	15	12	7	4	12	13	3.5
16	16	15	15	14	13	4	13

Table 5

Spearman Rank Order Correlation Coefficients

	Curriculum Evaluation	Property Wealth per Pupil	Expenditure per Pupil	District Enroll.	School Size	Pupil-Math Teacher Ratio	Percen. of Graduates Going on to College
Curriculum Evaluation		.702**	.492*	-.023	.079	-.285	.496*
Property Wealth per Pupil	.702**		.788**	-.226	-.129	-.412	.590*
Expenditure per Pupil	.492*	.788**		-.262	-.306	-.588*	.687**
District Enrollment	-.023	-.226	-.262		.582*	.265	-.127
School Size	.079	-.129	-.306	.582*		.432*	-.299
Pupil-Math Teacher Ratio	-.285	-.412	-.588*	.265	.432*		-.677**
Percentage of Graduates Going on to College	.496*	.590*	.687**	-.127	-.299	-.677**	

* Significant beyond the .05 level.
** Significant beyond the .01 level.

and outcomes. A four-point scale varying from 1 (poor) to 4 (excellent) was used. Individual school evaluations are presented in Table 3. Total evaluations varied from a minimum of 2.42 (fair) to a maximum of 3.50 (very good).

Test of Null Hypothesis 1

H_1: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the school district property wealth per pupil.

A summary of property wealth per pupil is presented in Table 2 for the various school districts. A range from a minimum of $26,471 to a maximum of $103,288 is indicated for the sample. This represents a total difference of $76,817 in property wealth per pupil, or a ratio of almost 1 to 4, between the lowest and highest school district in the study.

Table 5 presents the Spearman Rank Order Correlation Coefficient between the evaluation of the mathematics curriculum and property wealth per pupil. A substantial positive coefficient of .702 was found to exist, significant beyond the .01 level.

The null hypothesis was therefore rejected. There is a significant correlation between the evaluation of the senior high school mathematics curriculum and the school district property wealth per pupil.

Test of Null Hypothesis 2

H_2: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the school district expenditure per pupil.

A summary of school district expenditure per pupil is presented in Table 2. The table reveals a maximum difference in expenditure between districts of $1,257, or a ratio of almost 1 to 1.8 between the lowest and highest.

The Spearman Rank Order Coefficient between the evaluation of the mathematics curriculum and expenditure per pupil is presented in Table 5. A moderate correlation of .492 was found to exist, significant beyond the .05 level.

The null hypothesis was rejected. There is a significant correlation between the evaluation of the senior high school mathematics curriculum and the school district expenditure per pupil.

Test of Null Hypothesis 3

H_3: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and school district enrollment.

District enrollments for the sample are presented in Table 2. They range from a low of 4,202 to a high of 15,050, or a difference of 10,848, between the smallest and largest school district. This represents a ratio of low to high of 1 to 3.6.

The Spearman Rank Order Correlation Coefficient between the evaluation of the mathematics curriculum and district enrollment is indicated in Table 5. A negligible negative relationship of .023 was found to exist. The rank order correlation coefficient failed to reach the .05 level of significance.

The null hypothesis was not rejected. No significant correlation existed between the evaluation of the senior high school mathematics curriculum and school district enrollment.

Test of Null Hypothesis 4

H_4: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the size of the high school.

School size in the various school districts varied from an enrollment of 990 to 2,309 as indicated in table 2, or a ratio of low to high of 1 to 2.3. A negligible positive Spearman Rank Order Correlation Coefficient of .079 was obtained as shown in Table 5 between the evaluation of the mathematics curriculum and school size. The coefficient failed to reach the .05 level of significance.

The null hypothesis was not rejected. No significant correlation existed between the evaluation of the senior high school mathematics curriculum and the size of the high school.

Test of Null Hypothesis 5

H_5: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the pupil-mathematics teacher ratio.

A summary of the pupil-mathematics teacher ratio per school is presented in Table 2. The table reveals a low ratio of 114 and a high ratio of 203.

Table 5 indicates a low negative Spearman Rank Order Correlation Coefficient of .285 between the evaluation of the mathematics curriculum and the pupil-mathematics teacher ratio. The coefficient failed, however, to reach the .05 level of significance.

The null hypothesis was not rejected. No significant correlation existed between the evaluation of the senior high school mathematics curriculum and the pupil-mathematics teacher ratio.

Test of Null Hypothesis 6

H_6: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the percentage of graduates going on to college.

Table 2 indicates a range of 58.0 to 91.7 in the percentage of graduates going on to college for the schools sampled. A moderate positive Spearman Rank Order Correlation of .496 was obtained as shown in Table 5 between the evaluation of the mathematics curriculum and the percentage of graduates going on to college, and was significant beyond the .05 level.

The null hypothesis was rejected. There is a significant correlation between the evaluation of the senior high school mathematics curriculum and the percentage of graduates going on to college.

Test of Null Hypothesis 7

H_7: There is no significant difference in the mean property wealth per pupil in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

The t-test as presented in Table 6 was utilized to determine the difference in the mean property wealth per pupil in school districts rated high or low in the evaluation of the mathematics curriculum. A significant difference beyond the .001 level was found to exist.

The null hypothesis was rejected. There is a significant difference in the mean property wealth per pupil in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

Table 6

A Comparison of Property Wealth per Pupil in School Districts Rated High or Low in Evaluation of the Senior High School Mathematics Curriculum

Group	Number of Districts	Standard Deviation	Mean Property Wealth per Pupil	t
High	8	15,200	$73,250	4.49*
Low	8	11,900	$42,750	

*Significant beyond the .001 level.

Test of Null Hypothesis 8

H_8: There is no significant difference in the mean expenditure per pupil in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

The t-test was used to determine the difference in the mean expenditure per pupil in school districts rated high or low in the evaluation of the mathematics curriculum; results are shown in Table 7. A significant difference beyond the .05 level was found to exist between the two groups.

The null hypothesis was rejected. There is a significant difference in the mean expenditure per pupil in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

Table 7

A Comparison of Expenditure per Pupil in School Districts Rated High or Low in Evaluation of the Senior High School Mathematics Curriculum

Group	Number of Districts	Standard Deviation	Mean Expenditure per Pupil	t
High	8	349	$ 2,121	2.58*
Low	8	137	$ 1,779	

*Significant beyond the .05 level.

Test of Null Hypothesis 9

H_9: There is no significant correlation between school district expenditure per pupil and school district property wealth per pupil in school districts with the same evaluation of the senior high school mathematics curriculum.

Null hypothesis 9 was tested using the Spearman Rank Order Correlation Coefficients as indicated in Table 5, and Partial Correlation to determine the relationship between school district expenditure per pupil and property wealth per pupil while controlling the effect of the evaluation of the mathematics curriculum. A substantial positive correlation of .715 was found to exist; it was significant beyond the .01 level.

The null hypothesis was rejected. There is a significant correlation between school district expenditure per pupil and school district property wealth per pupil in school districts with the same evaluation of the senior high school mathematics curriculum.

Test of Null Hypothesis 10

H_{10}: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the school district property wealth per pupil in school districts with the same expenditure per pupil.

Null hypothesis 10 was tested using the Spearman Rank Order Correlation Coefficients as indicated in Table 5, and Partial Correlation. Determined was the relationship between the evaluation of the mathematics curriculum and school district property wealth while controlling the effects of expenditure per pupil. A positive correlation of .586 was found to exist; it was significant beyond the .05 level.

The null hypothesis was rejected. There is a significant correlation between the evaluation of the senior high school mathematics curriculum and the school district property wealth per pupil in school districts with the same expenditure per pupil.

Test of Null Hypothesis 11

H_{11}:There is no significant correlation between the evaluation of the senior high school mathematics curriculum and school district expenditure per pupil in school districts with the same property wealth per pupil.

Null hypothesis 11 was tested using the Spearman Rank Order Correlation Coefficients as indicated in Table 5, and Partial Correlation. Determined was the relationship between expenditure per pupil and the evaluation of the mathematics curriculum while controlling the effects of property wealth per pupil. A negligible negative correlation of .139 was found to exist which failed to reach the .05 level of significance.

The null hypothesis was not rejected. No significant correlation existed between the evaluation of the senior high school mathematics curriculum and school district expenditure per pupil in school districts with the same property wealth per pupil.

Test of Null Hypothesis 12

H_{12}:There is no significant difference in the mean evaluation of the mathematics curriculum organization in school districts rated high or low in property wealth per pupil.

The t-test was used to test the null hypothesis. Table 8 indicates no significant difference in the mean evaluation of the curriculum organization between the two groups.

The null hypothesis was not rejected. No significant difference existed in the mean evaluation of the mathematics curriculum organization in school districts rated high or low in property wealth per pupil.

Table 8

Evaluation of Curriculum Organization in School Districts Rated High or Low in Property Wealth per Pupil

Group	Number of Districts	Standard Deviation	Mean Evaluation of Curriculum Organization	t
High	5	.42	3.60	1.00*
Low	5	.35	3.50	

*Not significant beyond the .05 level.

Test of Null Hypothesis 13

H_{13}:There is no significant difference in the mean evaluation of the nature of mathematics offerings in school districts rated high or low in property wealth per pupil.

The t-test was used to test the null hypothesis. Table 9 indicates no significant difference in the mean evaluation of the nature of offerings between the two groups.

The null hypothesis was not rejected. No significant difference existed in the mean evaluation of the nature of mathematics offerings in school districts rated high or low in property wealth per pupil.

Table 9

Evaluation of Nature of Offerings in School Districts
Rated High or Low in Property Wealth per Pupil

Group	Number of Districts	Standard Deviation	Mean Evaluation of Nature of Offerings	t
High	5	.45	3.53	2.13*
Low	5	.33	3.00	

*Not significant beyond the .05 level.

Test of Null Hypothesis 14

H_{14}:There is no significant difference in the mean evaluation of physical facilities in school districts rated high or low in property wealth per pupil.

The t-test was used to test the null hypothesis. Table 10 indicates a significant difference in the mean evaluation of physical facilities between the two groups; significant beyond the .05 level.

The null hypothesis was rejected. There is a significant difference in the mean evaluation of physical facilities in school districts rated high or low in property wealth per pupil.

Table 10

Evaluation of Physical Facilities in School Districts
Rated High or Low in Property Wealth per Pupil

Group	Number of Districts	Standard Deviation	Mean Evaluation of Physical Facilities	t
High	5	.23	3.28	2.45*
Low	5	.54	2.64	

*Significant beyond the .05 level.

Test of Null Hypothesis 15

H_{15}:There is no significant difference in the mean evaluation of mathematics instructional activities in school districts rated high or low in property wealth per pupil.

The t-test was used to test the null hypothesis. Table 11 indicates a significant difference in the mean evaluation of instructional activities between the two groups; significant beyond the .02 level.

The null hypothesis was rejected. There is a significant difference in the mean evaluation of mathematics instructional activities in school districts rated high or low in property wealth per pupil.

Table 11

Evaluation of Instructional Activities in School Districts Rated High or Low in Property Wealth per Pupil

Group	Number of Districts	Standard Deviation	Mean Evaluation of Instructional Activities	t
High	5	.35	3.50	3.21*
Low	5	.22	2.90	

*Significant beyond the .02 level.

Test of Null Hypothesis 16

H_{16}: There is no significant difference in the mean evaluation of mathematics instructional materials in school districts rated high or low in property wealth per pupil.

The t-test was used to test the null hypothesis. Table 12 indicates a significant difference in the mean evaluation of instructional materials between the two groups; significant beyond the .001 level.

The null hypothesis was rejected. There is a significant difference in the mean evaluation of mathematics instructional materials in school districts rated high or low in property wealth per pupil.

Table 12

Evaluation of Instructional Materials in School Districts Rated High or Low in Property Wealth per Pupil

Group	Number of Districts	Standard Deviation	Mean Evaluation of Instructional Materials	t
High	5	.22	3.15	6.01*
Low	5	.27	2.20	

*Significant beyond the .001 level.

Test of Null Hypothesis 17

H_{17}:There is no significant difference in the mean evaluation of methods of evaluation in school districts rated high or low in property wealth per pupil.

The t-test was used to test the null hypothesis. Table 13 indicates no significant difference in the mean evaluation of the methods of evaluation between the two groups.

The null hypothesis was not rejected. No significant difference existed in the mean evaluation of methods of evaluation in school districts rated high or low in property wealth per pupil.

Table 13

Evaluation of Methods of Evaluation in School Districts Rated High or Low in Property Wealth per Pupil

Group	Number of Districts	Standard Deviation	Mean Evaluation of Methods of Evaluation	t
High	5	.43	2.93	0*
Low	5	.15	2.93	

*Not Significant.

Test of Null Hypothesis 18

H_{18}: There is no significant difference in the mean evaluation of mathematics outcomes in school districts rated high or low in property wealth per pupil.

The t-test was used to test the null hypothesis. Table 14 indicates a significant difference in the mean evaluation of outcomes between the two groups; significant beyond the .05 level.

The null hypothesis was rejected. There is a significant difference in the mean evaluation of mathematics outcomes in school districts rated high or low in property wealth per pupil.

Table 14

Evaluation of Outcomes in School Districts
Rated High or Low in Property Wealth per Pupil

Group	Number of Districts	Standard Deviation	Mean Evaluation of Outcomes	t
High	5	.38	2.96	2.53*
Low	5	.18	2.48	

*Significant beyond the .05 level.

Teacher Preparation

Five aspects of teacher preparation were studied and tested: highest degree obtained, mathematics courses completed, education courses completed, certification by the state department of education, and attendance at NSF Institutes.

Highest Degree Obtained

A study of Table 15 reveals that all the secondary mathematics teachers participating in the study had received a minimum of a bachelor's degree; 78 percent had a master's degree.

The distribution of mathematics teachers according to highest degree obtained in school districts rated high and low in the evaluation of the senior high school mathematics curriculum is shown in Table 15. The Chi-Square test failed to show any significant difference between the two groups.

Table 15

Highest Degree Obtained by Teachers

Highest Degree	Evaluation of Curriculum		Total Number of Teachers
	High	Low	
B. A.	13(13.94)	14(13.06)	27
M. A.	51(50.06)	46(46.94)	97
Total	64	60	124

χ^2 = .0367. Not significant beyond the .05 level.

Mathematics Courses Completed

The Secondary School Curriculum Committee of the National Council of Teachers of Mathematics[1] has recommended that the professional preparation of the secondary mathematics teacher be based on a strong program of general education. In view of current curriculum demands, teachers of secondary mathematics will need to have competence in:

(1) analysis -- trigonometry, plane and solid analytic geometry, and calculus; (2) foundations of mathematics -- theory of sets, mathematical or symbolic logic, postulation systems, real and complex number systems; (3) algebra -- matrices and determinants, theory of numbers, theory of equations, and structure of algebra; (4) geometry -- Euclidean and non-Euclidean, metric and projective, synthetic and analytic; (5) statistics -- probability and statistical inference, and (6) applications -- mechanics, theory of games, linear programming, and operations research.

The Committee further asserts that, as a minimum, teachers of mathematics in grades nine through twelve should have successfully completed a program of at least 24 semester hours, including a full-year program in calculus, in courses selected from the above areas.

A study of the data revealed very little difference in the average number of semester hours of mathematics preparation in school districts rated high or low in the evaluation of the mathematics curriculum; 61.2 for the high-rated and 59.8 for the low-rated. These averages for both groups far exceeded the minimum of 24 recommended by the National

Council of Teachers of Mathematics. The range of mathematics semester hours completed by the teachers varied from a minimum of 24 to a maximum of 107. Whereas all the teachers exceeded the minimum requirement of the National Council of Teachers of Mathematics, 41.4 percent of the total did not complete programs which the Committee considers "ideal."

In order to pinpoint the areas of preparation, or lack of it, details are summarized in Table 16. This table contains the number and percentage of teachers who had completed the specific mathematical courses. Data indicate the courses in analysis and algebra were taken by all teachers, whereas courses in applications presented the poorest showing.

Table 16

Mathematics Teachers Completing Specific Mathematics Courses

Mathematics Requirement	Number of Teachers Meeting Requirement	Percentage of Teachers Meeting Requirement
Analysis	116	100.0
Foundations	110	94.8
Algebra	116	100.0
Geometry	101	95.7
Statistics	106	91.4
Applications	79	68.1

Teachers meeting all mathematics course requirements:

$\frac{68}{116} = 58.6\%$

Table 17 presents the distribution of the number of teachers meeting the specific mathematics course recommendations of the National Council of Teachers of Mathematics in school districts rated high or low in the evaluation of the mathematics curriculum. The Chi-Square test failed to show any significant difference in the two groups.

Table 17

Distribution of Teachers Meeting NCTM Specific Mathematics Course Recommendations

NCTM Recommendations	Evaluation of Curriculum		Total Number of Teachers
	High	Low	
Meets Recommendations	34(35.17)	34(32.83)	68
Does Not Meet Recommendations	26(24.83)	22(23.17)	48
Total	60	56	116

χ^2 = .064. Not significant beyond the .05 level.

Table 18 indicates the distribution of the total number of semester hours obtained in mathematics courses in these two groups. An analysis utilizing the Chi-Square test also failed to show any significant difference between the high and low groups in the total number of semester hours obtained.

Table 18

Semester Hours of Mathematics Courses
Completed by Mathematics Teachers

Semester Hours	Evaluation of Curriculum High	Low	Total Number of Teachers
Up to 50	21(19.66)	17(18.34)	38
51 - 70	21(23.28)	24(21.72)	45
71 & Over	18(17.07)	15(15.93)	33
Total	60	56	116

$\chi^2 = .756$. Not significant beyond the .05 level.

Education Courses Completed

The National Council of Teachers of Mathematics has recommended that mathematics courses be supplemented by a basic program in education and psychology. As a minimum a teacher should have completed 18 semester hours, including student teaching in mathematics, in such courses as: a methods course in the teaching of mathematics; psychology of learning (with particular reference to adolescents); psychology of adjustment (mental hygiene), and tests and measurements.

Of the 118 respondents, 104 (88.1 percent) had met the minimum requirement of eighteen semester hours in education whereas 31.4 percent met all the specific requirements. The data revealed very little difference in the mean number of semester hours of preparation in education courses in school districts rated high or low in the evaluation of the mathematics curriculum; 34.2 for the high-rated and 31.0 for the low-rated. Semester hours of professional education courses ranged from a minimum of 12 to a maximum of 100 for individual teachers.

Table 19 indicates that teachers were most lacking in the specific requirements of student teaching, mental hygiene, and tests and measurements.

Table 19

Mathematics Teachers Completing Specific Education Courses

Education Requirement	Number of Teachers Meeting Requirement	Percentage of Teachers Meeting Requirement
Student Teaching in Mathematics	89	75.4
Methods Course in Teaching Mathematics	114	96.6
Psychology of Learning	114	96.6
Psychology of Adjustment (Mental Hygiene)	61	51.7
Tests and Measurements	80	67.8

Teachers meeting all educational requirements:

$\frac{37}{118} = 31.4\%$

Teachers not having 18 semester hours:

$\frac{14}{118} = 11.9\%$

Table 20 presents the distribution of the number of teachers meeting the minimum semester hours of education courses recommended by the National Council of Teachers of Mathematics in school districts rated high or low in the evaluation of the senior high school mathematics curriculum. The Chi-Square test failed to show any significant difference between the two groups.

Table 20

Distribution of Teachers Meeting
Minimum Semester Hours of
Education Courses Recommended by the NCTM

NCTM Recommendations	Evaluation of Curriculum		Total Number of Teachers
	High	Low	
Meets Recommendations	52(53.76)	52(50.24)	104
Does Not Meet Recommendations	9(7.24)	5(6.76)	14
Total	61	57	118

$\chi^2 = .515$. Not significant beyond the .05 level.

Table 21 shows the distribution of the total number of semester hours between the two groups. The Chi-square test also failed to show any significant difference between the two groups in the total number of semester hours of education courses obtained.

Table 21

Semester Hours of Education Courses
Completed by Mathematics Teachers

Semester Hours	Evaluation of Curriculum		Total Number of Teachers
	High	Low	
Up to 20	15(14.99)	14(14.01)	29
21 - 40	33(32.05)	29(29.95)	62
41 & Over	13(13.96)	14(13.04)	27
Total	61	57	118

χ^2 = .195. Not significant beyond the .05 level.

Certification by New York State

The qualifications for certification by the New York State Department of Education for the teaching of secondary mathematics (7-12) consists of the following:

A. Provisional Certificate (valid 5 years)

1. Four years of collegiate preparation, including baccalaureate degree at a regionally accredited or approved higher institution.
2. Professional education courses, 12 semester hours.
3. College-supervised student teaching experience (not included in 2 above).
4. Academic concentration in subject for which certificate

is issued, 18 semester hours.

B. Permanent Certificate

1. Requirements for Provisional Certificate.

2. Master's Degree in or related to fields of teaching service, or 30 semester hours of approved graduate studies distributed among liberal arts, behavioral sciences and professional study in education.

Substitution: One year of paid full-time teaching experience on the level for which the certification is sought may be accepted in lieu of the college-supervised student teaching but with the proviso that such experience carries the recommendation of the employing school district administrator.

Candidates preparing for certification in mathematics are urged to consider certification in the sciences.

On the basis of undergraduate and graduate courses in education, mathematics, and other fields, all the teachers had been certified by the state department of education to teach secondary mathematics. Table 22 indicates that five teachers of the 122 responding to this section of the questionnaire had not completed the state minimum requirements for permanent certification. Of the 117 teachers who were permanently certified 27, or 24 percent, were also certified in other fields. Sixty-eight percent of these teachers were certified in science.

Table 22

Certification of Mathematics Teachers by New York State

Type of Certification	Number of Teachers Who Hold Certification	Percent
Provisional	5	4.1
Permanent	117	95.9
Dual	28	23.9

Attendance at NSF Institutes

Table 23 indicates that most teachers had availed themselves of the opportunity for stimulation of interest in mathematics instruction and professional growth by attendance at NSF Institutes.

Analysis of Table 23 utilizing the Chi-Square test revealed no significant difference in the attendance of NSF Institutes by teachers in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

Table 23

Attendance at NSF Institutes by Mathematics Teachers

Attendance	Evaluation of Curriculum		Total Number of Teachers
	High	Low	
Yes	39(38.75)	36(36.25)	75
No	23(23.25)	22(21.75)	45
Total	62	58	120

$\chi^2 = .01$. Not significant beyond .05 level.

Test of Null Hypothesis 19

H_{19}:There is no significant difference in the preparation of senior high school mathematics teachers in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

Based on the analysis of data related to highest degree obtained, mathematics courses completed, education courses completed, certification by New York State, and attendance at NSF Institutes, the null hypothesis was not rejected.

No significant difference existed in the preparation of senior high school mathematics teachers in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

Summary

The findings are divided into three groups: relationships between school district characteristics; the results of the tests of null hypotheses related to district characteristics, and teacher preparation.

Relationships Between District Characteristics

Significant positive correlations were found to exist between property wealth per pupil and expenditure per pupil, property wealth per pupil and percentage of graduates going on to college, expenditure per pupil and percentage of graduates going on to college, district enrollment and school size, and school size and pupil-mathematics teacher ratio.

Significant negative correlations were found to exist between expenditure per pupil and pupil-mathematics teacher ratio, and pupil-mathematics teacher ratio and percentage of graduates going on to college.

Tests of Null Hypotheses Related to District Characteristics

H_1: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the school district property wealth per pupil. (Rejected.)

H_2: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the school district expenditure per pupil. (Rejected.)

H_3: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and school district enrollment. (Accepted.)

H_4: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the size of the high school. (Accepted.)

H_5: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the pupil-mathematics teacher ratio. (Accepted.)

H_6: There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the percentage of graduates going on to college. (Rejected.)

H_7: There is no significant difference in the mean property wealth per pupil in school districts rated high or low in the evaluation of the senior high school mathematics curriculum. (Rejected.)

H_8: There is no significant difference in the mean expenditure per pupil in school districts rated high or low in the evaluation of the senior high school mathematics curriculum. (Rejected.)

H_9: There is no significant correlation between school district expenditure per pupil and school district property wealth per pupil in school districts with the same evaluation of the senior high school mathematics curriculum. (Rejected.)

H_{10}:There is no significant correlation between the evaluation of the senior high school mathematics curriculum and the school district property wealth per pupil in school districts with the same expenditure per pupil. (Rejected.)

H_{11}:There is no significant correlation between the evaluation of the senior high school mathematics curriculum and school district expenditure per pupil in school districts with the same property wealth per pupil. (Accepted.)

H_{12}:There is no significant difference in the mean evaluation of the mathematics curriculum organization in school districts rated high or low in property wealth per pupil. (Accepted.)

H_{13}:There is no significant difference in the mean evaluation of the nature of mathematics offerings in school districts rated high or low in property wealth per pupil. (Accepted.)

H_{14}:There is no significant difference in the mean evaluation of physical facilities in school districts rated high or low in property wealth per pupil. (Rejected.)

H_{15}:There is no significant difference in the mean evaluation of mathematics instructional activities in school districts rated high or low in property wealth per pupil. (Rejected.)

H_{16}:There is no significant difference in the mean evaluation of mathematics instructional materials in school districts rated high or low in property wealth per pupil. (Rejected.)

H_{17}:There is no significant difference in the mean evaluation of methods of evaluation in school districts rated high or low in property wealth per pupil. (Accepted.)

H_{18}:There is no significant difference in the mean evaluation of mathematics outcomes in school districts rated high or low in property wealth per pupil. (Rejected.)

Teacher Preparation

All of the secondary mathematics teachers participating in the study had received a bachelor's degree and 78 percent had a master's degree.

All of the teachers exceeded the minimum requirement of semester hours of mathematics recommended by the National Council of Teachers of Mathematics; 41.4 percent, however, had not completed the specific course recommendations. The mathematics teachers were lacking mostly in applications of mathematics.

Almost 90 percent of the teachers met the minimum recommended education course requirement whereas 31.4 percent had completed all the specific course recommendations. The greatest deficiencies were found in the specific requirements of student teaching, mental hygiene, and tests and measurements.

All teachers were certified by the state department of education to teach secondary mathematics. Almost 96 percent were permanently certified. Of these, 24 percent had received dual certification, primarily in science.

The majority of the mathematics teachers had participated in NSF Institutes.

Based on the analysis of the data, null hypothesis 19 was accepted. No significant difference existed in the preparation of senior high school mathematics teachers in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

REFERENCE

1. "The Secondary Mathematics Curriculum," Report of the Secondary School Curriculum Committee of the National Council of Teachers of Mathematics, The Mathematics Teacher, LII (May, 1959), pp. 389-416.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

This chapter is divided into four main sections: (1) a summary of the study, (2) conclusions derived from the findings, (3) implications and recommendations, and (4) recommendations for further study.

Summary of the Study

The concerns of mathematics education have been many over the past quarter of a century. Among other indications, the inadequate grasp of mathematics shown by the military of World War II stirred educators into action. The two decades of the Fifties and Sixties saw an unprecedented proliferation of mathematics programs which presented new materials based on fundamental concepts. Addressed as well were an upgrading in the preparation of teachers and the need for a more effective evaluation of the mathematics curriculum. In more recent years, the courts of the land, both state and federal, have endorsed the notion that disproportionate expenditures result in disproportionate quality. On the other hand, many educators believe that the quality of education is due to factors other than those related to expenditures.

The purpose of this study was to analyze selected suburban public school district characteristics, including expenditures, and teacher preparation and to determine their relationship to the overall quality of the senior high school mathematics curriculum. The study encompassed 26 public senior high school districts in Nassau County, New York. Of these 26 districts, 16 were randomly selected as a sample.

The literature that was surveyed for the study has been reported in Chapter II, where it is divided into three sections: literature related to financial resources, that related to enrollment, and that related to teacher preparation.

Obtained from published records of the New York State Department of Education was information related to school district property wealth per pupil, expenditure per pupil, district enrollment, and percentage of graduates going on to college. Data related to school size, pupil-mathematics teacher ratio, teacher preparation, and the evaluation of the mathematics curriculum were obtained from mathematics teachers and department chairmen by means of questionnaires after permission to do so was obtained from the superintendents of the school districts under study.

One hundred percent of the department chairmen of the 16 school districts selected responded to the questionnaire. Seventy-two percent, or 124, mathematics teachers returned usable questionnaires. The data was tabulated, correlated, and analyzed utilizing statistical tests.

Summary of Findings Related to District Characteristics

1. A significant positive correlation existed between school district property wealth per pupil and school district expenditure per

pupil.

2. A significant positive correlation existed between school district property wealth per pupil and the percentage of graduates going on to college.

3. A significant positive correlation existed between school district expenditure per pupil and the percentage of graduates going on to college.

4. A significant positive correlation existed between school district enrollment and size of the senior high school.

5. A significant positive correlation existed between the size of the senior high school and the pupil-mathematics teacher ratio.

6. A significant negative correlation existed between school district expenditure per pupil and the pupil-mathematics teacher ratio.

7. A significant negative correlation existed between the pupil-mathematics teacher ratio and the percentage of graduates going on to college.

Summary of Findings Related to the Evaluation of the Curriculum

1. A significant positive correlation was found to exist between the evaluation of the senior high school mathematics curriculum and school district property wealth per pupil.

2. A significant positive correlation was found to exist between the evaluation of the senior high school mathematics curriculum and school district expenditure per pupil.

3. No significant correlation was found between the evaluation

of the senior high school mathematics curriculum and school district enrollment.

4. No significant correlation was found between the evaluation of the senior high school mathematics curriculum and the size of the senior high school.

5. No significant correlation was found between the evaluation of the senior high school mathematics curriculum and the pupil-mathematics teacher ratio.

6. A significant positive correlation was found to exist between the evaluation of the senior high school mathematics curriculum and the percentage of graduates going on to college.

7. The mean property wealth per pupil was significantly higher in school districts rated high in the evaluation of the senior high school mathematics curriculum.

8. The mean expenditure per pupil was significantly higher in school districts rated high in the evaluation of the senior high school mathematics curriculum.

9. A significant positive correlation was found to exist between school district expenditure per pupil and school district property wealth per pupil in school districts with the same evaluation of the senior high school mathematics curriculum.

10. A significant positive correlation was found to exist between the evaluation of the senior high school mathematics curriculum and school district property wealth per pupil in school districts with the same expenditure per pupil.

11. No significant correlation was found between the evaluation of the senior high school mathematics curriculum and school district expenditure per pupil in school districts with the same property wealth per pupil.

12. No significant difference was found in the mean evaluation of the mathematics curriculum organization in school districts rated high or low in property wealth per pupil.

13. No significant difference was found in the mean evaluation of the nature of mathematics offerings in school districts rated high or low in property wealth per pupil.

14. The mean evaluation of physical facilities was significantly higher in school districts rated high in property wealth per pupil.

15. The mean evaluation of mathematics instructional activities was significantly higher in school districts rated high in property wealth per pupil.

16. The mean evaluation of mathematics instructional materials was significantly higher in school districts rated high in property wealth per pupil.

17. No significant difference was found in the mean evaluation of methods of evaluation in school districts rated high or low in property wealth per pupil.

18. The mean evaluation of mathematics outcomes was significantly higher in school districts rated high in property wealth per pupil.

Summary of Findings Related to Teacher Preparation

1. No significant difference was found in the highest degree obtained by senior high school mathematics teachers in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

2. No significant difference was found in the number of teachers meeting the National Council of Teachers of Mathematics mathematics and professional educational recommendations in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

3. No significant difference was found in the distribution of semester hours of mathematics and education courses completed by senior high school mathematics teachers in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

4. No significant difference was found in the certification of senior high school mathematics teachers in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

5. No significant difference was found in the participation of NSF Institutes by senior high school mathematics teachers in school districts rated high or low in the evaluation of the senior high school mathematics curriculum.

6. All the secondary mathematics teachers had received a bachelor's degree. Seventy-eight percent had a master's degree.

7. All the teachers had more than the minimum semester hours of mathematics recommended by the National Council of Teachers of Mathematics. Approximately 41 percent had not completed the specific course recommendations.

8. Approximately 90 percent met the minimum recommended education course requirements whereas 31.4 percent had completed the specific course recommendations of the National Council of Teachers of Mathematics.

9. All teachers were certified by the state department of education. Almost 96 percent were permanently certified. Of these, 24 percent possessed dual certification.

10. The majority of teachers participated in NSF Institutes.

Conclusions of the Study

Following are conclusions and interpretations resulting from the findings.

1. College oriented suburban public school districts (those with a higher percentage of graduates going on to college) tended to have a higher property wealth per pupil, tended to support their districts more highly in terms of expenditures per pupil, tended to be better staffed in terms of pupils per mathematics teacher, and tended to have a higher quality senior high school mathematics curriculum.

2. Larger suburban public senior high schools tended to be located in larger school districts and tended to have more pupils per mathematics teacher.

3. Suburban public senior high school districts that had higher expenditures per pupil tended to be better staffed in terms of pupils per mathematics teacher.

4. A significant positive correlation existed between district property wealth per pupil and expenditure per pupil. The quality of the senior high school mathematics curriculum was not an important consideration affecting the relationship.

5. Suburban public senior high school districts with higher property wealth per pupil tended to be more college oriented and better staffed in terms of pupils per mathematics teacher. They provided their senior high school students with better physical facilities, mathematics activities and mathematics materials, and had higher outcomes.

6. A significant positive correlation existed between the district property wealth per pupil and the quality of the suburban public senior high school mathematics curriculum. District expenditure per pupil was not an important consideration affecting the relationship.

7. Although there appeared to be a direct positive relationship between the district expenditure per pupil and the quality of the suburban public senior high school mathematics curriculum, district expenditure per pupil showed virtually no relationship to the quality of the curriculum if the district property wealth per pupil was held constant. The findings did not support the view held by some educators that increased expenditures result in increased quality of education.

8. The district enrollment, size of the senior high school, and the pupil-mathematics teacher ratio all appeared to have no significant relationship to the quality of the senior high school mathematics curriculum in suburban public school districts.

9. Suburban public senior high school mathematics teachers were well qualified in terms of highest degree obtained, semester hours completed, state certification, and attendance at NSF Institutes. A large percentage, however, did not meet the specific course recommendations of the National Council of Teachers of Mathematics.

10. It cannot be specifically concluded that teacher preparation had no relationship to the quality of the senior high school mathematics curriculum in suburban public school districts. The study does indicate, however, that differences in teacher preparation between the districts was not an important consideration affecting the quality of the senior high school mathematics curriculum.

Implications and Recommendations

In terms of the study's findings, suburban school districts with higher property wealth per pupil had higher percentages of graduates going on to college. The high property wealth also correlated with high mathematics outcomes and superior physical facilities, instructional materials and instructional activities.

Since nothing was indicated to the effect that a normal distribution of students in terms of their mathematical ability was not operative and, further, since the qualifications of mathematics teachers could be considered as a constant in this study, students' motivations originating outside the school may be a paramount factor in determining outcomes. An explanation may reside in the institution of the family. Parents who have achieved and been rewarded in school and are enjoying success materially and prestigiously in life, may be expected to prize the school as a pattern of society that not only carries the force of tradition but also has, for them, proved its pragmatic worth. These parents can be counted upon to transmit such values to their children. Conversely, low outcomes would be the direct consequence of homes in which low motivation and lack of formal education go hand in hand.

It is also generally known that if a white pupil from a home that is strongly and effectively supportive of education is put in a school whose pupils do not come from such homes, his achievement will be little different than if he were in a school composed of others like himself. But if a minority pupil from a home without much educational awareness is put with schoolmates with strong educational backgrounds, his achievement is likely to improve.

Although there are some standardized tests that are used throughout the country to determine educational outcomes, their results are seldom used publicly to provide state by state or school district by school district comparisons, e.g., the National Assessment of Educational Progress, a series of reports by the Education Commission of the States, or tests made for the Coleman Report of 1965. These tests generally try to measure such factors as verbal ability, reading comprehension, and mathematics achievement. They exclude efforts by school districts to enrich educational offerings with additional programs.

What is generally known about the standardized tests is that white pupils from the metropolitan areas of the northeast score highest. Other regions are measured by their deviations from the northeastern norms. There is also evidence that the ability to excel in these tests is affected to a significant degree by the environment of the student outside of the school.

Regarding the correlation of higher property wealth per pupil to higher evaluation of physical facilities, instructional materials, and instructional activities, it could well be that these suburban college oriented districts (higher percentage of graduates going on to college) do provide more books, newer books, more classroom space, more interesting activities, and the like, for the college bound.

In view of the above, the following recommendations are presented:

1. Boards of education and administrators of suburban schools should provide exciting and imaginative mathematics programs designed to motivate their students.

2. The state departments of education should be more liberal in allowing schools the time and scope in which to innovate and experiment.

3. Schools showing consistently high evaluations of their mathematics curriculum should identify those practices and procedures which, in the opinion of the educators, account for the continual success of their programs. These practices should be disseminated widely, and, where other schools confirm the success of the practices, should begin to form the foundation of new standards.

The findings of the study indicated that school district property wealth per pupil was directly related to the quality of the suburban senior high school mathematics curriculum and that school districts with higher property wealth per pupil supported their districts most highly in terms of expenditures. School district property wealth per pupil was also a controlling factor in the relationship between the quality of the senior high school mathematics curriculum and expenditure per pupil. There was no significant relationship between the quality of the mathematics curriculum and expenditure per pupil in school districts with the same property wealth per pupil. The findings thus did not support the notion that increased expenditures will result in increased quality of education.

Obviously, there is a point where lack of money will adversely affect the educational opportunity of a child such as in the case of Negroes in the South studying without a sufficient number of textbooks or science laboratories. Likewise, there is a point where the number of dollars added to an educational program will not appreciably enhance what a pupil can learn. When the socio-economic factors of a suburban school district are statistically controlled, however, it appears that differences in expenditures per pupil have a negligible affect on the quality of the senior high school mathematics curriculum. The socio-economic background of a suburban community, therefore, appears to be a prime factor affecting the quality of the senior high school mathematics curriculum.

Although it is possible to measure educational cost with reference to population, there are many qualifying factors that must be considered. The per capita cost of education in an area with a high average age may be significantly lower than in some other area because the ratio of the school-age population to the total population is low. There can be wide cost variations from district to district despite a common teacher salary structure because of the teachers' age and length of service. It is more difficult still to apply a cost factor to the effect of cultural variations on cost of education. For example, to raise pupils to a particular level of education will cost less in a suburban college town than in a community characterized by the use of a foreign language.

The following recommendations are therefore suggested:

1. The courts should reassess their ruling that disproportionate expenditures result in disproportionate quality of education. They should also define more clearly what is meant by quality of education.

2. School boards of districts with higher property wealth per pupil should reassess their position on equalization of expenditures from district to district and should consider possibilities of reducing expenditures.

3. University sponsored seminars and institutes should allow practicing educators to reexamine premises about educational cost-benefits.

4. Schools should be encouraged to experiment in program redevelopment and to develop new priorities regarding dollar concerns and imaginative approaches to education.

Although the findings of the study indicated that the quality of the mathematics curriculum had no relationship to the size of the district or of the senior high school nor to the pupil-mathematics teacher ratio, expenditures were related to staffing.

It is suggested, therefore, that suburban school districts investigate cost benefits that might be achieved through consolidation of schools or districts and the possible reduction thereby of staffing requirements.

The very mention of school district consolidation may be upsetting to some districts. The major problem of school district reorganization lies in obtaining agreement from a district with higher property valuation per pupil to merge with one of lower valuation. This despite the fact that consolidation does spread both resources and the property tax burden over a wider base. Apparently the only way to overcome the problem is to embody the factors favoring consolidation in mandatory state statutory provisions.

Since the achievement of minority pupils depends more on the schools they attend than does the achievement of majority pupils, the inference might then be drawn that improving the school district for a minority pupil may improve his achievement more than improving the school district of a white child would improve his. Similarly, the average minority pupil's achievement may suffer more in a school district of low quality than might the average white pupil's. In short, whites are less affected one way or the other by the quality of their school than are minority pupils. This indicates that it is for the most disadvantaged children that improvements in school quality should make the most difference.

Although all mathematics teachers met the minimum state certification requirements, a large percentage did not meet the specific guidelines set forth by the National Council of Teachers of Mathematics. Yet if semester hours of credits in mathematics and education were used as a measure of preparation, then the teachers cannot but be considered well prepared. Indicated here is the current practice of erratic course-taking for the accumulation of credits whose chief purpose seems to be the meeting of requirements of certification and/or the salary schedule rather than the pursuance of a sequential program designed to provide a sound and balanced mathematics education preparation.

It is therefore suggested that requirements for the teaching certificate in secondary mathematics be reevaluated by institutions of higher learning and the state department of education. It is hoped that such studies lead to the certification of still better prepared mathematics teachers in the future.

Recommendations for Further Study

1. Further investigation should be made into the correlation of commitment to education on the part of the community to mathematics outcomes.

2. A longitudinal study should be undertaken in a single suburban school district which has experienced considerable change in the amount of dollars available for investment in education. The evaluation of the

mathematics curriculum should be examined over the years of change and for a substantial period thereafter, say ten years, to determine the relationship of per pupil expenditure to quality.

3. This study should be replicated using other senior high school disciplines to determine whether findings are consistent with those focusing on mathematics.

4. Research into the relationship between preparation of the mathematics teacher and teacher effectiveness should be pursued.

5. A study should be conducted to determine whether the teaching techniques and practices of teachers are in accordance with the recommendations of authorities in mathematics and leaders in the advancement of senior high school mathematics education.

APPENDIX A

SAMPLE LETTER TO SUPERINTENDENTS

SAMPLE LETTER TO SUPERINTENDENTS

As part of my doctoral work at the University of New Mexico, I am conducting a study to investigate the relationship between certain factors and the quality of senior high school mathematics education in the public school districts of Nassau County, New York. The study is limited to an analysis of district characteristics; an analysis of the secondary mathematics teacher in terms of professional preparation, and an evaluation of the mathematics curriculum by the department chairman.

I would be most appreciative if I may have your permission to contact the chairman of the mathematics department in your school so that a questionnaire might be completed by the chairman and the mathematics teachers.

This study has been approved by the Committee for Questionnaire Clearance and Screening of the Nassau County Chief School Administrators and the Doctoral Advisory Committee at the University of New Mexico.

Very truly yours,

Anthony J. Abruzzo

APPENDIX B

DEPARTMENT CHAIRMAN QUESTIONNAIRE

QUESTIONNAIRE FOR MATHEMATICS DEPARTMENT CHAIRMAN

Last Name____________________First Name____________________

Name of Senior High School____________________________________

How many teachers, including yourself, are engaged in teaching one or more mathematics courses? __________

Please indicate the total school enrollment, 1974-5 by grades.

Grade 10 __________

Grade 11 __________

Grade 12 __________

You're being asked to evaluate the senior high school mathematics curriculum in your school with respect to mathematics curriculum organization, nature of mathematics offerings, physical facilities, mathematics instructional activities, mathematics instructional materials, methods of evaluation, and mathematics outcomes.

Please rate each of the following using a four-point scale varying from 1 (poor), to 4 (excellent).

Mathematics Curriculum Organization:

a) To what extent are most mathematics courses available and suited to the abilities and needs of students? __________

b) To what extent are students electing mathematics beyond those courses that are required? __________

Nature of Mathematics Offerings:

a) How adequate is the variety of offerings in mathematics for meeting the needs of the students? __________

b) How adequate is the content of offerings for developing the mathematical knowledge and skills needed by all students?

____

c) How adequate is the content of offerings for developing the mathematical understanding and appreciation needed by all students? __________

Physical Facilities:

a) How adequate are the provisions for present class size?

____

b) How adequate is the equipment to meet enrollment and curricular needs? __________

c) How adequate are the storage facilities for equipment and supplies? __________

d) To what extent is the instructional equipment used? __________

e) How adequate is the area provided each teacher for work space and student conferences? __________

Mathematics Instructional Activities:

a) How adequate is the planning and preparation for instruction?

____

b) How adequate are the instructional activities adapted to the needs of individual students? __________

Mathematics Instructional Materials:

a) How adequate is the variety of instructional materials?

____

b) How adequate is the content of instructional materials? __________

c) To what extent do reference materials reflect contemporary professional views of mathematics and mathematics education?

____

d) To what extent are these materials being used? __________

Methods of Evaluation:

a) How comprehensive are evaluation activities? __________

b) To what extent do teachers use evaluation results in analyzing their teacher effectiveness? __________

c) To what extent do evaluation procedures identify students of unusual promise in the field of mathematics? __________

Mathematics Outcomes:

a) To what extent do students exhibit an understanding of the basic principles of mathematics? __________

b) To what extent do students exhibit skill in the performance of basic principles of mathematical operations? __________

c) To what extent do students demonstrate the ability to analyze and solve problems? __________

d) To what extent are students able to organize mathematical knowledge and make appropriate generalizations? __________

e) To what extent do students recognize and appreciate the role that mathematics has played in the development of past and present cultures? __________

APPENDIX C

MATHEMATICS TEACHER QUESTIONNAIRE

QUESTIONNAIRE FOR MATHEMATICS TEACHERS

Last Name____________________First Name____________________

Name of Senior High School______________________________________

Colleges and Universities Attended

Name of Institution	Degree Granted	Date of Degree	Major	Minor

Mathematics Courses Completed

In the blank on the right, please indicate the number of semester hours completed in each field.

Analysis - (trigonometry, plane and solid analytic geometry, calculus) ________

Foundations of Mathematics - (theory of sets, mathematical or symbolic logic, postulational systems, real and complex number systems) ________

Algebra - (matrices and determinants, theory of numbers, theory of equations, structure of algebra) ________

Geometry - (Euclidean and non-Euclidean, metric and projective, synthetic and analytic) ________

Statistics - (probability and statistical inference) ________

<u>Applications</u> - (mechanics, theory of games, linear programming, operational research) ________

<u>Others</u> - (please specify below) ________

Total number of semester hours in mathematics (including the above) ________

Professional Education Courses Completed

In the blank on the right, please indicate the number of semester hours completed in each field.

Student teaching in mathematics ________

Methods course in teaching mathematics ________

Psychology of learning
(with particular reference to adolescents) ________

Psychology of adjustment
(mental hygiene) ________

Tests and measurements ________

Total number of semester hours in education
(including the above) ________

Certification

Are you certified by New York State to teach secondary mathematics? ________

If so, please indicate type of certificate and year granted.

Provisional ________ Permanent ________

Year ________ Year ________

Are you certified by New York State to teach any other discipline?

____

If so, please indicate discipline.______________________________

NSF

Have you ever attended a NSF sponsored Summer Institute, or a NSF sponsored In-Service Institute?

Yes ________ No ________

APPENDIX D

LIST OF PARTICIPATING SCHOOL DISTRICTS

LIST OF PARTICIPATING SCHOOL DISTRICTS

East Meadow

Garden City

Great Neck

Herricks

Lawrence

Levittown

Long Beach

Plainview

Rockville Centre

Seaford

Sewanhaka

Syosset

Uniondale

Valley Stream CHS

Wantagh

Westbury

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SELECTED BIBLIOGRAPHY

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