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VARIABLES AFFECTING PUBLIC SCHOOL ENROLLMENT CHANGE

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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****

The Ohio State University
1964

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CHAPTER I

INTRODUCTION

Background of the Study

In recent years, school building planning and construction, recruitment and selection of staff personnel, and provision of adequate finance have become some of the more crucial tasks of public school administrators. There are three basic reasons for this. First, there was the backlog of needed building space which accumulated during World War II as the result of limits imposed on all building construction by the demands of the war effort. Second, there was, and still is, the burgeoning school population caused by the rapid rise in birth rates during and after the war years. The number of births rose dramatically throughout this period. In 1940 there were 2.57 million children born in the United States. In 1945 there were 2.87 million births; in 1950, 3.64 million; in 1955, 4.12 million; and in 1960, 4.31 million.[1] The number of annual births in the United States has remained above four million since 1955.[2] Third, the holding power of the secondary school has increased rapidly in recent years. Data recently released by the

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[1] U. S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1963 (84th ed.; Washington: United States Government Printing Office, 1963), p. 12.

[2] Ibid., p. 52.

Bureau of the Census shows that the percent of 14 through 19 year olds enrolled in school has increased considerably since 1947.[3] Table 1 shows these percents of enrollment for three age groups by three-year intervals from 1947 to 1962.

TABLE 1

PERCENT OF THE POPULATION 14 TO 19 YEARS OLD ENROLLED IN SCHOOL, BY AGE GROUP, FOR THE UNITED STATES: OCTOBER, 1947 TO 1962 BY THREE-YEAR INTERVALS

Year	14 and 15 years	16 and 17 years	18 and 19 years
1947	91.6	67.6	24.3
1950	94.7	71.3	29.4
1953	96.5	74.7	31.2
1956	96.9	78.4	35.4
1959	97.5	82.9	36.8
1962	98.0	84.3	41.8

Even though school building construction and staff recruitment have proceeded at a rapid pace, there still remains a lag in provision of needed space and personnel. The United States Office of Education began reporting in 1956 the total annual classroom shortage in the public schools of the country. This figure has remained above 120,000 each year although it has been reduced from the high of 159,800 in 1956. The

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[3] U. S. Department of Commerce, Bureau of the Census, Current Population Reports: Population Characteristics, Series P-20, No. 126 (September 24, 1963).

most recent figure, for 1963, stands at 124,000.[4] There appears to be no immediate relief for the problem. Although the birth rate has declined for each of the past six years, the base population continues to rise. Therefore, the number of births continues at a high level. Moreover, the number of births is very likely to increase in the future. The children born during and since 1947, when births increased so rapidly, have not yet reached marriageable age--but they soon will. When this occurs, the annual number of births in the United States is almost certain to surge upward once again. The latest projection of public school enrollment by the Office of Education predicts continued annual increases in total enrollment. Even the lowest of the four projections predicts a total public school enrollment of 52 million by 1979-80. The highest porjection predicts 58.3 million by 1979-80.[5] The 1963 fall enrollment in the public schools of this country was 40.2 million.[6] The net effect of all these causes is a constant need for more and more school buildings, staff personnel, and financial resources.

Of all the activities basic to the planning of school plant, staff personnel, and financial needs, the projection of future enrollments is one of the most important. In order for a school district to develop a

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[4] U. S. Department of Health, Education, and Welfare, Office of Education, Fall Enrollment, Teachers, and Schoolhousing, O. E. 20007 (Washington: United States Government Printing Office, 1957-1963).

[5] U. S. Department of Health, Education, and Welfare, Office of Education, Enrollment in Public and Nonpublic Elementary and Secondary Schools 1950-80, Circular 692 (Washington: United States Government Printing Office, 1962), p. 7.

[6] Carol Jay Hobson and Samuel Schloss, "Enrollment, Teachers, and Schoolhouses," School Life, XLVI (January-February, 1964), p. 18.

long-range plan of school plant facilities and to build schools when and where they are needed, it is very essential to have information concerning possible future enrollments. Enrollment projections are useful in determining and planning for future staff needs of a quantitative nature. In addition, future enrollment data are useful in developing plans for adequate financing of public schools.

Need for the Study

There are several methods in vogue for projecting public school enrollments. Brown[7] lists the three common methods as the growth curve technique, which is a rather complicated mathematical procedure involving projection of growth curve trends; the birth survival technique, which uses the average survival of children from birth to school entrance as a basis; and the corrected promotion technique, which is an expansion of the survival technique to include some of the other variables which affect enrollment change. Strevell[8] describes two other methods. These are the housing projection technique, which is based upon the number of homes and the ratio of children per home; and the population forecast technique, which projects upon the basis of school population as a percent of total population. These techniques, and their variations which are used, depend largely upon paper and pencil techniques abetted by a calculating machine. As a result, the projection of enrollments is a

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[7]Roscoe C. Brown, Jr., Predicting School Enrollments (New York: Center for School Services, School of Education, New York University, 1961), p. 9.

[8]Wallace H. Strevell, "Techniques of Estimating Future Enrollment," American School Board Journal, CXXIV (March, 1952), pp. 35-37.

laborious process. Consequently, many school districts, especially smaller ones, fail to project enrollment often enough to facilitate planning.

If enrollment projections are to have any real utility for planning purposes, they should, of course, have a rather high degree of accuracy. How accurate are enrollment forecasts? Some studies have been made in this area. Larson and Strevell[9] studied the relationship of enrollment forecasts to actual enrollment several years later. In surveying forty-eight studies which forecast enrollment, thirty-one of which could be checked later, these writers found median errors, after five years, ranging from 6.2 percent to 9.9 percent for three different methods of projection. This does not appear to be a large margin of error. However, if an 8 percent error were applied to 4,000 pupils, it would represent 320 pupils, or more than ten classrooms on the basis of thirty pupils per classroom. The writer surveyed nine sets of enrollment projections which were part of school building needs studies conducted by the Administration and Facilities Division of the Bureau of Educational Research and Service, Ohio State University, during 1957. In comparing the projected enrollments for certain grade groups with the actual enrollments six years later, the writer found differences ranging from +32.6 percent to -43.6 percent. Of the twenty-one different projections contained in these nine sets, however, fourteen had differences of less than 4 percent after six years. Over thirty years ago Chamberlain and

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[9]Knute Larson and Wallace H. Strevell, "How Reliable Are Enrollment Forecasts?" School Executive, LXXI (February, 1952), pp. 65-68.

Crawford studied thirty-five school surveys in which enrollment projections appeared. They found that the majority of these projections, or predictions as they called them, were derived from total population forecasts. Errors ranging from 0.24 percent to 27.15 percent were found when the enrollment predictions in these studies were compared to actual enrollments later.[10]

Thus it would appear that the accuracy and ease of enrollment projections need to be improved. Such an improvement would be invaluable to the planning of school facility, staff personnel, and financial needs.

Statement of the Problem

A review of the literature about school enrollment change and the methods of projecting enrollment revealed that public school enrollments are affected by two major classes of variables. The first class are population variables, or those which cause change in the number of school-age children. The second class are educational variables, or those which cause change in the number of school-age children who are enrolled in the public schools.

The school-age population in a given area is a variable percentage of the total population and depends upon certain variables which have socioeconomic determiners. These variables are births, deaths, and migration. The public school enrollment, in turn, is a function of the number of school-age children mitigated by certain other variables which

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[10] Leo M. Chamberlain and A. B. Crawford, "The Prediction of Population and School Enrollment in the School Survey," Bulletin of the Bureau of School Service, Vol. IV, No. 3 (Lexington: University of Kentucky Press, 1932).

also have a socioeconomic basis. Examples of these variables are drop-out rate, nonpublic school enrollment, and the number of school years provided at public expense. The relationships described in this paragraph are depicted graphically in Figure 1.

The enrollment projection methods discernible in the literature have included many of the population and educational variables but have not included the underlying socioeconomic variables. The problem of this study was to bring together selected socioeconomic variables along with the commonly used population and educational variables and by an appropriate statistical technique to see what relationships would obtain. This approach would have three basic purposes: (1) to promote parsimony and ease of enrollment projection by reducing the number of variables to a more manageable number, (2) to develop possible descriptive or predictive value of the results, and (3) to indicate directions for further research.

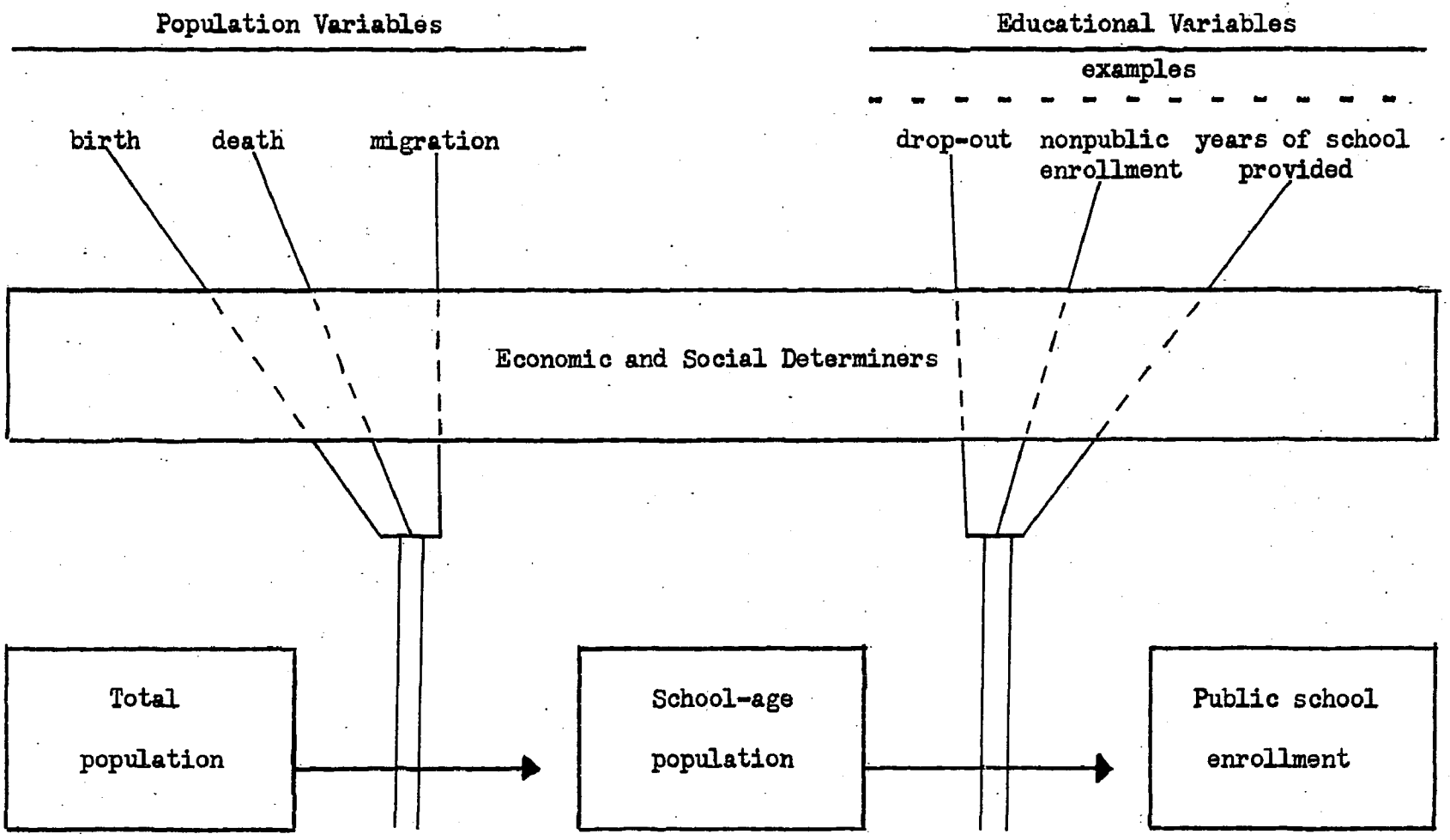
This study has attacked the problem of analyzing the selected variables affecting public school enrollments by means of a factor analysis technique and of developing some relationship among the resulting significant factors. Collection of the necessary data was a corollary problem because many school districts in the preliminary survey did not have the needed data available. As a result, it was necessary to seek data from several sources.

The objective of the study was to answer three questions:

1. Can the selected variables affecting public school enrollments be expressed in mathematical terms?

FIGURE 1

RELATIONSHIPS OF VARIABLES



2. Can the total number of selected variables affecting public school enrollments be expressed, through factor analysis techniques, in a few significant factors?
3. Can these significant factors be structured into a useable relationship or mathematical formula?

Definition of Terms

For the convenience of the reader the following terms are defined as they are used in the study:

Public school.--any institution providing elementary and secondary education and supported wholly or in part by one of the states, or a political subdivision thereof, of the United States.

Enrollment.--the number of persons in full-time attendance at a school or schools during the regular day-school program of instruction.

Enrollment projection.--a determination of probable future enrollment in a school or schools through a rationally or logically developed technique.

Design of the Study

Variables Selected

A total of twenty-five variables was selected for analysis in this study. The review of literature pertaining to public school enrollment change and prediction, as reported in Chapter II, suggested fifteen of the variables. These are variables three, four, seven through fifteen, seventeen, and twenty-three through twenty-five. The remaining ten variables were selected from the elements used in Jonassen's and

Peres' study of the dimensions of community systems.[11] In all cases these elements had a correlation coefficient of 0.400, or greater, with elementary and/or secondary school enrollment.

One of the conclusions drawn by the writer from the review of the literature was that current methods of public school enrollment projection do not adequately include economic factors. The variables from the Jonassen and Peres study were selected because they were related to the economic welfare of a community or had an economic basis. This was done in an effort to include economic related variables in the study analysis.

The twenty-five variables selected for this study are identified and described as follows:

1. Infant deaths--annual number of infant deaths per 1,000 live births.
2. Child neglect--annual per capita expenditure on aid to dependent children.
3. Net population migration change--annual increment of population change due to in- and out-migration.
4. Total population change--annual index of population change from a base year.
5. Retail sales gain--annual percent gain in retail sales.
6. Unemployment index--percent of unemployed persons in the total work force on a particular date each year.
7. Birth rate--annual number of live births per 1,000 population.

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[11] Christen T. Jonassen and Sherwood H. Peres, Interrelationships of Dimensions of Community Systems (Columbus: Ohio State University Press, 1960), pp. 30-39.

8. Nonpublic school enrollment--annual percent of nonpublic school pupils in the total school enrollment on á particular date each year.
9. Net dwelling unit change--annual net change in dwelling units caused by new construction.
10. Tax duplicate change--annual index of tax duplicate change from a base year.
11. Retention rate--annual school-wide rate of pupils retained in grade.
12. Female population ages 15 to 29--annual percent of total population in this category.
13. Female population ages 30 to 44--annual percent of total population in this category.
14. Occupational classifications: professional, managerial clerical and sales--percent of total labor force falling into the listed categories on a particular date each year.
15. Retailing--annual per capita retail sales.
16. Total educational expenditure--total annual expenditure per pupil in public school enrollment.
17. Elementary school enrollment--annual total enrollment in grades one through eight on October 1 of each year.
18. Family income--average annual income per family or household.
19. High school education--annual percent of persons 25 years of age and older who had completed high school.
20. Poverty--annual percent of families or households having a total income less than $2,000.

21. Dwelling modernity--annual percent of dwelling units with mechanical air conditioning.
22. Per capita local education expenditure--annual per capita expenditure of local funds for education.
23. Drop-out rate, grades 9 through 12--annual percent of pupils enrolled in grades 9 through 12 who leave school before graduation.
24. Ethnic character--annual percent of nonwhites in the total population.
25. Secondary school enrollment--annual total enrollment in grades 9 through 12 on October 1 of each year.

Sources of Data

In order to collect data relating to the above variables it was necessary to use several sources. Sources of data included:

1. Historical school enrollment records
2. School census records
3. Annual school enumeration reports
4. Records of city health districts
5. Local governmental agencies, such as a building authority
6. U. S. Census reports by census tract
7. Chamber of commerce records and forecasts

Selection of Community Sample

Data for the variables selected for analysis in this study were collected in three different Ohio cities. This plan provided three

different sets of data to be factor analyzed. One city would have been sufficient to perform a factor analysis and the exploratory nature and design of the study prohibited using a large sample. However, it was decided to collect data in three cities so that the effects of differing population size and growth rate could be assessed.

The three cities in the community sample were selected according to the following criteria:

1. The boundaries of the school district, city, and health district should be nearly coterminous.
2. The selected cities should contain unitary multiples of U. S. Census tracts or census data should be available.
3. No significant changes should have occurred in the boundaries of the city or school district.
4. The community sample should provide a range of population sizes and growth rates.

These criteria indicated that the community sample selected should be sizeable city school districts since few others would meet the criteria.

In order to select the optimum community sample, a preliminary questionnaire to determine the availability of needed data was sent to the superintendent of public schools, mayor, chamber of commerce, and health commissioner in all Ohio cities of 15,000 or more total population according to the 1960 U. S. Census. From an analysis of the returns on these questionnaires, the three cities which best met the above criteria and from which the greatest amount of needed data could be obtained were selected as the community sample for this study. Fifteen thousand was selected as the minimum city size to take advantage of

census data published for standard metropolitan statistical areas. The U. S. Bureau of the Census uses the following criteria in establishing standard metropolitan statistical areas (SMA):

> Each standard metropolitan statistical area must include at least:
>
> a. One city with 50,000 inhabitants or more, or
>
> b. Two cities having contiguous boundaries and constituting, for general economic and social purposes, a single community with a combined population of at least 50,000, the smaller of which must have a population of at least 15,000.[12]

Not all Ohio cities above 15,000 population are part of a SMA. However, the three cities ultimately selected for this study were each part of some SMA and certain data were available which might not otherwise have been obtained.

Collection of Data

Data on the selected variables which could be obtained in each selected community were collected for an eleven-year period beginning in 1950 and ending in 1960, thus permitting 1950 to be used as the base year and ten annual changes to be noted. This time period was also chosen to correspond with the decennial federal census. Data were collected through mailed data collection forms and through personal visits by the writer.

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[12] U. S. Department of Commerce, Bureau of the Census, U. S. Census of Population: 1960, Detailed Characteristics, Ohio, Final Report PC (1)-37D, Washington: U. S. Government Printing Office, 1962, p. x.

Treatment of Data

The collected data were first converted to a standard scale of measurement. Percent of change from the base year 1950 was used because of the nature of the raw data. Following conversion to a standard scale, a correlation matrix for paired variables, consisting of $\frac{N(N-1)}{2}$ (where N equals the number of variables) separate correlations, was developed by the Pearson product-moment method for each of the three community samples. These three correlation matrices were then subjected to factor analysis by the principle factor method using an I.B.M. 7094 computer. The purpose of the factor analysis was to convert the number of variables to a few factors which convey all the essential information of the original variables in the matrix. Harman stated that "the principal concern of factor analysis is the resolution of a set of variables linearly in terms of (usually) a small number of categories or 'factors'. . . . Thus, the chief aim is to attain scientific parsimony or economy of description."[13]

Treatment of the Factors

After the completion of the factor analysis described above, there was an attempt to develop a relationship among the significant factors and to structure this relationship into a formula which could be applied to public school enrollment projection. Two possible methods were selected for testing this relationship.

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[13]Harry H. Harman, Modern Factor Analysis (Chicago: The University of Chicago Press, 1960), p. 4.

The preferred method was to compare the results of enrollment projections produced by any formula or relationship developed in this study with projections made in three previously completed school building needs studies. In order to do this it was necessary to gather data from three school districts where such surveys were conducted during 1957.

The second method involved collecting the necessary data from the three community samples used in this study, making the enrollment projections, and comparing the facility of the projection operation with that of the current method employed by the Administration and Facilities Division of the Bureau of Educational Research, Ohio State University. Of course, the accuracy of any enrollment projections developed by this method could not be verified for a period of years and would be beyond the scope of this study.

Organization of Remaining Chapters

The remaining chapters of this report are described as follows:

Chapter II is a review of the literature related to public school enrollment change, especially that having to do with projection of enrollment.

Chapter III presents the research methodology including the preliminary survey to select the sample, the selection of the sample, the method of data collection, and the statistical treatment of the data.

Chapter IV presents the findings of the factor analysis and describes the effort to develop and test a relationship among the factors defined by the factor analysis.

Chapter V summarizes the research and presents the conclusions drawn from the study, including recommendations for further research.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter is a review of selected literature concerned with change in public school enrollments, especially that which deals with the projection of enrollments. Since public school enrollments are a segment of the general population, any discussion of public school enrollment change must be based upon some understanding of change in the general population. Therefore, the first part of this chapter reviews selected literature about general population growth.

General Population Growth

Concern for population growth and control have been apparent in the record of mankind for centuries. Records show that many ancient tribes and peoples, among them the Greeks and the American Indians, practiced infanticide as a means of controlling population growth. The practice has persisted even into this century among some primitive tribes. Abortion has also been used as a means of population control for many ages. Even today this practice is a recognized method of population control, notably in Japan. Of course, disease, famine, and natural disaster have taken their toll, but man has also used a number of control measures of his own invention. Thompson suggests that without any

natural or man-made controls a single pair of humans and their descendants could have produced the present world population in a few centuries.[1]

Along with concern for population growth and control, man has also searched for theories to explain population change. Although many writers such as Adam Smith, Arthur Young, and Benjamin Franklin preceded him, Thomas Mathus propounded what is generally recognized as the first theory of population growth.

Population Growth Theories

Theory of Malthus.--Simply stated, Malthus' theory was that man's propensity to increase his own kind is infinitely greater than his ability to produce his own sustenance. Malthus reasoned that population increased in a geometric ratio and sustenance in an arithmetic one. He also saw hunger and disease, along with self-imposed limits on family size, as the chief checks to population growth.[2] Of course, American population growth in recent years would tend to refute Malthus' theory, but it was a product of his times. In the latter eighteenth century, population growth did appear indeed to follow Malthus' ideas.

Post-Malthusian theories.--Thompson has provided a review of representative population theories since Malthus' time. Included were theories by Sadler, Doubleday, Spencer, Gini, Marx, George, Dumont, and

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[1] Warren S. Thompson, Population Problems (4th ed.; New York: McGraw-Hill Book Co., 1953), p. 10.

[2] Ibid., pp. 20-21.

Carr-Saunders.[3] Thompson divides these theories into two classes: natural theories and social theories. He stated that natural theories

> are based on the belief that there is something inherent in the nature of man, or of the world in which he lives, that determines his growth at a rate and in a direction largely or wholly beyond his control. . . . In the social theories of population growth, on the other hand, the underlying assumption is that population growth is not subject to any immutable natural law but is rather the resultant of the social conditions (social here is used to include economic) in which a people finds itself.[4]

Thompson believed that the social theorists were working in the right direction. He wrote that "it does seem eminently reasonable to hold that the way to discover the dynamics of population growth at any given time and place and in any given group is to study the environment of this group for elements which affect its birth rate and death rate as well as the fecundity of the people.[5]

Bowen's theory.--A recent theory which leans heavily on Malthus' early work is that of Bowen. In fact, he restated Malthus' basic postulate and added a new one of his own. Bowen's theory was stated: "Our hypothesis of the growth of human populations should therefore read: Populations tend to increase, directly with wealth, and inversely with prevailing levels of living standards."[6] Bowen saw population growth as social/psychological as well as economic. He stated that "modern birth rates are almost wholly determined by psychologic and economic forces;

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[3] Ibid., pp. 33-45. [4] Ibid., p. 45. [5] Ibid.

[6] Ezra Bowen, An Hypothesis of Population Growth (Studies in History, Economics and Public Law, No. 343; New York: Columbia University Press, 1931), p. 23.

they are governed almost entirely by the strength of the desire for higher living standards."[7] This is the dimension not basically recognized by Malthus. However, Bowen vigorously defended Malthus when he commented that "the Malthus essay then is not an essay on population but an essay on poverty. The author (Malthus) does not explain the cause and manner of population growth; but he does establish convincingly the chief cause of poverty and misery."[8] However, Bowen's theory, too, is suspect when one notes that the rate of population change and the birth rate recently increased in the United States along with an increase in the standard of living.

Logistic growth curve.--Another recent attempt to explain population growth was the "growth curve" of Raymond Pearl and Lowell Reed. Their theory was that population growth follows an S-shaped curve for which an equation can be developed as a means to understanding past population growth and predicting future growth.[9] Pearl and Reed did succeed in developing an equation for a curve which described the historical population growth of the United States and from which they made predictions of future population. The assumption which underlay their work was that "the rate of population increase in a limited area at any instant of time is proportional (a) to the magnitude of the population existing at that instant (amount of increase already attained)

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[7] Ibid., p. 172.

[8] Ibid., p. 39.

[9] Raymond Pearl and Lowell J. Reed, "On the Mathematical Theory of Population Growth," Metron, III, No. 1 (1923), pp. 6-19.

and (b) to the still unutilized potentialities of population support existing in the limited area."[10]

Cowgill's theory.--Donald Cowgill has suggested four theoretical types of population growth cycles. He proposed that population increases occur when (1) the birth rate is relatively stable and the death rate declines for a time, (2) both birth and death rates decline for a time but the latter at a greater negative increment, (3) birth rate increases for a time and death rate remains rather stable, and (4) both birth and death rates increase for a time but the former at a greater rate. Cowgill believed that the first cycle characterized the pre-industrial society; the second cycle, the industrialization period; and the third cycle, future population increases. He believed that the fourth cycle has neither precedent nor prospect.[11] In reality, Cowgill has offered a mechanical explanation of population increases rather than a theory which would aid in understanding underlying causes.

Trends in the United States Population

Growth has always characterized the population of the United States. Each census has recorded an increase in total population and there have been only two censuses (1920 and 1930) which recorded a lesser

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[10]Raymond Pearl and Lowell J. Reed, "On the Rate of Growth of the Population of the United States Since 1790 and Its Mathematical Representation," Proceedings of the National Academy of Sciences, VI (June 15, 1920), p. 281.

[11]Donald Olen Cowgill, "The Theory of Population Growth Cycles," The American Journal of Sociology, LV (September, 1949), pp. 163-170.

gross increase than the previous census.[12] Recent forecasts of the Bureau of the Census predict a continuation of this trend with a minimum population of 245 million by 1980.[13] Of even greater importance to public education than trends in total population are trends in the age-groups of the population. For example, the age-groups from five to nineteen years have shown the effects of the lower birth rates during the thirties. The age-group from five through fourteen declined from 1930 to 1940; the age-group from ten to nineteen declined from 1940 to 1950.[14] By 1960 all age-groups had shown increases and the forecasts cited above predict a continuation of this latter trend.

Another significant trend is that shown by the age-groups twenty-five through fifty-nine. By 1965 this group will have increased 43.6 percent above 1930. In the same time period the age-group five through nineteen years will have increased by 54.9 percent. This, of course, has an important implication for the financing of public education. The age group which pays the most for support of the public schools will have increased at a lower rate than the age group from which the public school pupils are drawn. Differently stated, the ratio of persons five through nineteen years to those twenty-five through fifty-nine was 0.67 in 1930. By 1965 this ratio will probably approach 0.73 and by 1980 could be approximately 0.80 based upon the population projections cited above.

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[12] U. S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1963 (84th ed.; Washington: U. S. Government Printing Office, 1963), p. 5.

[13] Ibid., p. 6.

[14] Ibid., p. 26.

School Enrollment Trends and Implications

Interest in enrollment trends and their implications for education have been apparent for many years in American education. Interest in this problem, however, seems to be heightened in periods of rapid change in enrollment. School surveys, which had their genesis in the early part of this century, first began to deal with the problem of enrollment projection during the 1920's when high school enrollments began to increase rapidly. During the decade from 1920 to 1930, approximately fifty school surveys were published in which attempts were made to predict total population and/or school enrollment of cities.[15]

During the late 1930's increased interest was shown in enrollment trends because of the decline in enrollments caused by the lower birth rates of the early thirties. One who reads the literature of this period will find a welter of articles decrying enrollment decline and the implications thereof. The National Education Association released a research report in 1938 which pointed to a definite slowing down of population growth, a steady rise in the average age of the population, and new geographic concentrations of population as having sharp implications for education. This report suggested that a decreasing enrollment would mean enrichment and extension of educational opportunity, more careful studies of school plant need and location, improvement in the

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[15]Leo M. Chamberlain and A. B. Crawford, "The Prediction of Population and School Enrollment in the School Survey," Bulletin of the Bureau of School Service, College of Education, University of Kentucky, IV (March, 1932), p. 7.

quality of teaching personnel, and emphasis on improving rural schools.[16] Eby, among others, saw a decline in enrollment as having a dire effect on teacher need.[17] Most writers of this period were predicting a stable or declining enrollment. Perhaps Stuart would speak for all in his statement that

> the era of rapidly expanding enrollments in the public schools on both a state and national basis has for the present, at least, come to an end. Individual communities and some states will undoubtedly continue to show moderate growth for the next few years, but the general trend for the next decade is distinctly toward a stationary or declining enrollment throughout the country as a whole.[18]

One of the more discerning studies during the thirties was made by Harvey. He suggested that the decline in enrollments was due not only to population changes but also to a gradual change in school policy; that is, a greater percent of pupils being promoted each year.[19] A later study by Harvey tended to support his earlier idea.[20]

The past fifteen to twenty years have witnessed an abrupt reversal of the enrollment trends discussed by the writers of the late thirties

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[16]National Education Association, Research Division, "Population Trends and Their Educational Implications," Research Bulletin, XVI (January, 1938), p. 32.

[17]Kermit Eby, "Population Decline--Its Effect on Education," Illinois Education, XXX (October, 1941), pp. 45-6+.

[18]Byron D. Stuart, "School Enrollment Trends: Their Causes and Educational Implications," American School Board Journal, XCVI (March, 1938), p. 22.

[19]O. L. Harvey, "Enrollment Trends and Population Shifts," The Elementary School Journal, XXXVIII (May, 1938), p. 659.

[20]O. L. Harvey, "Enrollment Trends in Elementary-School Grades, by States," The Elementary School Journal, XXXIX (November, 1938), p. 210.

and early forties. Now the concern is for the problems caused by a rapid increase in enrollments at all levels, and especially in secondary and higher education. Ten years ago Englehardt, in pointing to the high birth rate, high number of marriages, and rapid new home construction, as indicative of continued high enrollment, stated that "all this would indicate that the increase in the number of children which is occurring cannot be passed off as a temporary rise following the war."[21] He also suggested that ". . . although enrollments may tend to level off or even dip somewhat during the next decade, there is much reason to believe that another climb may be expected within twenty years."[22] It seems apparent that Englehardt was basing this belief on the fact that the large numbers of children born during the late forties and early fifties would reach marriage age in about twenty years, thus producing another surge in births and, later, in enrollments. Two recent publications project a continuation of the enrollment increases occurring since the war. Both offer four different projections, based upon different sets of assumptions, of total enrollment (public and nonpublic). The projections of the Bureau of the Census range from 41.2 million to 48.7 million for the elementary school and from 14.8 million to 17.4 million for the high school for 1980.[23] Those of the U. S. Office of Education range from

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[21] N. L. Englehardt, Jr., "The Impact of Population Trends on Long-range Planning," American School and University, 1953-54, XXV (New York: American School Publishing Corporation, 1953), p. 150.

[22] Ibid., p. 152.

[23] U. S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1963 (84th ed.; Washington: U. S. Government Printing Office, 1963), p. 118.

46.6 million to 52.2 million for the elementary school and from 16.0 million to 19.9 million for the high school for 1980.[24] In either case the implication is clear. If these projections have any accuracy at all, the problem of sheer numbers, which has plagued public education for the past twenty years, will continue for some time into the future.

Variables Affecting School Enrollment

The variables which affect or cause change in public school enrollments can be categorized into two groups or classes. One class can be labeled population variables and the other, educational variables. Population variables include those which affect or cause change in the number of persons in the age-groups in the total population from which public school enrollments are drawn. Thus, any variable which would affect the number of persons in the ten to fourteen age group would fall into this class. Educational variables, on the other hand, include those which affect or cause change in the percentage of persons in the population age groups which is actually enrolled in the public schools. Any variable which would affect the percentage of persons ten to fourteen years which is enrolled in the public schools would fall into this class. Jacoby saw this distinction clearly in stating that "two sets of statistical data will be needed (to analyze enrollment change): educational statistics and general population statistics."[25] In analyzing trends in the South, Robinson made a differentiation between trends in the

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[24] U. S. Department of Health, Education, and Welfare, Office of Education, Enrollment in Public and Nonpublic Elementary and Secondary Schools, 1950-80. Circular 692 (Washington: U. S. Government Printing Office, 1962, p. 7.

[25] E. G. Jacoby, Methods of School Enrollment Projection (Educational Studies and Documents, No. 32; Paris: UNESCO, 1959), p. 8.

school-age population (population variables) and trends in the public school enrollment (educational variables).[26]

Bernert and Nam made an interesting study of the relative effect of these two classes of variables. They found that population variables accounted for 72 percent and educational variables for 28 percent of the change in school enrollment of persons five to twenty-four years of age between 1910 and 1920. During the decade from 1940 to 1950, however, population variables accounted for 16 percent and educational variables for 84 percent of the change in school enrollments of the same age-group.[27] This indicates the importance of both classes of variables.

An important difference exists in these two classes of variables insofar as the public schools are concerned. Educational variables are subject to considerable control by the public schools, either through statutory law or administrative regulations. In contrast, the public schools have little or no control over population variables.

Population Variables

Total population in a given geographic area can change by only three means: births, deaths, and migration. These means are, of course, the agents which actually produce population change. Underlying them, however, are certain socioeconomic variables. Public school enrollment

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[26] Glen Edward Robinson, Some Trends in School-age Population, Enrollment, and Attendance in the Southern Region (Nashville: Southern States Cooperative Project in Educational Administration, George Peabody College for Teachers, 1955), pp. 93-295.

[27] Eleanor H. Bernert and Charles B. Nam, "Demographic Factors Affecting American Education," Chapter IV of Social Forces Influencing American Education: 60th Yearbook of the National Society for the Study of Education, Part II (Chicago: University of Chicago Press, 1961), p. 95.

change is most affected by births and migration since deaths in the five through nineteen age-group are a negligible cause of change. Therefore, anyone concerned with public school enrollment change would need to examine the variables affecting births and migration in a given school service area.

Economic, ethnic, and social variables are vitally important in analyzing population change. Gottlieb put major emphasis on socioeconomic variables in discussing school enrollment forecasts. He suggested that birth trends, as affected by economic conditions; migration patterns in age, occupation, racial, and ethnic character; land use changes; housing trends; and employment opportunities are important variables to be analyzed.[28] MacConnell listed fifteen variables having to do with enrollment change. Among those which could be classified as socioeconomic were water and gas meter connections, telephone stations, assessed property valuation, bank deposits, building permits, postal receipts, and number of dwelling units.[29] Apparently, the public schools have no way to control any of the means of school-age population change (births or migration) or any of the underlying causal variables unless school representatives would have some voice in community planning.

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[28]Abe Gottlieb, "A Planning Approach to School Enrollment Forecasts," American School Board Journal, CXXVIII (February, 1954), pp. 68-69, 110.

[29]James D. MacConnell, Planning for School Buildings (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1957), p. 33.

Educational Variables

A recent publication of the American Association of School Administrators contains a thorough discussion of the variables affecting public school enrollment change. Among the fourteen variables listed, the following could be classified as educational variables: compulsory school attendance laws, school drop-outs, attendance of non-resident pupils, handicapped children, promotion policies, attendance at non-public schools, and school district territorial changes.[30] Many of these variables are subject to different degrees of control by the public schools. For example, most public school districts have some policy regulating the promotion or nonpromotion of pupils. Compulsory school attendance is generally established by law in each state but school districts are often given considerable latitude in establishing entrance age dates for kindergarten or first grade.

Most writers suggest that the selection of these many variables in a given school service area and the amount of importance attached to each is a matter for subjective judgment. Moore, for example, points out that "no matter what procedures are used to estimate the future school population, there will be an element of judgment applied to such factors as . . . ."[31] All the variables listed in this discussion will not

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[30] American Association of School Administrators, School Building Commission, Planning America's School Buildings (Washington: The Association, 1960), p. 107.

[31] Harold E. Moore, "Estimating the School Population to Be Served," Bulletin of the School of Education, Indiana University, XXII (July, 1946), p. 48.

be applicable in all situations. Sumption and Landes suggest that

> Enrollment size in a given district will be related to numerous variables, some of which may be common to most districts, and others of which may be unique. It is probably safe to say that no two districts will have the same combination of variables operating in the same ways. An assessment of the influential variables in the district under study is the first step in making the projection.[32]

Sources of Data for Enrollment Studies

In view of the variety of variables indicated in the above discussion, it is apparent that a great many sources must be tapped in order to obtain adequate data for enrollment studies. This is especially true of those data relating to the socioeconomic characteristics of a community because these kinds of data are typically not kept by school districts.

Scammon listed five general sources of local statistics published by the Bureau of the Census: General Social and Economic Characteristics, County and City Data Book, census tract reports, 1962 Census of Governments, and 1961 annual surveys of state and city employment and finances.[33] Brown listed some of the more important sources of data as the school census, school enrollment reports, birth reports, building and occupancy reports, planning commission plans, and zoning and building ordinances.[34] Like many articles in the literature, these sources are not too specific. Strevell was somewhat more specific in the sources of

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[32]Merle R. Sumption and Jack L. Landes, Planning Functional School Buildings (New York: Harper and Brothers Publishers, 1957), p. 63.

[33]Richard Scammon, "Projecting Student Enrollment," Overview, III (December, 1962), pp. 39-41.

[34]Roscoe C. Brown, Jr., Predicting School Enrollments (New York: Center for School Services, School of Education, New York University, 1961), p. 8.

data which he suggested. These are special school censuses, annual resident births, new residential dwelling construction, private school enrollments, enrollment density by residential section, analysis of annual grade by grade enrollments and holding power, index of school plant utilization, U. S. census data, community setting and total population forecasts, and annual census class (age or grade-group) projection by five-and ten-year periods.[35] Although Strevell's list is more comprehensive than the others cited, it does not list many specific sources for the kinds of socioeconomic variables discussed in the preceding section of this report. Public school enrollments are most affected by births and migration. Yet the literature is rather silent on possible sources of data for migration of school-age children. In addition, the social and economic variables which produce migration are not sufficiently treated in the literature.

Most writers tend to cite the continuing school census as one of the primary sources of data for enrollment studies. Yet Komorek found, in a survey of state education departments, that the continuing school census was not used extensively in all school districts although he could discern a trend in this direction. Komorek also developed a set of criteria for evaluating school censuses and found that those in Massachusetts, which he examined carefully, did not meet many of the

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[35] Wallace H. Strevell, "School District Records Predicate Future Enrollments," Educational Administration and Supervision, XXXVIII (February, 1952), pp. 102-106.

standards established in his criteria.[36] The same situation would likely prevail in other states.

Enrollment Projection Methods

Many articles, pamphlets, and dissertations which deal with enrollment projection methods can be found in the literature. These range all the way from thorough discussions of the basic methods to "how we did it" presentations. Those cited in the following discussion are a representative sampling of the materials found in the literature of the past forty years.

Summary of Basic Projection Methods

After a careful review of the literature, the writer has been able to identify eight basic methods of projecting public school enrollments. These are identified and described below.

Projection from total population forecasts

Public school enrollments have been projected from forecasts of total population for a given area. In this method, a ratio of enrollments to total population, developed from historical data, is applied to the total population forecast to derive public school enrollments for the future. According to Chamberlain and Crawford this method was most

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[36] John J. Komorek, "A Critical Study of the School Census" (unpublished Ed.D. dissertation, Boston University School of Education, 1955).

commonly used during the 1920's.[37] However, it is not much used currently. Strevell and Burke state that

> during the late 1930's when it became apparent that the percent of enrollment to total population was declining, the method of estimation from total-population forecasts fell into disfavor because of uncertainty as to the probable future ratio of enrollment to total population.[38]

A problem in using this method is the difficulty in obtaining accurate forecasts of total population, especially in smaller communities. Population forecasts for larger cities are often available from the Bureau of the Census and from telephone or other utility companies, but are much more difficult to obtain for smaller cities and practically impossible for rural areas.

Projection by growth curve techniques

In this method, past enrollment data are used to develop a trend or pattern. By appropriate mathematical techniques, a curve is fitted to this pattern and the equation for the curve is used to project a growth pattern for the future. This method has had infrequent use because of the mathematics involved and because it is better when used in very large areas. Englehardt used an adaptation of the Pearl-Reed formula for a growth curve to project public school enrollments. He concluded that

> it should be used with great caution and the results derived from its use should be checked carefully with the results determined by other methods.

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[37] Chamberlain and Crawford, op. cit., p. 21.

[38] Wallace H. Strevell and Arvid J. Burke, Administration of the School Building Program (New York: McGraw-Hill Book Company, 1959), p. 199.

> The formula does not give satisfactory results when applied directly to the school population data except in the large school systems.[39]

Kuang, in discussing techniques for fitting curves to historical enrollment trends, analyzed the exponential curve, the Gompertz curve, and the logistic curve. He pointed out the inherent weakness of this approach: trends do not always continue. Kuang concluded that "the forecasting of future enrollment is not simply a statistical problem and therefore perhaps can never be settled by statistics alone."[40]

Projection by analogy

In projecting by analogy an attempt is made to locate a community which has had a growth pattern similar to the community under study, but which is now larger in population and public school enrollment. Insofar as possible, social and economic conditions are also required to be similar. The procedure is then to use the public school enrollments of the comparison community to predict the future enrollments of the community under study. The analogy method was widely used during the early days of the survey movement in the 1920's. It is found among the methods listed by Holy[41] and by the American Association of School Administrators[42]

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[39] Fred Englehardt, Forecasting School Population (New York: Teachers College, Columbia University, 1925), p. 50.

[40] H. P. Kuang, "Forecasting Future Enrollments by Curve-Fitting Techniques," Journal of Experimental Education, XXIII (March, 1955), p. 273.

[41] T. C. Holy, "What Future School Building Needs Are Revealed by School Population Studies?" American School Board Journal, CXIV (May, 1947), p. 40.

[42] American Association of School Administrators, op. cit., p. 109.

but is not commonly used at the present time because other methods are more accurate.

Housing projection techniques

The housing projection techniques attempt to project future public school enrollments on the basis of a ratio of pupils per dwelling unit in various areas of a school community. In this type projection, a school district can be divided into residential areas according to convenient boundaries such as highways, railroads, and streams. A study is then made of the residential patterns of these areas in terms of the types of housing located in them, the ratio of pupils per dwelling unit, and the potential for future housing. Projections of future public school enrollment are then made on the basis of this analysis. Strevell and Burke state that "there seem to be enrollment cycles in most residential neighborhoods. . . . Extensive study is needed on the question of the likelihood that an abnormally high or an abnormally low number of children per dwelling will prevail over a period of time in any given type of residential neighborhood."[43] The Metropolitan School Study Council has described a housing cycle which is based upon a long-term study of housing trends. It consists of four phases as follows:

Phase one--fifteen years:	75 to 85 percent of new homes occupied by young couples in the first five years of marriage; high incidence of elementary school children.
Phase two--fifteen years:	lower birth rate; larger enrollment in secondary than in elementary school.

[43] Strevell and Burke, op. cit., pp. 199-200.

Phase three: new families coming in; birth rate and elementary school enrollments gradually climb.

Phase four: blighting; rapid rise in enrollment at all levels.[44]

There are not only variations in the number of children per dwelling in a given residential neighborhood over a period of years, but there are also variations in the number of children according to the type of dwelling unit. Ellena, for example, in a study of over 100,000 dwelling units in Baltimore County, Maryland, found that the number of children per dwelling varied according to the size of the dwelling (measured by the number of bedrooms), its value, and its location.[45] From this discussion it is apparent that the housing projection technique is quite complicated and involves careful study. However, it has been used rather extensively, particularly in larger cities where wide differences exist among the various neighborhoods.

Census class projection

The census class projection is essentially a cohort survival technique. In it, the trends in survival of age groups (cohorts) from year to year are studied over a period of time. For example, the children born during 1940 could be studied each year for a period of time to determine the survival rates for this group at various ages. Through

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[44]Metropolitan School Study Council, The Committee on School Buildings, Forecasting School Enrollments (New York: The Council, 1953), pp. 6-8.

[45]William J. Ellena, "A Technique for Predicting Pupil Yield by Types of Dwelling Units" (unpublished Ed.D. dissertation, University of Maryland, 1959).

the study of several groups over a period of time, survival rates can be established. These rates then can be applied to existing age-groups in a given school community to determine the number of children in the various school-age groups at some future date. Then a ratio of pupil enrollment to corresponding school-age group can be developed from historical data and applied to the projected number of children by school-age group to derive public school enrollments.

The census class projection method would be among the better public school enrollment projection methods except that it demands types of data that are seldom available with the degree of accuracy required. According to Strevell and Burke, the basis of this technique is the school census.[46] This is so because the school census may be the only available source of the numbers of children in the age groups under school-age. These data would, of course, be necessary to project future age groups in the school-age population.

The census class projection method is actually an adaptation of the method of projecting from total population forecasts. The difference is in the fact that the former uses the school-age population as a base while the latter uses total population.

Trend projections

Trend projections have been used extensively because of their inherent simplicity. The only data required are historical public school enrollment records which are almost always available. Basically,

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[46] Strevell and Burke, op. cit., p. 198.

trend projections are a simple matter of determining an enrollment trend and projecting it into the future either graphically, or by a geometric or arithmetic ratio. Collins and Langston listed four methods of enrollment projection, three of which are trend types. They called these the (1) straight line, (2) average percent of increase, and (3) average numerical increase.[47] The straight line method consists of graphing the enrollment data for a grade or group for a period of years and projecting the graph into the future to determine enrollments. The average percent of increase, or geometric ratio method, consists of determining the annual percent increases in enrollment in a given grade or grade-group for a period of time and projecting the existing enrollment by applying the average percent of increase for the desired number of years. The average numerical increase, or arithmetic ratio, is similar in procedure except that the average gain in actual numerical enrollment over a period of years is used to make the projection.

Trend projections have an inherent weakness in that they assume the continuance of past trends in public school enrollment. However, they would be highly useful in a relatively stable community because of their simplicity and the availability of basic data.

Survival rate projections

The survival rate projection, or retention-ratio projection as it is often called, is based upon the survival rates of a particular age or

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[47]George J. Collins and LaMoine Langston, "Guesstimating Future School Enrollments," American School Board Journal, CXLIII (December, 1961), pp. 10-12.

grade group to the next age or grade group over a period of years. For example, the survival rate of fifth graders to the sixth grade one year later could be determined annually for a given school or school community.

Essentially there are four steps to this method. Step one is to determine the survival rates of births to first grade enrollment six years later for a period of five to ten years. Step two is to determine the survival rates of each grade to the next grade the following year for a like number of years. Step three is to calculate the average survival rates from birth to grade one and for each of the other grades. Step four is to apply the birth to first grade average survival rate to the birth groups below school age to derive first grade enrollments for the next six years, and to successively apply the average survival rates for grades two through twelve to the grade enrollment the preceding year to derive future enrollments in grades two through twelve. Basic data required for this method include actual or derived birth records, and historical public school enrollment records for the school community under study. One complicating problem is that health districts which maintain birth records are not always coterminous with school districts which may want to use these data for enrollment projection purposes.

Sumption and Landes have stated that "probably the most widely used projection technique is the retention ratio or survival method."[48] The writer has found this to be true in surveying the more recent literature in the field. The majority of reports from local school

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[48]Sumption and Landes, op. cit., p. 73.

districts, describing "how we did it," indicate the use of this method or a local adaptation of it. Strevell and Burke have given a very thorough discussion of the survival rate method (they use the term retention-ratio). They suggest that this method gives greatest accuracy in short-term projection of from two to five years.[49]

Brown describes a modification of the survival rate method which he calls the "corrected promotion" method. In his method the survival rates for the various grades are "corrected" to allow for possible or anticipated changes in such variables as migration of certain grade groups, numbers of nonpublic school enrollments, pupil dropout rates, retention policy, and the like.[50] If, for example, it was known that a new parochial high school would open within one year in a given school district, the survival rates for the public high school could be "corrected" to allow for the anticipated enrollment in the parochial high school. Brown states that "the 'corrected promotion' method is considered to be the most accurate method of predicting school enrollments."[51]

Multiple projection methods

One problem which has confronted persons making population projections has been the extreme difficulty in attaining a high degree of accuracy in the projections. This applies to projections of public

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[49] Strevell and Burke, op. cit., pp. 195-198.

[50] Brown, op. cit., pp. 12-13.

[51] Ibid., p. 12.

school enrollment as well as to general population projections. Stanbery, in discussing the problems of general population projection commented that "even the most thorough study will not assure that the forecast will come true. . . . By chance, a figure drawn at random or a curve sketched free-hand on paper may come closer to the future population than one derived from the most painstaking study."[52] Although Stanbery was writing about general population forecasting, his comments are most appropriate for projections of public school enrollments. Stanbery also stated that

> Population projections may be developed and presented as a single figure; as two figures, one high and one low, showing the expected range for the future population; or in three or more figures based on different assumptions.[53]

After a discussion of the advantages and disadvantages of the three approaches, Stanbery concluded: "In light of the foregoing, two projections, one high and one low, showing the 'probable' or 'expected' range of population change, are recommended."[54]

The practice of making multiple projections has been used by demographers for many years. For example, the Bureau of the Census published a set of multiple projections based upon different assumptions about fertility, mortality, and immigration in 1945.[55] Stanbery states

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[52] Van Beuren Stanbery, Better Population Forecasting for Areas and Communities (U. S. Department of Commerce, Domestic Commerce Series, No. 32; Washington: U. S. Government Printing Office, 1952), p. 1.

[53] Ibid., p. 10.

[54] Ibid., p. 12.

[55] U. S. Department of Commerce, Bureau of the Census, Forecasts of the Population of the United States 1945-75 (Washington: U. S. Government Printing Office, 1947), pp. 39-53.

that "the current practice among demographers is to present three projections--a high series, a low series, and a medium series."[56]

Multiple projections of public school enrollment have been made on a national basis by the Office of Education and the Bureau of the Census, as cited previously. However, this practice has not been used extensively in making public school enrollment projections for local school districts. Herrick described a method of making two public school enrollment projections used in a school building needs study conducted by the Bureau of Educational Research, Ohio State University. In this study, one set of projections was based on the birth-survival technique and the other on an assumed high migration.[57] This was the earliest reference to making more than one set of public school enrollment projections found by the writer. The writer requested information about enrollment projection methods employed by eleven midwestern universities which have field service divisions conducting school building needs surveys. Replies were received from seven of these. Of the number which could be checked only one makes a regular practice of developing more than one set of public school enrollment projections.

The institution which regularly makes more than one projection is the Educational Administration and Facilities Division, Bureau of Educational Research and Service, Ohio State University. Here the adopted

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[56]Stanbery, op. cit., p. 13.

[57]John H. Herrick, "Estimating Future Enrollments in Rapidly Growing Communities," Educational Research Bulletin, XXXI (April 16, 1952), pp. 92-94, 111, 112.

procedure is to make two sets of projections for each enrollment study. After an analysis of the variables affecting public school enrollment change, two projections are made based upon two different sets of assumptions which will tend to produce the probable lower and upper limits of enrollments during the period of the projection. Enrollment projections are made for planning purposes. The chief value of the dual projection method, one the probable low and the other the probable high, is that it forces the development of a flexible plan. That is, the planner must present a plan which will be able to meet the needs indicated by the low projection but which will also be readily adaptable to the high projection.[58]

Individual Projection Methods and Variations of Basic Methods

In view of the eight basic methods discussed in the preceding section it is not surprising that several variations of these and a number of individual local or state methods of projecting public school enrollments can be found in the literature. A selection of these are summarized under two headings: projection methods for states, and individual or local projection methods.

Projection methods for states

Armstrong and Harris developed projections of school-age population by census class (age group), ages four through twenty-two, for the state of New York. Survival rates for sex and color were used to

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[58] Personal interview with M. J. Conrad, Head, Educational Administration and Facilities Division, Bureau of Educational Research and Service, The College of Education, The Ohio State University, March 31, 1964.

establish the yearly numbers surviving by census class into the future. Age group projections were made for each year from 1947 to 1965.[59] While this method does not yield public school enrollment projections per se, it does provide basic data from which projections can be developed.

The Indiana Department of Public Instruction issued a bulletin describing a method of predicting public school enrollment for a ten-year period. This method was based upon a complete child census including preschool children, school children, and non-school children. Enrollments for grades one through six are projected by subtracting a sixth grade group and adding a proper preschool group to obtain enrollment for a desired year. Estimates of births for four years are also used to determine preschool groups beyond those enumerated by the census. Predictions for the secondary school grade groups are derived by applying the five-year average ratio of a secondary grade group to a corresponding elementary grade group to the predicted enrollments for the latter grade group. For example, the average five-year ratio of grades seven through nine to grades four through six would be applied to the predicted enrollments in grades four through six for the desired number of years.[60] This method assumes that the trends in birth rate and enrollment will

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[59] Charles M. Armstrong and Mary S. Harris, A Method of Predicting School-Age Population (Albany: The State Education Department, The University of the State of New York, 1949), pp. 1-23.

[60] State of Indiana, Department of Public Instruction, How to Study School Building Needs, Bulletin No. 216, "Section III: School Administration, Organization, and Population" (Indianapolis: The Department, 1953), pp. 29-67.

remain substantially unchanged. Except for very stable communities these would be somewhat tenuous assumptions.

Simon developed methods for projecting public school enrollments for the state of Pennsylvania, for separate counties, and for local school districts within the state. His method of projecting county enrollments was based upon what he called the "vital ratio" and the "K" ratio for the county. The vital ratio was defined as the ratio of school-age children in the county to school-age children in the state and was developed from historical census data. The K ratio was defined as the ratio of the actual county enrollment to the enrollment obtained by applying the county vital ratio to the state enrollment. Simon then projected these two ratios--vital ratio and K ratio--for the desired projection period by a linear trend projection. By then multiplying projected state enrollments by the projected vital ratio and projected K ratio he obtained projected county enrollments. Local school district enrollments were projected by studying the ratio of local district enrollment to county enrollment, projecting this ratio into the future, and applying it to the projected county enrollments.[61] Simon's method depends upon the continuation of certain trends in enrollment and provides for a single enrollment projection. His method also depends upon local population data to establish school-age population groups between census years. This appears to be a possible source of difficulty.

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[61]Kenneth Alan Simon, "Enrollment Forecasting in the Public Elementary and Secondary Schools of Pennsylvania" (unpublished Ed.D. dissertation, The Pennsylvania State University, 1959), pp. 168-171.

Individual or local projection methods

Hedlund has suggested a variation of the survival rate technique in which survival rates are determined for three-grade groupings rather than for single grades. This author believed that his procedure would be more appropriate in smaller districts because it would tend to negate the influence of a disproportionately smaller group of pupils moving through the grade years since it would always be grouped with two other grades.[62]

Throop reported a "grid" system implemented with data processing cards which could produce a type of continuous "spot map" of the locations of all school pupils. Grid lines following natural boundaries were used to divide the district into coded areas. Pupils were located according to their grid area code.[63] While such a system would have considerable utility in locating areas of facility need, it would be difficult to use as the basis for enrollment projection without the use of one of the methods described in the preceding section.

A recent study by Ellena, cited above, attempted to develop a method of predicting pupil yield by type of dwelling unit and to apply the technique to Baltimore County, Maryland. The study covered more than 100,000 dwelling units in collecting data. The study found a consistent difference in the number of children from any level of school (preschool,

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[62]Paul A. Hedlund, "How to Estimate Future Public School Enrollments," American School Board Journal, CXX (February, 1950), pp. 27-28, 94.

[63]Harold L. Throop, Jr., "Simplifying Student Population Projections," American School Board Journal, CXLV (July, 1962), pp. 11-12.

elementary, junior high, or senior high) which any given type of dwelling unit can be expected to produce, and that the location of the dwelling unit is a deciding factor in predicting pupil yield.[64] This method would be useful in a metropolitan area where large-scale housing developments are frequently built. Knowing the pupil-yield indexes for particular types of dwelling units would aid in estimating pupil yield in new housing developments. Of course, indexes would need to be developed for each area under study. Wheeler indicated the use of such a technique in determining probable pupil populations from large-scale public housing areas in Detroit.[65]

Problems in Enrollment Projections

The problems encountered in making projections of public school enrollment are chiefly centered around those involved in collecting needed data and those involved in evaluating the effects of the many variables affecting enrollment change. Stanbery, in discussing the problems of general population projection, writes:

> Population forecasting is essentially a matter of judgment. Judgment is required in selecting the kind of forecast to present, in determining the procedures for making it, and in appraising effects of the factors that induce population changes.
>
> . . . . . .
>
> The crux of the solution lies in the thoroughness with which the probable effects of the factors affecting population

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[64] Ellena, op. cit.

[65] Norman S. Wheeler, "Techniques Used for Predicting Public School Enrollments in Detroit, Michigan, Using the Elementary School Service Area as a Base for All Units" (unpublished Ed.D. dissertation, Wayne University, 1955).

> growth, or decline, in the particular area are evaluated, and the skill with which the evaluations are translated into the numerical figures.[66]

As one surveys the literature, the problems encountered in obtaining data and evaluating the effects of two particular variables become apparent. These are the variables of birth and migration as they affect public school enrollments.

Obtaining birth data for the school service area under study is generally one of the basic steps in making public school enrollment projections. The most widely used projection method, the survival rate and its variations, depends quite directly upon birth data. As a result, the availability and accuracy of birth data have a telling effect upon the utility and accuracy of enrollment projections. Morneweck advised school superintendents to become students of birth rate when planning school facilities for the future.[67] However, birth rates and birth data are often difficult for the school superintendent to obtain because they are kept for a political subdivision whose boundaries may not be the same as the school district.

Collecting data and evaluating the effects of migration appears to be a crucial problem in projecting public school enrollments. Zitter pointed up this problem in writing:

> The problems of preparing enrollment projections for states and smaller geographic areas, however, are substantially more difficult than those encountered when making projections for

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[66] Stanbery, op. cit., p. 1.

[67] Carl D. Morneweck, "Analysis of School Enrollment Trends as Influenced by Live Births," American School Board Journal, CIII (August, 1941), p. 32.

> the nation as a whole. The question of future migration into or out of a particular area is perhaps the most difficult to resolve, . . .[68]

Methods have been devised for determining migration, however. Zitter proposes that "estimates (of migration) for inter-censal periods for smaller geographic areas can be computed by a residual procedure, . . ."[69] Siegel and Hamilton have described

> two major variants of the residual method: (1) The vital statistics method, which employs birth and death statistics to allow for natural increase or decrease, and (2) the survival rate method, which, as it is generally applied, employs life table survival rates to allow for mortality and birth statistics to allow for natality.[70]

The first method consists of adding births and deaths, for a given period of time, algebraically to the beginning population. The sum is then subtracted algebraically from the population at the end of the period with the difference representing the estimated migration. In the second method, life table survival rates are applied to the beginning population to determine the expected population at the end of the time period. Subtracting the expected population algebraically from the actual population at the end of the time period produces the estimated migration. Of course, use of these methods in a school district would depend upon the availability of total population figures, vital statistics, or life

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[68] Meyer Zitter, "Forecasting School Enrollment for the United States and Local Areas," The Journal of Teacher Education, V (March, 1954), p. 60.

[69] Ibid., p. 61.

[70] Jacob S. Siegel and C. Horace Hamilton, "Some Considerations in the Use of the Residual Method of Estimating Net Migration," Journal of the American Statistical Association, XLVII (September, 1952), p. 477.

tables for the school district under study. These data are often not available.

Studies of Enrollment Projection Methods and Their Accuracy

Investigations have been made of the accuracy and utility of some of the methods of enrollment projection. Studies of the accuracy of selected enrollment projections by Chamberlain and Crawford and by Larson and Strevell have been cited in Chapter I.

Laidig studied enrollment projection techniques used in Texas. He found that the census class and survival rate techniques were mot frequently used by school districts which did make enrollment projections. Laidig also developed enrollment projections for three selected school districts in Texas using each of the two methods. He concluded that the retention ratio (survival rate) was more accurate for short projections of one or two years, but that the census class technique was more accurate for longer time periods. However, he also found that the census class method was much more difficult to apply and concluded that school districts would find it better to use the retention ratio technique.[71]

Peterson compared enrollment projections developed from the same basic data by six different methods: trend projection based upon average numerical change, survival rate based upon a five-year mean, survival rate based upon a three-year mean, last-year survival rate, curve fitting on linear graph paper, and curve fitting on semi-log graph paper. He

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[71]Eldon L. Laidig, "An Investigation of Public School Enrollment Predicting Techniques" (unpublished Master's thesis, The University of Texas, 1960), pp. 134-139.

concluded that the survival rate methods using either five-year or three-year mean survival rates were more reliable than the other methods.[72]

Strand in 1954 developed public school enrollment projections in St. Paul, Minnesota for the years 1931-32 through 1945-46 by six different methods. He used available data prior to the 1930-31 school year as the basis for the projections. Using this procedure, he was able to check the accuracy of the six different projections by comparing each with actual enrollments. Strand divided the six projection methods into two classes: those which predicted public school enrollments from projections of total population, and those which predicted enrollment directly from vital statistics and past enrollments. The three methods which predicted total population first were--

1. Linear extrapolation, which was done by plotting past populations and extending the curve of population into the future.

2. Multiple factor, which was done by developing population projections based upon different growth factors and taking the mean of the resulting eight projections.

3. Logistic curve, which was an adaptation of the formula for the logistic curve of population growth developed by Pearl and Reed.

From the population projections developed by these three methods, enrollment predictions were obtained by applying to the predicted population a ratio of enrollment to population which was developed from historical data. Then ratios of particular grade group to total

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[72]Donald Lee Peterson, "An Investigation of Techniques for Predicting School District Enrollments in Florida" (unpublished Ed.D. dissertation, University of Florida, 1959), pp. 100-158.

enrollment were applied to the predicted enrollments to obtain predictions for particular grade groups such as grades 1-6 or 7-12.

The three methods which predicted public school enrollments directly were these:

1. W. K. Wilson's method, which was done by deriving ratios of births for three-year periods to grades 1 to 3, 4 to 6, 7 to 9, and 10 to 12 the appropriate number of years later. These derived ratios were then applied to birth data by appropriate three-year groups to obtain enrollments by grade groups for future years.

2. Survival ratio method, which was the standard survival rate procedure described earlier in this chapter.

3. Survival ratio by three-year groupings, which was a variation of the standard survival ratio technique by using three-year groupings of grade groups to determine survival rates. For example, survival rates for the 1 through 3 grade groups to the 4 through 6 grade groups would be determined.

After making the six sets of projections, Strand devised two tests for comparing them with the actual enrollments for the fifteen-year projection period. The first test compared the means of the absolute difference between the projected and actual enrollments. The second test compared the weighted mean of error for the six sets of projections. Rankings of the six projection methods in order of their accuracy were the same for both tests. For grades 1 through 6 the methods ranked in order of accuracy were (1) survival rate by three-grade grouping, (2) standard survival rate, (3) Wilson's method, (4) linear extrapolation, (5) logistic curve, and (6) multiple factor. For grades 7 through 12 the methods ranked in order of accuracy were (1) standard survival rate, (2) survival rate by three-grade grouping, (3) Wilson's method, (4) curve extention (sic) (5) multiple factor, and (6) logistic curve.

Strand concluded that the method based upon survival rates by three-grade groupings was most accurate and most useful.[73]

Summary

Based upon the literature reviewed in this chapter, the following summary statements and/or generalizations appear reasonable:

1. History indicates that man has always been interested in population growth and control; this has caused a number of men to attempt development of theories of population growth.
2. Population growth theories seem to reflect the tenor of their times; no single theory has explained population growth for any extended period of time in history.
3. The most promising approach to understanding population growth seems to be that of studying population in its cultural setting of time, place, and socioeconomic conditions.
4. Growth has always characterized the population of the United States; the study of population trends, particularly age-group trends, is pertinent to public education.
5. Since public school enrollments are a segment of the general population, the study of public school enrollments must be founded on an understanding of the broader context of general population change.
6. Interest in change and projection of public school enrollments seems to be heightened during periods of rapid change in enrollments.

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[73] William H. Strand, "Forecasting Enrollment in the Public Schools" (unpublished Ph.D. dissertation, University of Minnesota, 1954), pp. 303-373.

7. The variables affecting public school enrollments may be grouped into two major classes: population variables, and educational variables.
8. Data for the variables affecting public school enrollments must be collected from several sources.
9. Eight basic methods of projecting public school enrollments were found in the literature as well as several individual state or local methods.
10. The survival rate method of projecting public school enrollments is most widely used.
11. The eight basic methods of projecting public school enrollments do not sufficiently take into account the economic variables which affect enrollment change.
12. The practice of making dual projections, one the probable high and one the probable low, seems very promising but has not been widely used.
13. Obtaining birth data and migration data are difficult problems in many enrollment projection studies.
14. Several studies have been made of the accuracy of various methods of projecting public school enrollments; the survival rate and its variations appear to provide the most accuracy, especially for short-term projections up to five or six years.

Apparently, then, it can be concluded that there is a need to improve upon the existing methods of projecting public school enrollments, to provide a more accurate method of enrollment projection, and to devise a method which will incorporate the economic variables which affect public school enrollment change.

CHAPTER III

METHODOLOGY AND DATA ANALYSIS

Preliminary Survey

As stated in the description of the study design in Chapter I, the first stage of the study was to conduct a preliminary survey in all Ohio cities having 15,000 or more total population according to the 1960 federal census. The purposes of this survey were to determine the availability of data for the variables selected for the study and to assist in selecting three cities for data collection and analysis.

Development of Questionnaires

The first task in the preliminary survey was to determine what sources to use for information concerning the variables in the study. In Chapter I a list of possible sources was presented. In order to Utilize these possible sources it was decided to survey four different agencies in each of the sixty-eight cities in the preliminary survey sample. These were the city school district, city government, local chamber of commerce, and the city health district. It was believed that these agencies would either have information about the variables or have access to it. For example, it was believed that the school district would have information about variables 8, 10, 11, 16, 17, 23, and 25. In addition, variables 19 and 22 were considered possibilities for information through the school district.

Accordingly, four different questionnaires were developed to be sent to the superintendent of schools, mayor or city manager, executive officer of the chamber of commerce, and the health commissioner. Samples of these questionnaires are included in Appendix A. Each questionnaire was designed to ascertain the availability of data directly for the variables or data which could be used to derive the variables. For example, information about the availability of nonpublic school enrollments was asked for directly on the questionnaire sent to superintendents of schools. By contrast, information about population migration was not requested directly. Rather, information concerning annual population, births, and deaths, from which migration could be derived, was requested. In addition to items pertaining to the variables included in the study, the questionnaires sent to superintendents of schools and mayors or city managers contained appropriate items to determine if the school district and city boundaries were coterminous and whether the city or school district had annexed any territory during the period from 1950 through 1960.

Questionnaire Mail-out and Response

After the questionnaires were developed they were sent to the four persons listed above in each of the sixty-eight cities in the sample. Only sixty-four questionnaires were sent to superintendents of schools since there were four instances where two of the cities in the preliminary sample were contained in one school district. This reduced the number of school districts involved to sixty-four even though the number of cities was still sixty-eight. A return envelope and appropriate

cover letter explaining the purpose of the survey were sent with each questionnaire. The first mail-out of questionnaires occurred on December 9, 1963.

After one month had elapsed, a check was made of questionnaire returns. Nearly 58 percent of the 268 questionnaires mailed had been returned. Returns from each of the four types of persons surveyed varied from 42.6 percent to 75.0 percent. A summary of returns from the first mail-out is presented in Table 2.

TABLE 2

PERCENT RETURN FROM FIRST MAIL-OUT OF PRELIMINARY QUESTIONNAIRE

Questionnaire Sendee	Number Sent	Number Returned	Percent Returned
Superintendent of schools	64	48	75.0
Mayor or City Manager	68	29	42.6
Executive officer, local chamber of commerce	68	31	45.6
Health commissioner	68	46	67.6
Totals	268	154	57.5

Even more significant than the percent returns, however, a complete return of four questionnaires was obtained from only twenty-three of the sixty-eight cities in the preliminary survey sample. As a result it was decided to send a second mail-out of the questionnaire to persons who had not responded to the first mail-out.

The second mail-out was made on January 9, 1964 and included the appropriate questionnaire, cover letter, and return envelope. A slightly different wording of the cover letter was used for the mayor or city manager since some changes in personnel had occurred at the end of the year. Samples of the cover letters are included in Appendix A. Table 3 shows the percent return from the second mail-out and Table 4, the complete return from both mail-outs of the preliminary survey questionnaire. Returns were received from 84.7 percent after two mail-outs. More importantly, however, complete returns of four questionnaires were received from thirty-five of the sixty-eight cities in the sample. This was believed to be a complete enough return to proceed with selection of the three cities to be used for actual data collection.

TABLE 3

PERCENT RETURN FROM SECOND MAIL-OUT OF PRELIMINARY QUESTIONNAIRE

Questionnaire Sendee	Number Sent	Number Returned	Percent Returned
Superintendent of schools	16	11	68.8
Mayor or City Manager	39	22	56.4
Executive officer, local chamber of commerce	37	22	59.5
Health commissioner	22	18	81.8
Totals	114	73	64.0

TABLE 4

PERCENT RETURN FROM BOTH MAIL-OUTS OF PRELIMINARY QUESTIONNAIRE

Questionnaire Sendee	Number of Sendees	Number Returned	Percent Returned
Superintendent of schools	64	59	92.2
Mayor or City Manager	68	51	75.5
Executive officer, local chamber of commerce	68	53	77.9
Health commissioner	68	64	94.1
Totals	268	227	84.7

Analysis of Questionnaire Results

The responses to the items on the preliminary survey questionnaire were analyzed in three different ways. The first analysis examined the availability of data for the twenty-five variables selected for the study in each of the cities in the preliminary sample. The number of cities indicating that data for a particular variable were available varied from a high of sixty-three for variables 10, 16, 17, and 25 to a low of two for variable 21. The results of this first analysis are shown in Table 5 which indicates for each of the twenty-five variables the number and percent of cities indicating that data were available, not available, or partially available, and the number and percent not responding. The variables for which data availability was most often indicated were public school financial data and enrollment data by grade, and variables derived from vital statistics kept by city health

departments. Data for three very important variables, which should be kept by all school districts in the writer's opinion, were available in less than half of the school districts in the preliminary sample. These were variables 8, nonpublic school enrollment, 11, retention rate, and 23, dropout rate. Data for these variables should be part of the school records and be revised annually.

The second analysis of the preliminary survey questionnaires was carried out to assist in measuring each city in the preliminary sample against the criteria established to select the three cities from which actual data were collected. Each city in the preliminary sample was listed along with seven pertinent items: (1) 1960 city population, (2) 1960 population rank, (3) percent growth in population between 1950 and 1960, (4) growth percent rank, (5) an indication of whether the school district and the city boundaries were coterminous, (6) an indication of whether territory had been annexed to the city or school district between 1950 and 1960, and (7) the number of variables for which data were indicated as available, not available, partially available, or for which there was no response. This analysis is depicted in Table 6. The information shown in Table 6 was used to help select the three cities which best met the criteria as well as one other usable combination of cities to be utilized if one or more of the selected cities were not possible to use.

The third analysis of the responses to the preliminary survey questionnaires was to determine whether any correlation existed between the number of variables for which data were available in each city and the size and growth rate of each city. The Pearson product-moment

TABLE 5

AVAILABILITY OF DATA FOR THE VARIABLES AS INDICATED BY RESPONSE TO PRELIMINARY QUESTIONNAIRES

Variable	Number and Percent of Cities Indicating Data for Each Variable as:							
	Available	Percent	Not Available	Percent	Partially Available	Percent	No Response	Percent
1. Infant deaths	54	79.4	5	7.3	6	8.8	3	4.4
2. Child neglect	18	26.5	29	42.6	1	1.5	20	29.4
3. Net population migration change	42	61.8	16	23.5	5	7.3	5	7.3
4. Total population change	54	79.4	9	13.2	2	2.9	3	4.4
5. Retail sales gain	28	41.2	24	35.3	1	1.5	15	23.1
6. Unemployment index	27	39.7	32	47.0	1	1.5	8	11.8
7. Birth rate	54	79.4	4	5.9	7	10.3	3	4.4
8. Nonpublic school enrollment	32	47.0	24	35.3	5	7.3	7	10.3
9. Net dwelling unit change	35	51.5	9	13.2	4	5.9	20	29.4
10. Tax duplicate change	63	92.6	0	0.0	0	0.0	5	7.3

TABLE 5 (contd.)

Variable	Number and Percent of Cities Indicating Data for Each Variable as:							
	Available	Percent	Not Available	Percent	Partially Available	Percent	No Response	Percent
11. Retention rate	17	25.0	35	51.5	7	10.3	9	13.2
12. Female population ages 15 to 29	11	16.2	50	73.5	1	1.5	6	8.8
13. Female population ages 30 to 44	11	16.2	51	75.0	0	0.0	6	8.8
14. Occupational classifications	8	11.8	42	61.8	0	0.0	18	26.5
15. Retailing	25	36.8	24	35.3	3	4.4	16	23.5
16. Total educational expenditure	63	92.6	0	0.0	0	0.0	5	7.4
17. Elementary school enrollment	63	92.6	0	0.0	0	0.0	5	7.4
18. Family income	34	50.0	22	32.4	2	2.9	10	14.7
19. High school education	11	16.2	49	72.1	2	2.9	6	8.8

TABLE 5 (contd.)

Variable	Number and Percent of Cities Indicating Data for Each Variable as:							
	Available	Percent	Not Available	Percent	Partially Available	Percent	No Response	Percent
20. Poverty	27	39.7	29	42.6	1	1.5	11	16.2
21. Dwelling modernity	2	2.9	49	72.1	0	0.0	17	25.0
22. Per capita local education expenditure	52	76.5	9	13.2	2	2.9	5	7.4
23. Drop-out rate	17	25.0	34	50.0	10	14.7	7	10.3
24. Ethnic character	29	42.6	28	41.2	1	1.5	10	14.7
25. Secondary school enrollment	63	92.6	0	0.0	0	0.0	5	7.4

TABLE 6

PRELIMINARY QUESTIONNAIRE RESPONSE SUMMARY BY CITY

City Number	1960 Population	Rank	Percent Population Growth, 1950 to 1960	Rank	City and School District Coterminous	Territory Annexed	Number of Variables for Which Data Are: Available	Not Available	Partially Available	No Response
1.	290,351	5	7.7	49	yes	no	19	6	0	0
2.	28,362	38	8.4	46	yes	yes	6	14	1	4
3.	17,419	54	21.9	33	no	yes	14	10	1	0
4.	24,559	41	3.6	55	no	yes	9	12	0	4
5.	16,470	60	41.3	22	no	yes	15	7	3	0
6.	33,805	29	21.5	36	yes	no	14	11	0	0
7.	15,223	67	67.2	14	no	no	12	11	2	0
8.	16,592	59	37.7	23	yes	no	9	14	2	0
9.	113,631	8	-2.8	60.5	yes	no	7	8	0	10

TABLE 6 (contd.)

City Number	1960 Population	Rank	Percent Population Growth, 1950 to 1960	Rank	City and School District Coterminous	Territory Annexed	Number of Variables for Which Data Are: Available	Not Available	Partially Available	No Response
10.	24,957	40	24.0	31	no	yes	14	9	0	2
11.	502,550	2	-0.3	57	yes	no	18	7	0	0
12.	876,050	1	-4.2	64	yes	no	11	12	0	2
13.	61,813	15	4.5	54	yes	no	11	12	0	2
14.	471,316	3	25.4	28	yes	yes	22	3	0	0
15.	47,922	18	64.1	15	yes	no	21	3	1	0
16.	262,332	6	7.6	47	yes	yes	18	7	0	0
17.	37,991	25	-5.1	65	yes	no	7	18	0	0
18.	22,306	42	-7.9	66	NR[a]	NR	3	4	1	17
19.	43,782	20	44.5	19	yes	yes	15	6	2	2

TABLE 6 (contd.)

City Number	1960 Population	Rank	Percent Population Growth, 1950 to 1960	Rank	City and School District Coterminous	Territory Annexed	Number of Variables for Which Data Are: Available	Not Available	Partially Available	No Response
20.	62,998	14	52.2	18	yes	no	10	2	0	13
21.	19,453	47	147.9	8	no	no	13	12	0	0
22.	30,344	35	27.3	27	yes	no	19	6	0	0
23.	15,732	65	9.6	42.5	yes	no	17	0	0	8
24.	17,573	53	6.3	48	no	no	16	8	1	0
25.	38,455	24	77.5	13	yes	no	5	7	7	6
26.	72,354	11	24.9	30	yes	yes	13	12	0	0
27.	15,745	64	-3.6	62.5	yes	no	13	6	0	6
28.	17,836	52	43.6	21	no	yes	15	8	0	2
29.	66,154	13	-2.8	60.5	yes	no	8	3	3	11

TABLE 6 (contd.)

City Number	1960 Population	Rank	Percent Population Growth, 1950 to 1960	Rank	City and School District Coterminous	Territory Annexed	Number of Variables for Which Data Are: Available	Not Available	Partially Available	No Response
30.	29,916	36	23.7	32	no	no	15	10	0	0
31.	51,037	17	1.6	56	yes	no	20	1	2	2
32.	68,932	12	34.6	24	yes	yes	16	9	0	0
33.	16,805	57	128.4	10	yes	no	6	19	0	0
34.	47,325	19	8.6	45	no	no	17	8	0	0
35	31,667	33	103.2	11	NR	NR	2	0	0	23
36.	16,847	56	5.3	52	no	yes	14	3	6	2
37.	37,079	26	9.6	42.5	yes	yes	15	3	1	6
38.	31,236	34	5.5	50	yes	yes	13	12	0	0
39.	42,115	21	25.0	29	no	yes	14	7	0	4
40.	41,790	22	21.9	33.5	yes	no	8	5	2	10

TABLE 6 (contd.)

City Number	1960 Population	Rank	Percent Population Growth, 1950 to 1960	Rank	City and School District Coterminous	Territory Annexed	Number of Variables for Which Data Are: Available	Not Available	Partially Available	No Response
41.	19,545	46	16.5	38	yes	no	18	7	0	0
42.	16,290	61	146.7	9	yes	no	11	14	0	0
43.	34,580	28	-1.2	59	yes	no	14	11	0	0
44.	16,116	62	11.7	40	yes	no	10	5	0	10
45.	82,845	9	186.7	6	yes	no	18	3	0	4
46.	18,100	50	364.0	2	yes	no	8	12	0	5
47.	19,219	48	10.2	41	yes	no	19	4	0	0
48.	33,637	30	-8.6	67	NR	NR	5	7	5	8
49.	18,097	51	61.0	16	yes	no	14	7	0	4
50.	31,989	32	8.9	44	yes	no	12	8	5	0
51.	36,460	27	29.2	26	yes	no	11	13	1	0

TABLE 6 (contd.)

City Number	1960 Population	Rank	Percent Population Growth, 1950 to 1960	Rank	City and School District Coterminous	Territory Annexed	Number of Variables for Which Data Are: Available	Not Available	Partially Available	No Response
52.	27,569	39	78.6	12	yes	no	13	12	0	0
53.	82,723	10	5.4	51	NR	NR	10	2	0	13
54.	32,495	31	-9.4	68	yes	no	11	14	0	0
55.	15,631	66	30.9	25	yes	NR	10	12	1	2
56.	21,478	43	13.3	39	yes	yes	13	12	0	0
57.	318,003	4	4.7	53	yes	no	20	5	0	0
58.	16,641	58	43.9	20	yes	no	9	11	0	5
59.	28,486	37	215.7	4	yes	yes	15	7	3	0
60.	59,648	16	19.6	37	yes	yes	9	12	2	2
61.	20,818	44	326.9	3	yes	no	7	15	1	2
62.	15,760	63	215.1	5	yes	yes	8	10	2	5

TABLE 6 (contd.)

City Number	1960 Population	Rank	Percent Population Growth, 1950 to 1960	Rank	City and School District Coterminous	Territory Annexed	Number of Variables for Which Data Are: Available	Not Available	Partially Available	No Response
63.	15,058	68	168.8	7	no	no	12	11	0	2
64.	18,749	49	409.9	1	NR	NR	0	7	0	18
65.	17,046	55	21.7	35	yes	no	17	7	1	0
66.	20,445	45	58.8	17	no	yes	12	13	0	0
67.	166,689	7	-1.0	58	yes	no	17	7	1	0
68.	39,077	23	-3.6	62.5	NR	NR	2	12	4	7

[a]No response.

correlation coefficient between the size of each city and the number of variables for which data were indicated as available was 0.228. The correlation coefficient between the growth rate of each city and the number of variables for which data were indicated as available was -0.297. The coefficient of correlation between size and growth rate for each city was -0.166. A multiple correlation was calculated between the number of variables for which data were indicated as available in each city and the combined effects of city size and growth rate. This correlation was 0.348 and is significant at the .05 level of confidence. This suggests that data for the variables in this study would more likely be obtainable in large, less rapidly growing cities. However, this is a tentative conclusion because a complete response was not received on all items in the preliminary questionnaires. Additional responses could well cause a change in the correlation.

Sample Selection

Although the findings cited above are interesting and pertinent to future investigations, the primary purpose of the preliminary survey was to provide information needed to select the three cities from which actual data for the variables in the study were to be collected. The data amassed in the preliminary survey were placed in a suitable form (Table 6) to be tested against the previously established criteria for selecting the cities for the final data collection.

Criteria for Selection

Four different criteria were established for selecting the three cities in the final sample:

1. The boundaries of the city and the school district must be nearly coterminous. An arbitrary standard was established that at least 90 percent of the pupils enrolled in the public schools of the school district must reside within the city limits. It was believed that this percentage would be high enough for the data collected for the city and school district to be comparable.
2. United States Census data must be available for each selected city. Since the Bureau of the Census publishes data for cities above 2,500 population, this criterion was met by all cities in the preliminary sample.
3. No significant changes in either the city or school district boundaries may have occurred between the years 1950 through 1960 inclusive. In this instance, significant was defined as a change of not more than five percent in total territory.
4. The three cities selected for data collection for the twenty-five variables in the study must provide a range of both size (population) and growth rate.

Selection Process

Each city in the preliminary sample was first checked against criteria one and three. In order for a city to meet these criteria, the entries under columns six and seven in Table 6 must be yes and no

respectively. Inspection of the table indicated that thirty-three of the sixty-eight cities should be rejected due to failure to meet criteria one and three or because there was no response for these items. It was also decided to reject any city for which the returns on the preliminary questionnaire indicated that data for less than fourteen of the variables were available. This eliminated an additional twenty of the cities. The remaining fifteen cities were grouped according to size in groups of five. Cities numbered fifteen and fifty-seven were selected respectively from the middle and highest groups according to size because they had data available for the greatest number of variables in their respective groups. Cities fifteen and fifty-seven also were in the highest and lowest groups according to growth rate. As a result, the third city to be selected had to come from the lowest group according to size and the middle group according to growth rate. Among those cities meeting this classification, city forty-one was high in number of variables for which data were available. Thus, cities fifteen, forty-one, and fifty-seven, as listed in Table 6, were chosen for collection of data for the variables indicated as available in each. These cities will be referred to hereafter as cities A, B, and C respectively. Cities thirty-one, forty-five, and forty-seven were selected as an alternate group in the event that the preferred group could not be used.

Data Collection

In each of the three selected cities the persons who had responded to the preliminary questionnaire were sent letters explaining that their city had been selected for data collection and asking their cooperation

and assistance. Samples of this letter are included in Appendix B. All persons contacted indicated a willingness to provide data on appropriate forms supplied by the writer.

The writer then developed a number of data collection forms to be sent to the twelve persons who were to assist with the data collection. Samples of these data collection forms and the letter of transmittal which accompanied them are included in Appendix B. The data collection forms were mailed to the twelve persons (four in each city) who had agreed to provide data on March 16, 1964. Completion and return of the forms was requested by March 31, 1964. Several follow-up contacts were needed to secure return of all forms.

Treatment of Data

According to the results of the preliminary survey as summarized in Table 6, data for twenty-one variables were available in City A, eighteen in City B, and twenty in City C. However, some data were not obtained, the forms being returned with an indication that the data were not really available. Data were obtained for sixteen of the variables in the study in City A, seventeen in City B, and twenty in City C. The first step in data processing was to convert the raw data into some type of meaningful standard score or index.

Conversion of Raw Data to Percent Indexes

Some of the data collected for the study were simple numbers, others were dollar amounts, and still others were percent figures. Since the collected data were to be compared over a ten-year period and since a common basis for comparison was desired, it was decided to convert the

raw data into percent index scores by dividing the data for each variable by the base data for the year 1950 and multiplying the quotient by one hundred. For example, in variable four, total population change, the population for each year from 1951 through 1960 was divided by the population in 1950 to obtain annual indexes of population change. These indexes were rounded to the nearest hundredth and multiplied by one hundred to obtain percent index scores. Data for each variable in each city in the data collection sample were treated in a similar fashion. An example of the conversion method is provided in Appendix B.

Conversion of the raw data into percent index scores had no effect upon the coefficients of correlation which were developed among the variables in the study. It can be proved that the correlation between two variables X and Y is the same as that between these same two variables divided by the constants k and l respectively. This proof is given in Appendix B.

It was believed necessary to negate the influence of inflation which occurred between 1950 and 1960 upon those variables for which the raw data were expressed in dollars. To accomplish this the percent index scores for these variables were divided by the annual average consumer price index for United States cities.[1] The average annual consumer price indexes for the years 1951 through 1960 were divided by the index

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[1] U. S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index: Price Indexes for Selected Items and Groups, Washington: U. S. Government Printing Office, September, 1962.

for 1950 to obtain indexes based upon 1950. The percent index scores derived from the above described calculations are shown in Tables 7, 8, and 9 for cities A, B, and C respectively.

Development of Correlation Matrixes and Factor Analysis of the Matrixes

Means and standard deviations were calculated for the percent index scores of each variable in Tables 7, 8, and 9. It was assumed that the relationships were rectilinear between all possible combinations of variables. Accordingly, correlations were developed by the Pearson product-moment method and the resulting correlation coefficients placed in symmetric matrixes with unity in the principal diagonal.

The three matrixes were each subjected to factor analysis by the principal factor method as described by Harman.[2] The principal factor solution was chosen in preference to other factor solutions for two important reasons. First, and foremost, the principal factor solution yields bi-polar factors. It was believed that bi-polar factors would be helpful in interpreting and naming the factors. Since there have not been any previous efforts to use factor analysis in studying public school enrollment change, no precedents existed to assist with this important phase of the factor analysis process. The second reason for choosing the principal factor solution was that a program existed for this solution on the IBM 7094 computer and was available to the writer.

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[2]Harry H. Harman, Modern Factor Analysis (Chicago: The University of Chicago Press, 1960), pp. 154-191.

TABLE 7

CITY A--PERCENT INDEX SCORES FOR AVAILABLE VARIABLES

Year	Variables															
	1	3	4	5	7	9	10	11	15	16	17	18	20	22	23	25
1951	096	084	102	099	122	105	114	096	097	098	109	097	099	113	102	104
1952	097	229	109	101	131	110	120	091	093	095	122	102	093	104	100	113
1953	097	116	113	111	138	115	164	090	098	097	140	095	085	133	087	127
1954	098	146	118	162	142	120	190	099	137	108	154	094	077	160	095	134
1955	095	361	130	184	127	126	204	090	142	116	170	094	068	169	090	145
1956	073	299	139	217	105	129	216	085	156	117	180	096	061	163	114	160
1957	100	235	147	220	115	132	223	102	149	117	191	092	053	157	162	173
1958	073	000	147	207	117	135	223	116	140	113	203	087	046	158	142	188
1959	090	675	169	235	098	137	249	119	139	119	214	090	037	167	141	205
1960	137	017	170	240	092	139	257	125	141	135	220	090	029	196	145	218

TABLE 8

CITY B--PERCENT INDEX SCORES FOR AVAILABLE VARIABLES

Year	Variables																
	1	3	4	5	6	7	8	9	10	14	15	16	17	18	22	24	25
1951	062	068	100	093	100	099	109	101	100	104	092	117	097	115	125	100	103
1952	061	104	101	093	100	112	111	102	109	104	091	112	102	135	138	100	105
1953	098	065	102	087	100	115	113	104	119	104	085	111	110	130	149	107	105
1954	072	007	103	083	140	114	115	105	136	104	081	124	116	119	171	107	110
1955	120	114	104	094	120	111	109	108	168	104	091	140	124	127	207	107	116
1956	055	063	105	100	092	121	107	109	174	106	095	161	124	133	213	107	122
1957	057	060	105	109	100	115	110	110	173	107	103	165	123	134	208	114	133
1958	056	395	108	098	130	114	115	112	178	109	091	167	127	133	240	114	136
1959	049	972	115	081	228	097	117	115	187	111	070	171	128	112	237	100	139
1960	049	171	116	104	192	107	116	118	185	115	089	179	139	124	232	107	130

TABLE 9

CITY C--INDEX SCORES FOR AVAILABLE VARIABLES

Year	Variables																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	22	23	25
1951	093	112	099	101	102	100	104	102	101	095	093	098	099	101	091	103	108	091	096	103
1952	102	128	187	104	103	100	104	102	103	101	091	094	096	099	098	108	110	111	108	106
1953	104	144	079	104	114	095	103	101	104	109	091	092	096	109	100	115	110	113	081	110
1954	093	162	140	106	110	089	103	103	105	111	073	089	095	103	101	119	116	123	091	114
1955	086	173	119	107	111	229	101	102	105	112	079	087	094	104	108	123	122	121	088	116
1956	101	185	111	108	118	084	105	105	106	118	083	085	093	108	106	124	125	122	085	118
1957	103	209	066	108	111	125	106	105	107	119	082	084	093	102	099	128	120	107	058	125
1958	086	226	000	106	099	102	104	104	108	117	094	084	095	094	119	131	112	151	068	128
1959	088	230	086	106	101	189	104	104	108	117	096	083	096	095	117	135	118	151	070	127
1960	087	238	047	105	104	100	103	104	109	115	099	083	097	100	121	138	118	150	065	130

Six factors were extracted from each of the three matrixes of correlations. Some statistical methods do exist for determining the number of significant factors which should be extracted from a matrix, but they are rather involved mathematical procedures. The writer was guided by Harman, who quoted Kaiser that the number of factors necessary for explaining the correlations among a set of variables is from one-sixth to about one-third of the number of variables.[3] Thus, for matrixes of order 16, 17, and 20, six would appear to be adequate. Moreover, the results of the factor analysis showed that six factors accounted for at least 97 percent of the total variance of the variables in each matrix.

After the factor extraction was stopped at six factors, the residual matrixes were calculated. Ideally, of course, a residual matrix should appear with zeros in all its elements since the factors should theoretically account for all the variance of the original matrix. In practice, however, this rarely happens because the number of factors is usually less than the order of the matrix. This was true in the present study. However, the elements of all three residual matrixes are zero in the first decimal place except for two elements in the residual matrix for City C.

The sets of factors produced from the three correlation matrixes were rotated in an effort to achieve simple structure according to Kaiser's varimax method as described by Harman.[4] The rotated factor coefficients, or loadings, were used to identify and interpret the factors.

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[3] Ibid., p. 363.

[4] Ibid., pp. 301-308.

The complete statistical results of the calculations of correlation coefficients and the factor analysis are presented in Tables 10 through 27 which follow. For each set of percent index scores the following are presented: means and standard deviations for each variable (Tables 10, 16, and 22), symmetric correlation matrix (Tables 11, 17, and 23), coefficients of unrotated factors (Tables 12, 18, and 24), residual matrix (Tables 13, 19, and 25), coefficients of rotated factors (Tables 14, 20, and 26), and fractional contributions of original and rotated factors (Tables 15, 21, and 27).

The writer's interpretation and names applied to the factors is presented in Chapter IV.

TABLE 10

MEANS AND STANDARD DEVIATIONS OF THE PERCENT INDEX SCORES FOR SIXTEEN VARIABLES, CITY A

Variable	Mean	Sigma
1	95.6	16.72
3	216.2	189.13
4	134.4	22.90
5	177.6	53.07
7	118.7	15.79
9	124.8	11.21
10	196.0	46.92
11	101.3	13.24
15	129.2	22.38
16	111.5	11.70
17	170.3	36.40
18	93.7	4.03
20	64.8	22.57
22	152.0	26.23
23	117.8	25.77
25	156.7	36.83

TABLE 11
SYMMETRIC CORRELATION MATRIX FOR SIXTEEN VARIABLES
WITH UNITY IN THE PRINCIPAL DIAGONAL, CITY A

Variable	1	3	4	5	7	9	10	11	15	16	17	18	20	22	23	25
1. Infant deaths	1.00	-.26	.22	.07	-.21	.09	.14	.40	-.11	.38	.13	-.04	-.20	.29	.14	.22
3. Net population migration change	-.26	1.00	.31	.30	-.26	.23	.26	-.04	.25	.13	.23	.03	-.20	.12	.06	.19
4. Total population change	.22	.31	1.00	.94	-.84	.96	.94	.77	.72	.90	.98	-.77	-.99	.83	.80	.99
5. Retail sales gain	.07	.30	.94	1.00	-.76	.97	.97	.60	.91	.93	.96	-.75	-.95	.89	.75	.93
7. Birth rate	-.21	-.26	-.84	-.76	1.00	-.72	-.68	-.63	-.52	-.79	-.74	.49	.79	-.59	-.73	-.81
9. Net dwelling unit change	.09	.23	.96	.97	-.72	1.00	.98	.68	.84	.90	.99	-.82	-.98	.89	.75	.97
10. Tax duplicate change	.14	.26	.94	.97	-.68	.98	1.00	.64	.86	.91	.98	-.82	-.96	.94	.68	.94
11. Retention rate	.40	-.04	.77	.60	-.63	.68	.64	1.00	.31	.64	.73	-.77	-.78	.55	.73	.82
15. Retailing	-.11	.25	.72	.91	-.52	.84	.86	.31	1.00	.82	.81	-.63	-.76	.85	.55	.71
16. Total educational expenditure	.38	.13	.90	.93	-.79	.90	.91	.64	.82	1.00	.90	-.68	-.91	.94	.66	.89
17. Elementary school enrollment	.13	.23	.98	.96	-.74	.99	.98	.73	.81	.90	1.00	-.84	-.99	.88	.77	.98
18. Family income	-.04	.03	-.77	-.75	.49	-.82	-.82	-.77	-.63	-.68	-.84	1.00	.83	-.74	-.66	-.82
20. Poverty	-.20	-.20	-.99	-.95	.79	-.98	-.96	-.78	-.76	-.91	-.99	.83	1.00	-.87	-.79	-.99
22. Per capita local educational expenditure	.29	.12	.83	.89	-.59	.89	.94	.55	.85	.94	.88	-.74	-.87	1.00	.48	.83
23. Drop-out rate	.14	.06	.80	.75	-.73	.75	.68	.73	.55	.66	.77	-.66	-.79	.48	1.000	.80
25. Secondary school enrollment	.22	.19	.99	.93	-.81	.97	.94	.82	.71	.89	.98	-.82	-.99	.83	.80	1.00

TABLE 12

COEFFICIENTS OF UNROTATED FACTORS
FOR SIXTEEN VARIABLES, CITY A

	Variables	Factor Coefficients					
		1	2	3	4	5	6
1.	Infant deaths	-.20	.79	.14	.54	.08	.15
3.	Net population migration change	-.21	-.68	.58	.22	.30	.09
4.	Total population change	-.98	.00	.17	-.00	.02	-.02
5.	Retail sales gain	-.97	-.19	-.05	.06	-.10	.05
7.	Birth rate	.79	-.06	-.42	-.02	.33	.27
9.	Net dwelling unit change	-.98	-.11	-.07	-.03	.02	.02
10.	Tax duplicate change	-.97	-.12	-.12	.08	.09	.02
11.	Retention rate	-.75	.47	.18	-.28	.25	-.03
15.	Retailing	-.81	-.39	-.32	.14	-.18	.12
16.	Total educational expenditure	-.94	.08	-.07	.28	-.12	-.05
17.	Elementary school enrollment	-.99	-.06	-.03	-.04	.05	-.00
18.	Family income	-.83	-.09	.27	.34	-.27	.04
20.	Poverty	.99	-.03	-.03	.04	-.03	.02
22.	Per capita local educational expenditure	-.89	-.02	-.29	.32	.09	-.07
23.	Drop-out rate	-.79	.15	.22	-.36	-.27	.30
25.	Secondary school enrollment	-.98	.08	.08	-.07	.04	-.05

TABLE 13
RESIDUAL MATRIX FOR SIXTEEN VARIABLES, CITY A

Variable	1	3	4	5	7	9	10	11	15	16	17	18	20	22	23	25
1.	.002	.001	-.000	-.001	-.003	-.001	.002	-.007	-.003	-.001	-.001	-.008	.001	.001	.002	-.001
3.		.005	-.005	.001	-.006	-.008	-.004	.005	.007	.005	-.008	-.013	.006	.004	.003	-.007
4.			.006	-.002	.006	.009	.005	-.009	-.010	-.006	.008	.010	-.006	-.004	-.002	.008
5.				.001	-.001	-.003	-.002	.007	.005	.002	-.003	.000	.002	.001	-.000	-.002
7.					.009	.011	.002	-.000	-.006	-.004	.009	.019	-.008	-.005	-.005	.008
9.						.016	.005	-.013	-.015	-.007	.014	.017	-.011	-.007	-.004	.011
10.							.010	-.014	-.011	-.010	.006	.004	-.004	-.001	.000	.007
11.								.040	.027	.012	-.012	.008	.008	.005	-.004	-.010
15.									.022	.011	-.014	-.007	.010	.006	.000	-.012
16.										.010	-.007	-.009	.006	.002	.001	-.009
17.											.012	.016	-.010	-.006	-.004	.011
18.												.041	-.014	-.008	-.011	.016
20.													.008	.005	.003	-.009
22.														.003	.002	-.005
23.															.003	-.003
25.																.011

TABLE 14

COEFFICIENTS OF FACTORS ROTATED ACCORDING TO KAISER'S VARIMAX METHOD, CITY A

	Variable	Coefficients of Rotated Factors					
		1	2	3	4	5	6
1.	Infant deaths	-.05	.98	-.14	-.10	-.06	.01
3.	Net population migration change	-.15	-.14	.97	.02	-.09	-.01
4.	Total population change	-.67	.14	.21	-.51	-.40	.24
5.	Retail sales gain	-.85	-.00	.15	-.31	-.30	.26
7.	Birth rate	.42	-.13	-.14	.28	.81	-.23
9.	Net dwelling unit change	-.81	.00	.11	-.46	-.24	.22
10.	Tax duplicate change	-.86	.06	.14	-.43	-.18	.13
11.	Retention rate	-.24	.29	-.05	-.84	-.27	.21
15.	Retailing	-.95	-.16	.08	-.04	-.09	.21
16.	Total educational expenditure	-.83	.30	.02	-.26	-.37	.12
17.	Elementary school enrollment	-.77	.04	.12	-.51	-.27	.21
18.	Family income	.59	.10	.13	.77	.02	-.11
20.	Poverty	.72	-.10	-.10	.54	.33	-.22
22.	Per capita local educational expenditure	-.92	.21	.01	-.29	-.12	-.07
23.	Drop-out rate	-.38	.04	-.01	-.46	-.34	.72
25.	Secondary school enrollment	-.66	.12	.09	-.58	-.37	.22

TABLE 15

FRACTIONAL CONTRIBUTIONS OF ORIGINAL AND ROTATED FACTORS, CITY A

Factor	Original Contribution	Rotated Contribution
1.	0.73	0.46
2.	0.10	0.08
3.	0.06	0.07
4.	0.06	0.21
5.	0.03	0.11
6.	0.01	0.06
Total	0.99	0.99

TABLE 16

MEANS AND STANDARD DEVIATIONS OF THE PERCENT INDEX SCORES FOR SEVENTEEN VARIABLES, CITY B

Variable	Mean	Sigma
1	67.9	22.05
3	201.9	276.17
4	105.9	5.26
5	94.2	8.47
6	130.2	43.23
7	110.5	7.10
8	112.2	3.28
9	108.4	5.28
10	152.9	31.72
14	106.8	3.60
15	88.8	8.33
16	144.7	25.43
17	119.0	12.14
18	126.2	7.93
22	192.0	40.68
24	106.3	4.90
25	119.9	13.21

TABLE 17
SYMMETRIC CORRELATION MATRIX FOR SEVENTEEN VARIABLES
WITH UNITY IN THE PRINCIPAL DIAGONAL, CITY B

Variable	1	3	4	5	6	7	8	9	10	14	15	16	17	18	22	24	25
1. Infant deaths	1.00	-.34	-.45	-.25	-.34	.21	-.29	-.39	-.25	-.58	.01	-.50	-.20	.11	-.27	.06	-.48
3. Net population migration change	-.34	1.00	.68	-.39	.78	-.59	.59	.56	.48	.53	-.68	.49	.38	-.46	.54	-.25	.64
4. Total population migration change	-.45	.68	1.00	.09	.88	-.35	.66	.96	.80	.95	-.41	.84	.85	-.29	.81	.08	.81
5. Retail sales gain	-.25	-.39	.09	1.00	-.32	.37	-.39	.30	.34	.30	.87	.47	.33	.60	.30	.58	.33
6. Unemployment index	-.34	.78	.88	-.32	1.00	-.61	.80	.74	.55	.77	-.73	.56	.60	-.62	.58	-.22	.59
7. Birth rate	.21	-.59	-.35	.37	-.61	1.00	-.37	-.14	.07	-.32	.53	-.05	.10	.82	.05	.63	-.09
8. Nonpublic school enrollment	-.29	.59	.66	-.39	.80	-.37	1.00	.53	.29	.61	-.70	.30	.42	-.40	.37	.01	.42
9. Net dwelling unit change	-.39	.56	.96	.30	.74	-.14	.53	1.00	.92	.93	-.19	.94	.95	-.10	.93	.34	.90
10. Tax duplicate change	-.25	.48	.80	.34	.55	.07	.29	.92	1.00	.72	-.05	.95	.95	.05	.99	.49	.92
14. Occupational classifications	-.58	.53	.95	.30	.77	-.32	.61	.93	.72	1.00	-.21	.84	.79	-.18	.74	.15	.78
15. Retailing	.01	-.68	-.41	.87	-.73	.53	-.70	-.19	-.05	-.21	1.00	.03	-.10	.70	-.10	.51	-.08
16. Total educational expenditure	-.50	.49	.84	.47	.56	-.05	.30	.94	.95	.84	.03	1.00	.90	.01	.94	.43	.95
17. Elementary school enrollment	-.20	.38	.85	.33	.60	.10	.42	.95	.95	.79	-.10	.90	1.00	.04	.95	.49	.83
18. Family income	.11	-.46	-.29	.60	-.62	.82	-.40	-.10	.05	-.18	.70	.01	.04	1.00	.04	.56	.00
22. Per capita local edu. expenditure	-.27	.54	.81	.30	.58	.05	.37	.93	.99	.74	-.10	.94	.95	.04	1.00	.49	.93
24. Ethnic character	.06	-.25	.08	.58	-.22	.63	.01	.34	.49	.15	.51	.43	.49	.56	.49	1.00	.45
25. Secondary school enrollment	-.48	.64	.81	.33	.59	-.09	.42	.90	.92	.78	-.08	.95	.83	.00	.93	.45	1.00

TABLE 18

COEFFICIENTS OF UNROTATED FACTORS
FOR SEVENTEEN VARIABLES, CITY B

	Variable	Factor Coefficients					
		1	2	3	4	5	6
1.	Infant deaths	-.47	.01	.70	-.42	-.25	.01
3.	Net population migration change	.70	-.51	.02	-.08	.44	.05
4.	Total population change	.97	-.12	-.05	.02	-.13	-.14
5.	Retail sales gain	.15	.86	-.43	-.08	-.19	.02
6.	Unemployment index	.82	-.53	.04	.02	-.14	-.05
7.	Birth rate	-.27	.77	.39	.29	.12	-.22
8.	Nonpublic school enrollment	.62	-.47	.22	.52	-.18	.15
9.	Net dwelling unit change	.98	.16	.02	-.04	-.12	-.08
10.	Tax duplicate change	.89	.34	.17	-.20	.10	-.04
14.	Occupational classifications	.92	.01	-.25	.13	-.23	-.10
15.	Retailing	-.33	.86	-.34	-.12	-.08	.11
16.	Total educational expenditure	.92	.34	-.13	-.12	.07	.02
17.	Elementary school enrollment	.89	.32	.24	-.08	-.15	-.11
18.	Family income	-.22	.82	.11	.26	.18	-.24
22.	Per capita local educational expenditure	.91	.30	.19	-.13	.13	.00
24.	Ethnic character	.24	.79	.32	.18	-.05	.41
25.	Secondary school enrollment	.92	.24	-.03	-.03	.24	.17

TABLE 19
RESIDUAL MATRIX FOR SEVENTEEN VARIABLES, CITY B

Variable	1	3	4	5	6	7	8	9	10	14	15	16	17	18	22	24	25
1.	.051	.049	.011	.026	-.002	-.044	.026	.005	-.020	-.021	.017	-.019	-.021	.070	-.010	-.005	.010
3.		.049	.011	.024	-.005	-.042	.023	.006	-.021	.024	.015	-.017	-.020	.066	-.010	-.004	.009
4.			.004	.005	-.004	-.007	.003	.003	-.005	.007	.001	-.003	-.005	.012	-.005	.001	.002
5.				.014	.003	-.023	.015	.002	-.009	.008	.010	-.010	-.010	.037	-.006	-.004	.007
6.					.013	-.001	.005	-.003	.005	-.011	.005	-.002	.002	.003	-.000	-.005	.005
7.						.040	-.025	-.003	.017	-.017	-.017	.017	.018	-.063	.006	.006	-.008
8.							.017	.000	-.008	.007	.012	-.011	-.010	.038	-.002	-.006	.006
9.								.002	-.003	.004	-.000	-.001	-.002	.005	-.003	.001	.001
10.									.101	-.012	-.005	.006	.009	-.026	.003	.000	-.002
14.										.017	.003	-.006	-.010	.026	-.003	.002	-.000
15.											.009	-.007	-.006	.026	-.001	-.005	.005
16.												.008	.007	-.027	.004	.003	-.005
17.													.008	-.028	.004	.002	-.004
18.														.099	-.012	-.010	.015
22.															.011	-.001	-.006
24.																.003	-.003
25.																	.006

TABLE 20

COEFFICIENTS OF FACTORS ROTATED ACCORDING TO KAISER'S VARIMAX METHOD, CITY B

	Variable	Coefficients of Rotated Factors					
		1	2	3	4	5	6
1.	Infant deaths	-.26	.10	.93	-.08	.04	.04
3.	Net population migration change	.52	-.38	-.28	-.23	.64	.03
4.	Total population change	.86	-.25	-.21	.28	.21	-.13
5.	Retail sales gain	.35	.25	-.20	.02	-.87	.06
6.	Unemployment index	.62	-.49	-.12	.30	.50	-.11
7.	Birth rate	-.01	.93	.17	-.01	-.23	.09
8.	Nonpublic school enrollment	.34	-.19	-.20	.60	.62	.21
9.	Net dwelling unit change	.96	-.10	-.13	.21	.04	-.00
10.	Tax duplicate change	.99	.06	.01	-.07	.00	.09
14.	Occupational classifications	.80	-.23	-.36	.39	.00	-.10
15.	Retailing	-.09	.36	-.05	-.16	-.90	.13
16.	Total educational expenditure	.95	-.05	-.25	-.02	-.13	.09
17.	Elementary school enrollment	.97	.09	.09	.21	.00	.03
18.	Family income	.01	.86	-.05	-.09	-.38	.02
22.	Per capita local educational expenditure	.98	.07	-.03	-.04	.07	.14
24.	Ethnic character	.41	.51	.12	.12	-.34	.65
25.	Secondary school enrollment	.91	-.04	-.29	-.10	.06	.27

TABLE 21

FRACTIONAL CONTRIBUTIONS OF ORIGINAL AND ROTATED FACTORS, CITY B

Factor	Original Contribution	Rotated Contribution
1.	0.53	0.47
2.	0.27	0.16
3.	0.08	0.08
4.	0.04	0.05
5.	0.04	0.18
6.	0.02	0.04
Total	0.98	0.98

TABLE 22

MEANS AND STANDARD DEVIATIONS OF THE PERCENT INDEX SCORES FOR TWENTY VARIABLES, CITY C

Variable	Mean	Sigma
1	94.3	7.13
2	180.7	42.24
3	93.4	48.80
4	105.5	2.01
5	107.3	6.00
6	121.3	45.89
7	103.7	1.27
8	103.2	1.33
9	105.6	2.37
10	111.4	7.49
11	88.1	7.94
12	87.9	4.95
13	95.4	1.74
15	101.5	4.63
16	106.0	9.58
17	122.4	10.77
18	115.9	5.41
22	124.0	19.53
23	81.0	14.81
25	117.7	9.09

TABLE 23
SYMMETRIC CORRELATION MATRIX FOR TWENTY VARIABLES
WITH UNITY IN THE PRINCIPAL DIAGONAL, CITY C

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	22	23	25
1. Infant deaths	1.00	-.47	.39	.01	.56	-.48	.53	-.09	-.41	-.16	-.22	.36	-.25	.59	-.67	-.47	-.11	-.63	.23	-.46
2. Child neglect	-.47	1.00	-.67	.61	-.18	.23	.15	.75	.99	.87	.25	-.96	-.35	-.44	.88	.99	.54	.84	-.86	.99
3. Net pop. migration change	.39	-.67	1.00	-.14	.26	.05	-.16	-.41	-.62	-.51	-.44	.53	-.01	.31	-.58	-.62	-.02	-.51	.83	-.69
4. Total population change	.01	.61	-.14	1.00	.48	.29	.18	.67	.65	.88	-.49	-.81	-.94	.11	.39	.65	.86	.37	-.48	.62
5. Retail sales gain	.56	-.18	.26	.48	1.00	-.09	.01	.04	-.11	.27	-.64	-.06	-.61	.92	-.32	-.09	.54	-.36	.05	-.17
6. Unemployment index	.48	.23	.05	.29	-.09	1.00	-.47	-.09	.17	.20	-.10	-.28	-.19	-.20	.27	.28	.38	.19	-.13	.21
7. Birth rate	.53	.15	-.16	.18	.01	-.47	1.00	.63	.13	.20	.11	-.13	-.22	-.13	-.20	.05	.04	-.17	-.30	.17
8. Nonpublic school enroll.	-.09	.75	-.41	.67	.04	-.09	.63	1.00	.72	.75	-.02	-.77	-.51	-.26	.46	.69	.64	.44	-.65	.75
9. Net dwelling unit change	-.41	.99	-.62	.65	-.11	.17	.13	.72	1.00	.89	.21	-.96	-.40	-.37	.88	.99	.54	.86	-.83	.99
10. Tax duplicate change	-.16	.87	-.51	.88	.27	.20	.20	.75	.89	1.00	-.14	-.96	-.72	-.06	.67	.89	.73	.65	-.78	.87
11. Retention rate	-.22	.25	-.44	-.49	-.64	-.10	.11	-.02	.21	-.14	1.00	-.02	.63	-.49	.41	.19	-.43	.37	-.24	.23
12. Female pop. ages 15 to 29	.36	-.96	.53	-.81	-.06	-.28	-.13	-.77	-.96	-.96	-.02	1.00	.58	.25	-.81	-.97	-.72	-.77	.79	-.95
13. Female pop. ages 30 to 44	-.25	-.35	-.01	-.94	-.61	-.19	-.22	-.51	-.40	-.72	.63	.58	1.00	-.28	-.13	-.38	-.74	-.11	.29	-.36
15. Retailing	.59	-.44	.31	.11	.92	-.20	-.13	-.26	-.37	-.06	-.49	.25	-.28	1.00	-.48	-.34	.25	-.53	.24	-.43
16. Total educational expend.	-.67	.88	-.58	.39	-.32	.27	-.20	.46	.88	.67	.41	-.81	-.13	-.48	1.00	.89	.36	.97	-.60	.86
17. Elem. school enrollment	-.47	.99	-.62	.65	-.09	.28	.05	.69	.99	.89	.19	-.97	-.38	-.34	.89	1.00	.60	.85	-.83	.98
18. Family income	-.11	.54	-.02	.86	.54	.38	.04	.64	.54	.73	-.43	-.72	-.74	.25	.36	.60	1.00	.29	-.37	.52
22. Per capita local edu. exp.	-.63	.84	-.51	.37	-.36	.19	-.17	.44	.86	.65	.37	-.77	-.11	-.53	.97	.85	.29	1.00	-.54	.82
23. Drop-out rate	.23	-.86	.83	-.48	.05	-.13	-.30	-.65	-.83	-.78	-.24	.79	.29	.24	-.60	-.83	-.37	-.54	1.00	-.88
25. Sec. school enrollment	-.46	.99	-.69	.62	-.17	.21	.17	.75	.99	.87	.23	-.95	-.36	-.43	.86	.98	.52	.82	-.88	1.00

TABLE 24

COEFFICIENTS OF UNROTATED FACTORS
FOR TWENTY VARIABLES, CITY C

	Variable	Factor Coefficients					
		1	2	3	4	5	6
1.	Infant deaths	-.44	.58	.55	.08	-.04	.28
2.	Child neglect	.99	-.12	.05	.01	.00	.03
3.	Net population migration change	-.64	.35	-.31	-.40	-.34	.26
4.	Total population change	.71	.65	-.12	-.17	-.02	-.03
5.	Retail sales gain	-.08	.91	-.06	.38	-.04	.07
6.	Unemployment index	.27	-.03	-.74	-.23	.49	.29
7.	Birth rate	.14	.21	.89	-.34	.09	.10
8.	Nonpublic school enrollment	.77	.24	.41	-.31	-.05	-.04
9.	Net dwelling unit change	.98	-.06	.05	.06	-.10	.03
10.	Tax duplicate change	.92	.35	.03	.08	-.01	-.02
11.	Retention rate	.14	-.79	.32	.19	-.02	.45
12.	Female population ages 15 to 29	-.99	-.15	.04	.01	.04	-.04
13.	Female population ages 30 to 44	-.47	-.80	.06	.16	-.01	.08
15.	Retailing	-.36	.73	-.06	.55	-.03	.08
16.	Total educational expenditure	.85	-.36	-.21	.12	-.24	.06
17.	Elementary school enrollment	.98	-.06	-.05	.08	-.03	.07
18.	Family income	.62	.63	-.27	-.10	-.02	.15
22.	Per capita local educational expenditure	.82	-.38	-.18	.06	-.35	.02
23.	Drop-out rate	-.84	.04	-.29	-.23	-.37	.03
25.	Secondary school enrollment	.99	-.10	.07	.02	.03	-.01

TABLE 25

RESIDUAL MATRIX FOR TWENTY VARIABLES, CITY C

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	22	23	25
1	.076	.001	.014	.031	-.022	.011	-.016	-.081	.022	.029	-.014	-.006	-.059	-.037	-.001	.001	-.091	.026	-.016	.006
2		.004	.012	-.005	-.001	-.004	-.004	.002	.006	-.004	-.008	-.001	.013	.002	-.007	.007	.003	-.005	-.009	.006
3			.039	-.012	-.004	-.006	-.009	-.008	.020	-.003	-.030	-.005	.034	-.001	-.022	.022	-.008	-.005	-.030	.015
4				.021	-.010	.007	-.005	-.035	.002	.013	.009	-.001	-.047	-.018	.011	-.010	-.039	.012	.007	-.003
5					.008	-.000	.009	.022	-.008	-.003	.002	.002	.019	.010	-.000	-.001	.023	-.001	.005	-.004
6						.007	.004	-.015	-.002	.012	.000	.000	-.015	-.007	.004	-.004	-.019	.014	.003	-.005
7							.012	.014	-.011	.003	.003	.002	.010	.007	.003	-.004	.013	.007	.008	-.008
8								.087	-.020	-.034	.012	.006	.069	.040	-.003	.002	.099	-.032	.013	-.003
9									.015	.002	-.015	-.004	.001	-.008	-.010	.010	-.021	-.001	-.017	.010
10										.022	-.005	-.001	-.026	-.015	.003	-.004	-.042	.025	-.001	-.005
11											.026	.004	-.025	.002	.017	-.016	.014	-.005	.024	-.009
12												.001	.000	.002	.002	-.002	.006	-.001	.004	-.002
13													.104	.036	-.027	.024	.078	-.025	-.021	.009
15														.019	-.003	.003	.045	-.014	.003	-.000
16															.013	-.013	-.003	.004	.017	-.008
17																.012	.003	-.006	-.016	.008
18																	.113	-.041	.013	-.001
22																		.029	.002	-.008
23																			.024	-.012
25																				.008

TABLE 26

COEFFICIENTS OF FACTORS ROTATED ACCORDING TO KAISER'S VARIMAX METHOD, CITY C

	Variable	Coefficients of Rotated Factors					
		1	2	3	4	5	6
1.	Infant deaths	-.39	.05	.61	.59	-.14	-.17
2.	Child neglect	.94	.07	.09	-.19	.22	.10
3.	Net population migration change	-.55	.22	-.02	.11	-.76	.11
4.	Total population change	.62	.71	.17	.18	-.03	.18
5.	Retail sales gain	-.04	.49	.04	.86	-.05	-.02
6.	Unemployment index	.14	.17	-.33	-.16	-.00	.90
7.	Birth rate	.06	.05	.96	-.06	.11	-.20
8.	Nonpublic school enrollment	.67	.35	.54	-.17	.09	-.08
9.	Net dwelling unit change	.97	.09	.06	-.12	.15	.03
10.	Tax duplicate change	.86	.40	.14	.14	.18	.08
11.	Retention rate	.27	-.91	.13	-.21	.06	.02
12.	Female population ages 15 to 29	-.94	-.29	-.08	.04	-.12	-.14
13.	Female population ages 30 to 44	-.36	-.78	-.22	-.29	.04	-.12
15.	Retailing	-.28	.23	-.09	.91	-.02	-.08
16.	Total educational expenditure	.92	-.14	-.26	-.23	.01	.04
17.	Elementary school enrollment	.96	.09	-.01	-.09	.17	.14
18.	Family income	.57	.60	.06	.28	-.14	.32
22.	Per capita local educational expenditure	.89	-.12	-.25	-.29	-.07	-.06
23.	Drop-out rate	-.73	.00	-.24	-.01	-.61	-.12
25.	Secondary school enrollment	.93	.09	.10	-.19	.26	.08

TABLE 27

FRACTIONAL CONTRIBUTIONS OF ORIGINAL AND ROTATED FACTORS, CITY C

Factor	Original Contribution	Rotated Contribution
1.	0.52	0.47
2.	0.22	0.16
3.	0.12	0.10
4.	0.05	0.12
5.	0.04	0.06
6.	0.02	0.06
Total	0.97	0.97

CHAPTER IV

FACTOR INTERPRETATION AND TREATMENT

Chapter III presented the methodology of this study, the statistical treatment of the data, and the results obtained. It is the purpose of Chapter IV to interpret the results presented in Chapter III and to present the writer's ideas for further treatment of those results.

Interpreting and Naming the Factors

The crux of this study was the factor analysis of the correlation matrixes produced by the three sets of variables from the three cities in the community sample. The statistical results of that analysis have been presented. The remaining task is to interpret those results by identifying or naming the factors extracted from the correlation matrixes. This step is, of course, the heart of any factor analysis study. Poor interpretation of factors will produce a poor study regardless of how sophisticated the statistical treatment might have been. Factor interpretation thus becomes the final crowning act in the chain of events initiated by measurement of the variables in the study. Rizzo points out that many writers in the field have stressed the importance of factor interpretation.[1]

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[1] John Raymond Rizzo, "An Approach to the Interpretation and Naming of Factors" (unpublished Master's thesis, The Ohio State University, 1961), p. 1.

Interpretation of factors is a difficult task, but becomes extremely difficult when little or no prior evidence is available. Rizzo states that "the investigation may be such that the experimenter is employing the factor analysis technique in an attempt to identify new relationships and concepts in an area not treated in a similar manner in previous experimentation. The interpretation and naming of factors in such cases is a pronouncedly more difficult task."[2] Such is the case in the study being reported. The writer, after an extensive search of the literature, was not able to find previous investigations into public school enrollment change or prediction which had used a factor analysis technique. As a result, factor interpretation was an exacting task and the discussion which follows presents tentative conclusions about the nature of the factors.

The procedure for presenting the factor interpretations is to show, in tabular form, the high (positive) and low (negative) factor coefficients or loadings[3] for each variable and follow with appropriate discussion showing how the factor names were derived. This is done for each correlation matrix (A, B, and C) for each city in the community sample.

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[2] Ibid., p. 5.

[3] The terms factor coefficient and factor loading are used synonymously in this paper.

Interpretation of Factors from Matrix A

Table 28 shows the high and low factor loadings on each variable in matrix A and the percent contribution of each factor to the total variance of the variables. The factor loadings shown in the table are those $\geq .35$ and those $\leq -.35$. The standard error of the factor loadings is 0.15. This was obtained by interpolation from a table developed by Harman.[4] It was believed that factor loadings should be at least 0.20 greater or less than the standard error in order to be meaningful.

Factor one had high or low loadings on thirteen of the sixteen variables and appeared to be a general factor. However, the very low negative loadings and the three high loadings are important in the writer's view. Both retailing and per capita local educational expenditure are measures of dollars per person. Moreover, a high loading on family income coupled with high loadings on poverty and birth rate would have an implication for dollars per person. As a result, an appropriate name for factor one appeared to be Per Capita Financial Potential. The other low factor loadings, while not direct measures of dollars per person, all had to do with change in population or capital wealth. Thus, they appeared consistent with the selected factor name. The total pattern of factor loadings suggested low financial potential. Reversing the factor loading signs, which is useful in factor interpretation, suggested the reverse. Consequently, it did not seem necessary to add either the word high or low to the factor name.

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[4] Harry H. Harman, Modern Factor Analysis (Chicago: The University of Chicago Press, 1960), p. 441.

TABLE 28

HIGH AND LOW FACTOR COEFFICIENTS EXTRACTED FROM CORRELATION MATRIX FOR CITY A

Variables	Factors					
	1	2	3	4	5	6
1. Infant deaths	--	.98	--	--	--	--
3. Net population migration change	--	--	.97	--	--	--
4. Total population change	-.67	--	--	-.51	-.40	--
5. Retail sales gain	-.85	--	--	--	--	--
7. Birth rate	.42	--	--	--	.81	--
9. Net dwelling unit change	-.81	--	--	.46	--	--
10. Tax duplicate change	-.86	--	--	.43	--	--
11. Retention rate	--	--	--	-.84	--	--
15. Retailing	-.95	--	--	--	--	--
16. Total educational expenditure	-.83	--	--	--	-.37	--
17. Elementary school enrollment	-.77	--	--	-.51	--	--
18. Family income	.59	--	--	.77	--	--
20. Poverty	.72	--	--	.54	--	--
22. Per capita local educational expenditure	-.92	--	--	--	--	--
23. Drop-out rate	-.38	--	--	-.41	--	.72
25. Secondary school enrollment	-.66	--	--	-.58	-.37	--
Percent contribution to total variance	46	8	7	21	11	6

Factor four was labeled Population Age. The low factor loadings on the variables having to do with school pupils and housing growth suggested fewer young people. The high loadings on family income and poverty suggested a condition of more older people in the population. When the loading signs were reversed, the inverse of the situation appeared true. In either case the factor appeared related to the relative age of the population.

The remaining factor contributing more than ten percent to the total variance of the variables, factor five, was difficult to interpret because it had fewer low and high loadings. It was tentatively identified as Economic Opportunity. A high loading on birth rate coupled with the low loadings on total population change, total educational expenditure, and secondary school enrollment suggested out-migration of people. Reversing the signs of the factor loadings indicated migration in a different direction. In either case, economic opportunity seemed a possible cause.

Factors two, three, and six each had only a single, high factor loading. This indicated that the vectors for the variables were very close to the respective factor axes, or that measurement of the variables would closely approximate their respective factors. This was especially true of factors two and three which had very high loadings on a single variable which did not show loadings on any other factor. The writer did not identify the factor with the variable; however, if further investigation should reveal a similar factor pattern, the apparent relationship may be very important.

Interpretation of Factors from Matrix B

The high and low factor coefficients on each variable in matrix B and the percent contribution of each factor to the total variance of the variables are shown in Table 29. The standard error of the factor loadings extracted from matrix B was 0.25. Accordingly, only those loadings ≥ 0.45 or ≤ -0.45 were considered meaningful.

All loadings for factor one shown in Table 29 are positive. It appeared, then, that factor one was a general factor, especially since high loadings were exhibited on ten of the seventeen variables. Examination of the high loaded variables suggested that General Population Growth was an appropriate name. Four of the ten high loaded variables, net population migration change, total population change, elementary school enrollment, and secondary school enrollment are direct measures of population change. Four others, net dwelling unit change, tax duplicate change, total educational expenditure, and per capita educational expenditure, are indicative of or related to population change. The remaining two variables, unemployment index and occupational classifications, did not seem to follow the pattern so well because these could change without a corresponding change in population. However, population growth does occur along with increase in unemployment and change in occupational classifications. Therefore, general population growth appeared to be most descriptive of factor one.

Factor two was less difficult to identify than most of the others. The high loadings on birth rate, family income, and ethnic character coupled with low loadings on unemployment index indicated that economic status was paramount. When the loading signs were reversed

TABLE 29

HIGH AND LOW FACTOR COEFFICIENTS EXTRACTED
FROM CORRELATION MATRIX FOR CITY B

Variables	Factors					
	1	2	3	4	5	6
1. Infant deaths	--	--	.93	--	--	--
3. Net population migration change	.52	--	--	--	.64	--
4. Total population change	.86	--	--	--	--	--
5. Retail sales gain	--	--	--	--	-.87	--
6. Unemployment index	.62	-.49	--	--	.50	--
7. Birth rate	--	.93	--	--	--	--
8. Nonpublic school enrollment	--	--	--	.60	.62	--
9. Net dwelling unit change	.96	--	--	--	--	--
10. Tax duplicate change	.99	--	--	--	--	--
14. Occupational classifications	.80	--	--	--	--	--
15. Retailing	--	--	--	--	-.90	--
16. Total educational expenditure	.95	--	--	--	--	--
17. Elementary school enrollment	.97	--	--	--	--	--
18. Family income	--	.86	--	--	--	--
22. Per capita local educational expenditure	.98	--	--	--	--	--
24. Ethnic character	--	.51	--	--	--	.65
25. Secondary school enrollment	.91	--	--	--	--	--
Percent contribution to total variance	47	16	8	5	18	4

the same indication of economic status was apparent. That is, a high loading on unemployment index together with low loadings on the other variables indicated low economic status. For either case Economic Health appeared to be descriptive and the factor was so named.

One of the more interesting and challenging factors to interpret was factor five. The pattern exhibited by the factor loadings was not similar to another from any of the three matrixes. After initial examination, the low factor loadings on retailing and retail sales gain compared to the high loadings on net population migration change and nonpublic school enrollment seemed incongruous. After much thought the writer concluded that a change in residential pattern could account for such a situation. That is, a growth in the residential facet of a community without a concurrent growth in the business facet could produce this phenomenon. Reversing the signs of the factor loadings suggested the converse of the above relationship. Thus, the term Residential Pattern was assigned to factor five as most descriptive of the factor pattern.

Much like the factor pattern produced by Matrix A, Matrix B produced three factors which had only a single high loading on one variable. As in the first case, the writer was reluctant to attach the variable name to the factor because the evidence was not conclusive enough. One interesting result was that variable 1, infant deaths, appeared as a single high loading on only one factor from both matrixes A and B. In both cases it accounted for eight percent of the total variance of the variables.

Interpretation of Factors from Matrix C

Table 30 depicts for each variable of matrix C the low and high factor loadings and the percent of total variance of the variables accounted for by each factor. The standard error of the factor loadings extracted from matrix C was 0.26. Therefore, the loadings in Table 30 are only those $\geq .46$ and $\leq -.46$.

Thirteen of the twenty variables in matrix C had high or low loadings on factor one, with ten being positive and three negative. This suggested that factor one was probably a general growth factor. Yet certain characteristics of the variables indicated that it might be a particular kind of general factor. A high factor loading on secondary school enrollment along with a low loading on drop-out rate indicated a rapid change in the secondary-school-age portion of the population. The low factor loading on net population migration change coupled with a high loading on total population change suggested that the impetus for population change was coming from within the city. Adding to these ideas the high loadings on elementary school enrollment, nonpublic school enrollment, and per capita local educational expenditure pointed to the rapid growth of a particular segment of the total population--the school-age population. The low factor loading on female population ages 15 to 29 looked inconsistent with this conclusion at first. However, it is an expression of the percent of persons in that population category. Therefore, it was thought possible for the numbers to remain nearly stable even though the percent decreased due to growth of some other age group. It was concluded, then, that School-age Population Ratio was a logical name for factor one.

TABLE 30

HIGH AND LOW FACTOR COEFFICIENTS EXTRACTED FROM CORRELATION MATRIX FOR CITY C

Variables	Factors					
	1	2	3	4	5	6
1. Infant deaths	--	--	.61	.59	--	--
2. Child neglect	.94	--	--	--	--	--
3. Net population migration change	-.55	--	--	--	-.76	--
4. Total population change	.62	.71	--	--	--	--
5. Retail sales gain	--	.49	--	.86	--	--
6. Unemployment index	--	--	--	--	--	.90
7. Birth rate	--	--	.96	--	--	--
8. Nonpublic school enrollment	.67	--	.54	--	--	--
9. Net dwelling unit change	.97	--	--	--	--	--
10. Tax duplicate change	.86	--	--	--	--	--
11. Retention rate	--	-.91	--	--	--	--
12. Female population ages 15 to 29	-.94	--	--	--	--	--
13. Female population ages 30 to 44	--	-.78	--	--	--	--
15. Retailing	--	--	--	.91	--	--
16. Total educational expenditure	.92	--	--	--	--	--
17. Elementary school enrollment	.96	--	--	--	--	--
18. Family income	.57	.60	--	--	--	--
22. Per capita local educational expenditure	.89	--	--	--	--	--
23. Drop-out rate	-.73	--	--	--	-.61	--
25. Secondary school enrollment	.93	--	--	--	--	--
Percent contribution to total variance	47	16	10	12	6	6

Factor two was among the more difficult to interpret of those factors which contributed more than ten percent to the total variance of the variables in any matrix. The three high loadings on total population change, family income, and retail sales gain indicated economic and population growth. However, the low loadings on retention ratio and female population ages 30 to 44 did not appear consistent. The writer was not able to account for this. Factor two was tentatively named Economic Health but additional evidence is needed to make a more definite identification.

The third factor was tentatively called Young Family Growth. The high loading on birth rate was most influential in determining the name. A high loading on infant deaths, a regressive influence, appeared contrary, yet it could be attributed to gross increase in births. No negative loadings appeared under factor three. However, the lowest negative loading produced by the factor analysis was on unemployment index (-0.33). Even though not low enough to be included in Table 30, it did lend some credence to the tentative factor name because a low loading on unemployment index seemed to fit the pattern for young family growth. The remaining high loading on nonpublic school enrollment did not appear to follow the pattern so well as the others although it would be more consistent if the negative loading on unemployment index had been low enough to be considered meaningful. That is, a low unemployment index would tend to support an increase in nonpublic school enrollment.

The writer was not able to arrive at a satisfactory identification for factors four and five. In factor four, the high loadings on retailing and retail sales together with a high loading on infant deaths

did not suggest any interpretation other than general growth, and there were not enough factor loadings to indicate a general factor. Much the same situation existed for factor five. The low loadings on net population migration change and drop-out rate did not suggest any possibility other than population stability or decline. But there was not enough evidence to corroborate this possibility.

Factor six, although contributing only six percent to the total variance of the variables, was extremely interesting. It exhibited a single high loading on only one variable, unemployment index. In addition, factor six was the only one on which this particular variable had a loading. This was the same type factor pattern as found in factors two and three from matrix A and factor three from matrix B. Although this type factor pattern suggested that the variable name was likely suitable for the factor, the writer did not apply the name because he felt that the evidence was not conclusive enough.

Summary of Factor Interpretation

As stated above, the names of the factors established by the writer are only tentative. In many cases the writer believed that further investigation will be necessary before any firmer interpretation of the factors can be established. There were some similarities in the factor patterns for the three matrixes of this study. An economic factor appeared from all three matrixes. A general factor emerged from each matrix although these varied in nature. Table 31 summarizes the names assigned to the factors extracted from each matrix of correlations. The reader will remember that matrixes A, B, and C were derived from correlations of variables for cities A, B, and C.

TABLE 31

SUMMARY OF FACTOR INTERPRETATIONS

Factor Number	Factor Names		
	Matrix A	Matrix B	Matrix C
1	Per capita financial potential	General population growth	School-age population ratio
2	--	Economic health	Economic health
3	--	--	Young family growth
4	Population age	--	--
5	Economic opportunity	Residential pattern	--
6	--	--	--

Further Treatment of Factors

One purpose of this study was to attempt development of a general formula or a procedure, based upon the results of the factor analysis, to be used in projecting public school enrollments. However, the writer did not believe such an attempt was possible with the results obtained. There were two reasons for this belief.

First, the factors extracted from the three matrixes in this study, while bearing some similarities, were not alike. Each matrix produced an economic factor but this was the only common one. Therefore, it did not appear feasible to attempt development of a general approach.

The second reason was that the variables correlated in the three matrixes were not all the same. Consequently, it was not deemed reasonable to attempt generalization from the results. This could indicate a fault in the study design. However, the writer was anxious to include all obtainable variables for the sake of gathering evidence in this exploratory type of study.

Another possibility would have been to develop individual formulas or procedures for each city in the community sample. But this did not seem worth the effort required. To develop projection methods for individual cases from a factor analysis study appeared to the writer to negate the basic purpose of the factor analysis technique.

In spite of the above statements, the writer believed that there are possibilities for development of a general formula or procedure using the results of factor analysis studies. The very fact that at least one factor was common to each matrix suggested this possibility. Moreover, the two factors, population age from matrix A and young family growth from matrix B, appeared to have some common elements.

Three possibilities for further exploration were apparent to the writer. One possibility would be to use those variables from the present study which showed high correlation with public school enrollment and to collect data from a larger community sample for further factor analysis. One purpose of this approach would be to determine if one or more factors common to all cities emerged from the analysis. A second method would be a further study of those factors which were tentatively identified in the present study. This could be done by using the variables which had

high or low loadings on the factors and collecting data from a wider sample of communities. A study of this type might show whether certain factors were common to all communities or types of communities. Still a third approach would be to work with the tentatively identified factors in the same cities of the present study in an effort to add credence to the factor identification. To accomplish this, new variables which would likely affect the factors could be added to the correlation matrix. Then the factor analysis would show whether, in fact, the factor loadings would be high on the new variables. This would further assist in identifying factors.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter summarizes the entire thesis, presents the conclusions drawn from the research, and offers the writer's recommendations for improvement of public school enrollment projection in Ohio and for further research into the causes of change in public school enrollment.

Summary

Interest in the prediction or projection of public school enrollment had its real genesis in the survey movement which began in the 1920's. This interest appears to be heightened during periods of rapid change in public school enrollment. Much more on this subject appears in the literature during the 1930's when public school enrollment declined and during the 1950's and early 1960's when public school enrollment increased rapidly. There have been a number of studies which investigated the accuracy of public school enrollment projections. Without exception they have pointed to the need for more accuracy.

An extensive search of the literature revealed eight basic methods for projecting public school enrollment which have been or are now being used. These vary in complexity from simple trend projections to the very involved housing projection techniques. Several comparative studies have been done to determine which of these basic methods is best. The consensus result of these investigations is that the survival rate

method or one of its variations is best. The writer would agree but would add the dual projection technique to the survival rate method. The purpose of projecting public school enrollment is to facilitate planning and the dual projection technique forces development of a flexible plan which can adapt to changing needs.

There are two classes of variables which affect change in public school enrollment: population variables and educational variables. The former are those variables which cause change in the number of school-age children in the general population however the term school-age is defined. The latter are those variables which cause change in the number of school-age children who are actually enrolled in the public schools. But both classes of variables are subject to change by a more basic group of socioeconomic determiners or variables. The various methods of projecting public school enrollments have taken account of the population and educational variables, but they have not sufficiently involved the socio-economic variables which are more basic.

The present study was undertaken for two basic purposes: (1) to discover relationships between socioeconomic variables and the two classes of variables directly affecting public school enrollment with an eye to improving the accuracy of projection methods, and (2) to develop a formula or a procedure for public school enrollment projection with an eye to improving convenience. In order to attack the problem presented in the study, a number of socioeconomic variables were combined with the more commonly used population and educational variables. The socio-economic variables were selected if evidence could be found that they had some correlation with public school enrollment. The procedure for the

study was to develop intercorrelations among the selected variables and to analyze these correlations by an appropriate statistical technique to determine what relationships would obtain.

The writer recognized that data collection for the study would be a problem because of comments in the literature and his prior experience in public school enrollment projection. The kinds of variables included in the study indicated that data collection would be more fruitful in cities than in suburban or rural areas. To facilitate data collection, a preliminary survey was conducted in all Ohio cities which had 1960 populations above 15,000. Based upon the findings of this survey and certain other criteria, three cities which provided a range of both size and growth rate were selected for data collection and analysis.

The collected data were converted into percent index scores which were intercorrelated for each city. The correlations were placed in matrixes and subjected to factor analysis by the principal factor method. Six factors were extracted from each matrix and rotated by the varimax method to approximate simple structure.

The heart of the study, according to its stated purposes, was the interpretation and naming of the factors produced by the factor analysis. This was a difficult task because no examples of previous uses of this approach were found in the literature. Nine of the factors were given tentative identification. These were per capita financial potential, population age, and economic opportunity in one city; general population growth, economic health, and residential pattern in another city; and school-age population ratio, economic health, and young family

growth in the third city. The other factors were not named although seven of them exhibited a pattern of only a single loading on one variable. An economic factor emerged from all three matrixes, but this was the only common one.

The results of the factor analysis did not lend themselves to development of a formula or procedure for public school enrollment projection for two reasons: (1) the factors derived from the correlation matrixes for the three cities were not alike, and (2) the variables correlated were not exactly the same for all three cities.

Conclusions

Based upon the procedures used in this study and the results obtained, the following six conclusions are presented.

1. The majority of school districts surveyed in the preliminary sample do not keep appropriate statistical data to aid in projecting public school enrollment. Even data like pupil drop-out and retention, which should be part of school records, were not kept by more than half of the districts surveyed.

2. Data collection for this study or for others similar to it is a great problem. This is caused by the facts that boundary lines for school districts, cities, and health districts are too seldom the same and that many kinds of data are not available in some cities.

3. It was possible to express the variables selected for this study in mathematical terms which were appropriate for the kind of data analysis used. The percent index scores used in this study were simple

to derive and useful in comparing data which had different types of measures.

4. The data collected for this study could be factor analyzed and the variables could be expressed in fewer factors.

5. The factor analytic technique appears to be useful for further research into public school enrollment change and prediction. Some commonality and similarity of results were obtained in this study from the three cities used. As a result, the technique would seem appropriate for additional research.

6. It could not be determined whether a formula or procedure could be derived from the approach used in this study since the results did not appear suitable. However, the results did suggest that further studies may lead to development of formula(s) or procedure(s) if the common factor revealed by this study is found in additional cities and if other common factors are discovered.

Recommendations

The following six recommendations are offered as a result of this study.

1. A comprehensive and continuing school census should be required in all Ohio school districts. This should be done either by legislative action or by regulation of the state board of education. Such a census should include an accurate accounting of the number of school-age and preschool-age children, the number and grade of children attending nonpublic schools, the number of pre-school children who migrate into or out of the school district each year, and the number of

dwelling units in the school district along with notation of their condition and location. The data provided by such a census would be useful in projecting local school district enrollment and in future studies of this type.

2. All Ohio school districts should be required to keep records of the annual numbers of pupils by grade who drop out of school or who are retained in grade. This information, too, would be useful for the purposes citied in the preceding recommendation.

3. Legislation or regulation requiring that vital statistics be kept according to school district as well as health district should be enacted in Ohio. This action would provide needed birth data to assist in projecting public school enrollment and needed vital data to determine migration by the residual method.

4. The dual technique of projecting public school enrollment should be adopted for general use in Ohio and appropriate steps taken to publicize the method and provide instruction in its use.

5. Further research is needed to identify additional socio-economic variables which show correlation with public school enrollment. Identification of additional variables would facilitate further research into the prediction of public school enrollment.

6. Further research using a factor analysis technique should be undertaken to explore the following:

a. Use a larger sample of cities with the same variables of the present study to determine if the one common factor tentatively identified appears in other cities or if other common factors appear.

b. Add other variables to those used in the present study. Variables should be chosen which can be shown to have some correlation with public school enrollment.

c. Investigate the factors tentatively identified in the present study. This could be done in two ways: (1) continue investigation in the same cities used in this study by adding new variables which would likely show high loadings on the factors, and (2) collect data for the variables showing high or low loadings on the factors in a larger sample of cities.

APPENDIX A

THE OHIO STATE UNIVERSITY
COLLEGE OF EDUCATION
1945 NORTH HIGH STREET
COLUMBUS 10, OHIO

BUREAU OF EDUCATIONAL RESEARCH AND SERVICE

Letter of transmittal for first mail-out
of preliminary questionnaire

In recent years Americans have become increasingly more interested in the public schools. One reason is that schools are costing more. A substantial part of this increased cost is due to the large amount of school building construction caused by the rise in school enrollments.

As you are aware, these rapid enrollment increases have presented severe problems in many cities. The undersigned is undertaking research designed to uncover new knowledge about the forces which cause change in public school enrollments.

This letter and enclosed one-page questionnaire(s) constitute a preliminary survey to assist in selecting three cities in which the research is to be carried on. A different questionnaire is being sent to each of four agencies in sixty-eight Ohio cities. When the returns are in and tabulated, a selection of the three cities will be made. Won't you please see that the questionnaire is completed and returned in the enclosed envelope? Your cooperation and assistance will be greatly appreciated.

Sincerely yours,

W. J. Griffith

W. J. Griffith, Instructor

THE OHIO STATE UNIVERSITY
COLLEGE OF EDUCATION
1945 NORTH HIGH STREET
COLUMBUS, OHIO 43210

BUREAU OF EDUCATIONAL RESEARCH AND SERVICE

Letter of transmittal for second mail-out of preliminary questionnaire

January 9, 1964

Dear Sir:

Perhaps you will recall receiving a letter and questionnaire(s) from the undersigned approximately one month ago. They concerned research which is being conducted to discover new information about the causes of change in public school enrollments.

Two hundred sixty-eight questionnaires were sent to various persons in sixty-eight Ohio cities. Fifty-seven percent have been returned to date. Since a much greater return is needed for the results to be useful, this second request is being sent.

Won't you please see that the questionnaire is completed and returned in the enclosed envelope? Your early response will be appreciated.

Sincerely yours,

W. J. Griffith

W. J. Griffith, Instructor

THE OHIO STATE UNIVERSITY
COLLEGE OF EDUCATION
1945 NORTH HIGH STREET
COLUMBUS, OHIO 43210

BUREAU OF EDUCATIONAL RESEARCH AND SERVICE

Letter of transmittal for second mail-out
of preliminary questionnaire

January 9, 1964

Dear Sir:

One month ago a letter and questionnaire were sent to your predecessor in office. They concerned research which is being conducted by the undersigned to discover new information about the causes of change in public school enrollments. Since a reply was not received, this second request is being sent to you.

Two hundred sixty-eight questionnaires were sent to various persons in sixty-eight Ohio cities. Fifty-seven percent have been returned to date. However, a much greater return is needed for the results to be useful.

Won't you please see that the questionnaire is completed and returned in the enclosed envelope? Your early response will be appreciated.

Sincerely yours,

W. J. Griffith

W. J. Griffith, Instructor

_____
City School District

A. Please check or fill in the appropriate blank to the right of each question.

1. Are the boundaries of your school district and city the same? ____yes ____no
   (Note: Please include all cities involved if more than one city is in your school district.)

2. If not, do at least 90% of your pupils reside within the city limits? ____yes ____no

3. How many square miles are contained within your school district? _____ sq. mile

4. How many square miles were annexed to your school district during the years 1950 through 1960, if any? _____ sq. mile

B. Please check in column 2 or 3 to indicate whether the data described in column 1 are available for your school district for <u>each year</u> during the eleven years from 1950 through 1960. If the data are only partially available, please indicate which years are available in column 4.

1	2	3	4
Description of Data	Available	Not Available	Which years available
1. The total number of resident pupils enrolled in nonpublic schools in grades 1-8 and 9-12 on a particular date each year.			
2. Annual number of failures by grade in grades 1 through 12.			
3. Annual number of pupils in grades 9 through 12 who dropped out of school			
4. Total annual population of the school district.			
5. For the years between 1950 and 1960, the number of school district residents 25 years of age and older who completed high school.			

Name of person responding _____

Title _____

_____
City

A. Please check or fill in the appropriate blank to the right of each question.

1. How many square miles are contained within your city? _____ sq. miles

2. How many square miles were annexed to your city during the years 1950 through 1960, if any? _____ sq. miles

B. Please check in column 2 or 3 to indicate whether the data described in column 1 are available for your city for <u>each</u> <u>year</u> during the eleven years from 1950 through 1960. If the data are only partially available, please indicate which years are available in column 4.

1	2	3	4
Description of Data	Available	Not Available	Which Years Available
1. Total annual local funds expended for child welfare in your city.			
2. Percent of unemployed persons in the total work force in your city on a specified date each year.			
3. Total number of new family dwelling units built within your city each year.			
4. Total annual city population.			
5. Annual number of nonwhites in the total city population.			
6. Annual number of females aged 15 to 29 years in your city for the years between 1950 and 1960.			
7. Annual number of females aged 30 to 44 years in your city for the years between 1950 and 1960.			
8. Average annual income per family or household in your city.			
9. Annual percent of families with total income under $2,000 in your city.			

Name of person responding _____

Title _____

-Preliminary Questionnaire-

_____

City

Please check in column 2 or 3 to indicate whether the data described in column 1 are available for the city for <u>each year</u> during the eleven years from 1950 through 1960. If the data are only partially available, please indicate which years are available in column 4.

1	2	3	4
Description of Data	Available	Not Available	Which Years Available
1. Annual number of persons migrating both into and out of the city.			
2. Total annual city population.			
3. Annual number of nonwhites in the total city population.			
4. For the years between 1950 and 1960, the number of city residents 25 years of age and older who completed high school.			
5. Average annual income per family or household in the city.			
6. Annual percent of families with total income under $2,000 in the city.			
7. Total annual retail sales within the city.			
8. Percent of the total work force in the city falling into the professional, white collar, clerical and sales, skilled, and unskilled classifications on a specified date each year.			
9. Percent of unemployed persons in the total work force in the city on a specified date each year.			
10. Annual percent of total family dwelling units in the city with mechanical air conditioning.			

Name of person responding _____

Title _____

-Preliminary Questionnaire-

_____
City Health District

Please check in column 2 or 3 to indicate whether the data described in column 1 are available for the city health district for each year during the eleven years from 1950 through 1960. If the data are only partially available, please indicate which years are available in column 4.

1	2	3	4
Description of Date	Available	Not Available	Which years Available
1. Total annual deaths of city residents.			
2. Total annual resident births in the city.			
3. Annual number of resident infant deaths occurring within one year after birth in the city.			
4. Annual number of females aged 15 to 29 years in the city for the years between 1950 and 1960.			
5. Annual number of females aged 30 to 44 years in the city for the years between 1950 and 1960.			

Name of person responding _____

Title _____

APPENDIX B

Mr. John Doe
Official Capacity
Podunk, Ohio

Dear Mr. Doe:

Thank you for returning the questionnaire which I sent to you some time ago. Be assured that your response will be useful in my research into the causes of change in public school enrollments. You may recall my previous letter stating that your response, along with many others, would be used in selecting three cities in which the actual research is to be carried on.

Through analysis of returns, Podunk was selected as a city for research since it was among those where the most data are available and meets certain other criteria established for the project.

Therefore, my purpose now is to solicit your further assistance. Would you be willing to supply the data which you indicated are available? If so, I will send data collection forms to you and/or come to Podunk to assist with the collection if this would prove helpful. Some of your staff time will be required. Of course, the results of my analysis and any resulting enrollment projections will be made available to the school administration in your city.

Before proceeding with the research, I will need to secure approval from some other sources in Podunk as well. Will you please indicate your willingness to provide data by marking and returning the enclosed card? Your continued cooperation and assistance will be sincerely appreciated.

Sincerely yours,

William J. Griffith
Instructor

Sample of the letters requesting assistance in collecting data from those persons who responded to the preliminary questionnaire.

Sample of letter of transmittal
for data collection forms

Mr. John Doe
Official Capacity
Podunk, Ohio

Dear Mr. Doe:

Thank you very much for your willingness to provide data for my research into the causes of change in public school enrollments. As I indicated earlier, I am enclosing the appropriate data collection forms. You will find three copies of each form: one for a work copy, one for your files, and one to be returned to me.

Should any question arise as you complete these forms please do not hesitate to write to me. Also, I will be quite willing to come to your office to assist if you believe it will be helpful.

If possible and convenient for you I will appreciate your completing and returning the forms in the enclosed mailing envelope on or before March 31, 1964. Again, many thanks for your assistance.

Sincerely yours,

William J. Griffith
Instructor

_____
school district

DATA COLLECTION FORM S-1

Nonpublic School Enrollment

Please indicate only the number of pupils residing in your school district who attended nonpublic schools located either in or outside your school district.

Year	Resident nonpublic school enrollment*	
	Grades 1-8	Grades 9-12
1950		
1951		
1952		
1953		
1954		
1955		
1956		
1957		
1958		
1959		
1960		

*Enrollments as of _____ each year.
(date)

Prepared by _____

Title _____

_____
school district

DATA COLLECTION FORM S-2

Annual Number of Retentions by Grade

Please list for each year indicated the number of pupils in each grade who were retained for any reason.

	Number of pupils retained in each grade											
Year	1	2	3	4	5	6	7	8	9	10	11	12
1950												
1951												
1952												
1953												
1954												
1955												
1956												
1957												
1958												
1959												
1960												

Prepared by _____

Title _____

_____
school district

DATA COLLECTION FORM S-3

Annual Number of Drop-outs

Please list for each year the number of pupils who dropped out of school in each grade indicated.

Year	Number of drop-outs by grade			
	9	10	11	12
1950				
1951				
1952				
1953				
1954				
1955				
1956				
1957				
1958				
1959				
1960				

Prepared by _____

Title _____

_____
school district

DATA COLLECTION FORM S-4

Population of the School District

Please list the total population (all ages) of the school district for each year indicated.

Year	Total population
1950	
1951	
1952	
1953	
1954	
1955	
1956	
1957	
1958	
1959	
1960	

Prepared by _____

Title _____

_____
school district

DATA COLLECTION FORM S-5

High School Graduation

For each year indicated please list the number or percent (whichever is most readily available) of school district residents 25 years of age and older who had completed high school

Year	Residents 25 and older who had completed high school	
	Number	Percent
1950		
1951		
1952		
1953		
1954		
1955		
1956		
1957		
1958		
1959		
1960		

Prepared by _____

Title _____

_____
school district

DATA COLLECTION FORM S-6

Annual Public School Enrollment by Grade

Please list the number of pupils by grade for each year indicated.

	Enrollment by grade*											
Year	1	2	3	4	5	6	7	8	9	10	11	12
1950												
1951												
1952												
1953												
1954												
1955												
1956												
1957												
1958												
1959												
1960												

*Enrollments as of _____ each year.
(date)

Prepared by _____

Title _____

_____
school district

DATA COLLECTION FORM S-7

Financial Data

Please list the total tax duplicate of the school district (as certified by the auditor), school tax rates for current operation and debt service, and the total annual expenditure for public education by the categories indicated.

Year	Tax duplicate	School tax rates		Total expenditure for public education	
		Current operation	Debt service	General fund	Debt service*
1950					
1951					
1952					
1953					
1954					
1955					
1956					
1957					
1958					
1959					
1960					

*Include both principle and interest payments.

Prepared by _____

Title _____

_____
city

DATA COLLECTION FORM C-1

Child Welfare

For each year indicated please list the total funds expended for child welfare in your city.

Year	Funds expended for child welfare
1950	
1951	
1952	
1953	
1954	
1955	
1956	
1957	
1958	
1959	
1960	

Prepared by _____

Title _____

_____
city

DATA COLLECTION FORM C-2

Unemployment

For each year indicated please list the percent of unemployed persons in the total work force of your city.

Year	Percent of unemployed*
1950	
1951	
1952	
1953	
1954	
1955	
1956	
1957	
1958	
1959	
1960	

*Unemployed as of _____ each year.
(date)

Prepared by _____

Title _____

_____
city

DATA COLLECTION FORM C-3

Dwelling Unit Construction

For each year indicated please list the total residential dwelling units constructed; count each unit separately in apartments of double houses.

Year	Dwelling units constructed
1950	
1951	
1952	
1953	
1954	
1955	
1956	
1957	
1958	
1959	
1960	

Prepared by _____

Title _____

_____
city

DATA COLLECTION FORM CC-1

Population Migration

Please list for each year indicated the number of persons who migrated into or out of the city.

Year	Total migration	
	Into the city	Out of the city
1950		
1951		
1952		
1953		
1954		
1955		
1956		
1957		
1958		
1959		
1960		

Prepared by _____

Title _____

_____
city

DATA COLLECTION FORM _____

City Population

Please list the total population and the nonwhite population of the city for each year indicated.

Year	Total population	Nonwhite population
1950		
1951		
1952		
1953		
1954		
1955		
1956		
1957		
1958		
1959		
1960		

Prepared by _____

Title _____

_____
city

DATA COLLECTION FORM CC-3

High School Graduation

For each year indicated please list the number or percent (whichever is most readily available) of city residents 25 years of age and older who had completed high school.

Year	Residents 25 and older who had completed high school	
	Number	Percent
1950		
1951		
1952		
1953		
1954		
1955		
1956		
1957		
1958		
1959		
1960		

Prepared by _____

Title _____

_____

city

DATA COLLECTION FORM _____

Family Income

Please list for each year indicated the average income per family or household and the percent of families or households having total annual incomes under $2,000.

Year	Average family income	Percent having income under $2,000
1950		
1951		
1952		
1953		
1954		
1955		
1956		
1957		
1958		
1959		
1960		

Prepared by _____

Title _____

_____
city

DATA COLLECTION FORM CC-5

Retail Sales

Please list the total retail sales within the city for each year.

Year	Total retail sales
1950	
1951	
1952	
1953	
1954	
1955	
1956	
1957	
1958	
1959	
1960	

Prepared by _____

Title _____

_____
city

DATA COLLECTION FORM CC-6

Employment

Please list for each year indicated the percent of persons in the total work force in the city who were classified as professional, managerial, and clerical or sales; in the second column list the percent of unemployed persons in the total work force of the city on a particular date each year.

Year	Percent classified as professional, managerial, and clerical or sales	Percent unemployed*
1950		
1951		
1952		
1953		
1954		
1955		
1956		
1957		
1958		
1959		
1960		

*Unemployed as of _____ each year.
(date)

Prepared by _____

Title _____

_____

city health district

DATA COLLECTION FORM H-1

Vital Statistics

For each year indicated please list the number of resident deaths (all ages), resident births, and infant deaths (under one year).

Year	Resident deaths	Resident births	Resident infant deaths
1950			
1951			
1952			
1953			
1954			
1955			
1956			
1957			
1958			
1959			
1960			

Prepared by _____

Title _____

_____
city health district

DATA COLLECTION FORM H-2

Female Population by Age Group

For each year please list the number of resident females by indicated age group.

Year	Females aged 15 to 29	Females aged 30 to 44
1950		
1951		
1952		
1953		
1954		
1955		
1956		
1957		
1958		
1959		
1960		

Prepared by _____

Title _____

Example Showing Conversion of Raw Data
to Percent Index Score
Variable 17, Elementary School Enrollment,
City C

Year	Raw Data	Percent Index Score
1950	23,245	--
1951	23,900	103
1952	25,111	108
1953	26,849	115
1954	27,563	119
1955	28,649	123
1956	28,913	124
1957	29,772	128
1958	30,468	131
1959	31,459	135
1960	32,097	138

The percent index scores were obtained by dividing each raw data entry by the raw data entry for the year 1950, rounding the quotient to the nearest hundredth, and multiplying the result by one hundred.

A proof that the Pearson product-moment correlation coefficient between two variables x and y is the same as that between the same variables divided respectively by the constants k and l

1. Let variable x have the items $a_1, a_2, a_3, \ldots a_n$

2. Let variable y have the items $b_1, b_2, b_3, \ldots b_n$

3. The Pearson product-moment correlation coefficient between x and y is given by the formula:

$$r_{xy} = \frac{N(a_1b_1+a_2b_2+a_3b_3 \ldots +a_nb_n) - (a_1+a_2+a_3 \ldots +a_n)(b_1+b_2+b_3 \ldots +b_n)}{\sqrt{[N(a_1^2+a_2^2+a_3^2 \ldots +a_n^2) - (a_1+a_2+a_3 \ldots +a_n)^2][N(b_1^2+b_2^2+b_3^2 \ldots +b_n^2) - (b_1+b_2+b_3 \ldots +b_n)^2]}}$$

4. Let each item of x and y be divided respectively by the constants k and l

5. Then the coefficient of correlation between $\frac{x}{k}$ and $\frac{y}{l}$ is the same as that between x and y, or

$$r_{\frac{xy}{kl}} = r_{xy}$$

PROOF

6. $$r_{\frac{xy}{kl}} = \frac{N\left(\frac{a_1b_1+a_2b_2+a_3b_3 \ldots +a_nb_n}{kl}\right) - \left(\frac{a_1+a_2+a_3 \ldots +a_n}{k}\right)\left(\frac{b_1+b_2+b_3 \ldots +b_n}{l}\right)}{\sqrt{N\left[\frac{a_1^2+a_2^2+a_3^2 \ldots +a_n^2}{k^2}\right] - \frac{(a_1+a_2+a_3 \ldots +a_n)^2}{k^2}\Bigg]\; N\left[\frac{b_1^2+b_2^2+b_3^2 \ldots +b_n^2}{l^2}\right] - \frac{(b_1+b_2+b_3 \ldots +b_n)^2}{l^2}\Bigg]}}$$

7. $$r_{\frac{xy}{kl}} = \frac{\frac{N(a_1b_1+a_2b_2+a_3b_3 \cdots +a_nb_n) - (a_1+a_2+a_3 \cdots +a_n)(b_1+b_2+b_3 \cdots +b_n)}{kl}}{\sqrt{\frac{[N(a_1^2+a_2^2+a_3^2 \cdots +a_n^2) - (a_1+a_2+a_3 \cdots +a_n)^2][N(b_1^2+b_2^2+b_3^2 \cdots +b_n^2) - (b_1+b_2+b_3 \cdots +b_n)^2]}{k^2l^2}}}$$

8. $$r_{\frac{xy}{kl}} = \frac{N(a_1b_1+a_2b_2+a_3b_3 \cdots +a_nb_n) - (a_1+a_2+a_3 \cdots +a_n)(b_1+b_2+b_3 \cdots +b_n)}{\sqrt{[N(a_1^2+a_2^2+a_3^2 \cdots +a_n^2) - (a_1+a_2+a_3 \cdots +a_n)^2][N(b_1^2+b_2^2+b_3^2 \cdots +b_n^2) - (b_1+b_2+b_3 \cdots +b_n)^2]}}$$

9. $\therefore$ $r_{\frac{xy}{kl}} = r_{xy}$

BIBLIOGRAPHY

Books

American Association of School Administrators, School Building Commission. Planning America's School Buildings. Washington: The Association, 1960. Chapter VIII, "Predicting Pupil Population," pp. 105-115.

Bernert, Eleanor H., and Nam, Charles B. "Demographic Factors Affecting American Education," Chapter IV of Social Forces Influencing American Education: 60th Yearbook of the National Society for the Study of Education, Part II. Chicago: The University of Chicago Press, 1961. Pp. 89-119.

Bowen, Ezra. An Hypothesis of Population Growth. (Studies in History, Economics, and Public Law, No. 343.) New York: Columbia University Press, 1931.

Englehardt, Fred. Forecasting School Population. New York: Teachers College, Columbia University, 1925.

Harman, Harry H. Modern Factor Analysis. Chicago: The University of Chicago Press, 1960.

MacConnell, James D. Planning for School Buildings. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1957.

Pearl, Raymond, and Reed, Lowell J. "On the Rate of Growth of the Population of the United States Since 1790 and Its Mathematical Representation," Proceedings of the National Academy of Sciences, VI (June 15, 1920), pp. 275-288.

Strevell, Wallace H., and Burke, Arvid J. Administration of the School Building Program. New York: McGraw-Hill Book Company, 1959. Pp. 199-210.

Sumption, Merle R., and Landes, Jack L. Planning Functional School Buildings. New York: Harper and Brothers Publishers, 1957. Chapter VI, "Predicting the Pupil Population," pp. 63-79.

Thompson, Warren S. Population Problems. 4th ed. New York: McGraw-Hill Book Co., 1953.

U. S. Department of Commerce, Bureau of the Census. Statistical Abstract of the United States, 1963. 84th ed. Washington: U. S. Government Printing Office, 1963.

Articles and Periodicals

Chamberlain, Leo M., and Crawford, A. B. "The Prediction of Population and School Enrollment in the School Survey," Bulletin of the Bureau of School Service, IV, No. 3. Lexington: University of Kentucky Press, 1932.

Collins, George J., and Langston, LaMoine. "Guesstimating Future School Enrollments," American School Board Journal, CXLIII (December, 1961), pp. 10-12.

Cowgill, Donald Olen. "The Theory of Population Growth Cycles," The American Journal of Sociology, LV (September, 1949), pp. 163-170.

Eby, Kermit. "Population Decline--Its Effect on Education," Illinois Education, XXX (October, 1941), pp. 45-6ff.

Englehardt, N. L., Jr. "The Impact of Population Trends on Long-range Planning," American School and University, 1953-54, XXV. New York: American School Publishing Corporation, 1953. Pp. 149-152.

Gottlieb, Abe. "A Planning Approach to School Enrollment Forecasts," American School Board Journal, CXXVIII (February, 1954), pp. 68-69, 110.

Harvey, O. L. "Enrolment Trends and Population Shifts," The Elementary School Journal, XXXVIII (May, 1938), pp. 655-662.

_____. "Enrolment Trends in Elementary-School Grades, by States," The Elementary School Journal, XXXIX (November, 1938), pp. 200-210.

Hedlund, Paul A. "How to Estimate Future Public School Enrollments," American School Board Journal, CXX (February, 1950), pp. 27-28, 94.

Herrick, John H. "Estimating Future Enrollments in Rapidly Growing Communities," Educational Research Bulletin, XXXI (April 16, 1952), pp. 92-94, 111, 112.

Hobson, Carol Jay, and Schloss, Samuel. "Enrollment, Teachers, and Schoolhouses," School Life, XLVI (January-February, 1964), pp. 18-23.

Holy, T. C. "What Future School Building Needs Are Revealed by School Population Studies?" American School Board Journal, CXIV (May, 1947), pp. 39-40, 84.

Kuang, H. P. "Forecasting Future Enrollments by Curve-Fitting Techniques," Journal of Experimental Education, XXIII (March, 1955), pp. 271-274.

Larson, Knute, and Strevell, Wallace H. "How Reliable Are Enrollment Forecasts?" School Executive, LXXI (February, 1952), pp. 65-68.

Moore, Harold E. "Estimating the School Population to Be Served," Bulletin of the School of Education, Indiana University, XXII (July, 1946), pp. 47-62.

Morneweck, Carl D. "Analysis of School Enrollment Trends as Influenced by Live Births," American School Board Journal, CIII (August, 1941), pp. 31-32.

National Education Association, Research Division. "Population Trends and Their Educational Implications," Research Bulletin, XVI (January, 1938), pp. 1-59.

Pearl, Raymond, and Reed, Lowell J. "On the Mathematical Theory of Population Growth," Metron, III, No. 1 (1923), pp. 6-19.

Scammon, Richard. "Projecting Student Enrollment," Overview, III (December, 1962), pp. 39-41.

Siegel, Jacob S., and Hamilton, C. Horace. "Some Considerations in the Use of the Residual Method of Estimating Net Migration," Journal of the American Statistical Association, XLVII (September, 1952), pp. 475-500.

Strevell, Wallace H. "School District Records Predicate Future Enrollments," Educational Administration and Supervision, XXXVIII (February, 1952), pp. 102-106.

_____. "Techniques of Estimating Future Enrollment," American School Board Journal, CXXIV (March, 1952), pp. 35-37.

Stuart, Byron D. "School Enrollment Trends: Their Causes and Educational Implications," American School Board Journal, XCVI (March, 1938), pp. 22-24.

Throop, Harold L., Jr. "Simplifying Student Population Projections," American School Board Journal, CXLV (July, 1962), pp. 11-12.

Zitter, Meyer. "Forecasting School Enrollment for the United States and Local Areas," The Journal of Teacher Education, V (March, 1954), pp. 53-63.

Reports

Armstrong, Charles M., and Harris, Mary S. A Method of Predicting School-Age Population. Albany: The State Education Department, The University of the State of New York, 1949.

Brown, Roscoe C., Jr. Predicting School Enrollments. New York: Center for School Services, School of Education, New York University, 1961.

Jacoby, E. G. Methods of School Enrollment Projection. (Educational Studies and Documents, No. 32.) Paris: UNESCO, 1959.

Jonassen, Christen T., and Peres, Sherwood H. Interrelationships of Dimensions of Community Systems. Columbus: The Ohio State University Press, 1960.

Metropolitan School Study Council, The Committee on School Buildings. Forecasting School Enrollments. New York: The Council, 1953.

Robinson, Glen Edward. Some Trends in School-age Population, Enrollment, and Attendance in the Southern Region. Nashville: Southern States Cooperative Project in Educational Administration, George Peabody College for Teachers, 1955.

Stanbery, Van Beuren. Better Population Forecasting for Areas and Communities. (Domestic Commerce Series, No. 32, U. S. Department of Commerce.) Washington: U. S. Government Printing Office, 1952.

State of Indiana, Department of Public Instruction. How to Study School Building Needs. Bulletin No. 216. Indianapolis: The Department, 1953. "Section III: School Administration, Organization, and Population." Pp. 29-67.

U. S. Department of Commerce, Bureau of the Census. Current Population Reports: Population Characteristics, Series P-20, No. 126, September 24, 1963.

U. S. Department of Commerce, Bureau of the Census. Forecasts of the Population of the United States 1945-75. Washington: U. S. Government Printing Office, 1947.

U. S. Department of Commerce, Bureau of the Census. U. S. Census of Population: 1960, Detailed Characteristics, Ohio. Final Report PC (1) - 37D. Washington: U. S. Government Printing Office, 1962.

U. S. Department of Health, Education, and Welfare, Office of Education. Enrollment in Public and Nonpublic Elementary and Secondary Schools 1950-80, Circular 692. Washington: U. S. Government Printing Office, 1962.

U. S. Department of Health, Education, and Welfare, Office of Education. Fall Enrollment, Teachers, and Schoolhousing, O. E. 20007. Washington: U. S. Government Printing Office, 1957-1963.

U. S. Department of Labor, Bureau of Labor Statistics. Consumer Price Index: Price Indexes for Selected Items and Groups. Washington: U. S. Government Printing Office, September, 1962.

Unpublished Materials

Ellena, William J. "A Technique for Predicting Pupil Yield by Types of Dwelling Units." Unpublished Ed.D. dissertation, University of Maryland, 1959.

Komorek, John J. "A Critical Study of the School Census." Unpublished Ed.D. dissertation, Boston University School of Education, 1955.

Laidig, Eldon L. "An Investigation of Public School Enrollment Predicting Techniques." Unpublished Master's thesis, The University of Texas, 1960.

Peterson, Donald Lee. "An Investigation of Techniques for Predicting School District Enrollments in Florida." Unpublished Ed.D. dissertation, University of Florida, 1959.

Rizzo, John Raymond. "An Approach to the Interpretation and Naming of Factors." Unpublished Master's thesis, The Ohio State University, 1961.

Simon, Kenneth Alan. "Enrollment Forecasting in the Public Elementary and Secondary Schools of Pennsylvania." Unpublished Ed.D. dissertation, The Pennsylvania State University, 1959.

Strand, William H. "Forecasting Enrollment in the Public Schools." Unpublished Ph.D. dissertation, University of Minnesota, 1954.

Wheeler, Norman S. "Techniques Used for Predicting Public School Enrollments in Detroit, Michigan, Using the Elementary School Service Area as a Base for All Units." Unpublished Ed.D. dissertation, Wayne University, 1955.

Other Sources

_____. Personal Interview with M. J. Conrad, Head, Educational Administration and Facilities Division, The Bureau of Educational Research and Service, The College of Education, The Ohio State University, March 31, 1964.