1

Introduction

This volume presents statistical time series on trends in education in the United States. The principal purpose is to bring together time series that indicate changing characteristics of education -- education considered both organizationally and as a characteristic of the population.

In "laying out" statistical time series and in searching for indicators of educational change, many single-time studies of the educational system had to be neglected. Similarly, time series of trends in limited or localized areas are disregarded, except in using them to illustrate a series not otherwise available for the nation as a whole.

The educational system offers a variety of statistical evidence on itself. One may be surprised to find so many time series available on trends in education. Upon closer inspection, however, one may be equally amazed that so "literate" a system as Education, with a capital E, does not provide more evidence on many vital aspects of the system, such as the amount of learning that takes place or the qualifications of the teaching staff. Such omissions become evident when the data are assembled in one place.

By assembling in one place a great part of the statistical evidence one may then identify the missing elements, the data needed for adequate monitorship of the system.

"Monitorship of the system" may have several functions. Statistical measures across time serve to identify changes. Whether a characteristic is increasing or decreasing may be intrinsically interesting to us, such as whether a larger or smaller percentage of the 17-year-olds are enrolled in school, or whether the number graduating from engineering colleges is increasing or decreasing. Such intrinsically interesting indicators may be called criterion indicators and monitored from the viewpoint of the society.

A change in a statistical measure may also indicate a forecast of a future change in another, perhaps more important, statistical measure. Thus, a decrease in school enrollment of one population category may herald a decline in educational attainment of that population cohort five or ten years later, or a decline in Bachelor's degrees may forecast a decrease in Master's degrees a few years later, as did first-level degrees in Agriculture when they began to decline in 1958-59. Just as "leading indicators" have proven quite valuable in business forecasting, herald (or mercurial) indicators, when identified and when the systemic linkage is verified, may prove equally valuable in signaling the need for counter-moves or other adjustments to forestall an unwanted future consequence.

However, the linkage between indicators may not always be obvious. The change in one indicator may be associated with a change in another but the important, causative force may be a

third variable whose influence is not understood or suspected. A third purpose, then, in monitoring social indicators is to identify significant changes that cry to be explained. There are two approaches in discovering the interactions and interconnections among elements of the social system which will identify such cause-effect linkages. Ideally, both would be firmly grounded in a theory of how the system functions, a model.

One approach would associate the criterion indicator with other indicators of changes in the system, indicators theoretically relevant to the criterion. Regression analysis of time series rests upon the adequacy of the theory and the precision of the indicators. It leads to statements of what "accounts for" changes in the criterion. As an example, the continuation of students in secondary school from one class to another is analyzed (chapter 2) in relation to changes in unemployment, in per capita expenditures, and to changes in the size of the Armed Forces. Such a regression analysis offers some explanation of the change in the criterion indicator and leads to identifying other measures needed for more complete explanation, in this example, marriage rates by age and sex, fertility rates, etc.

A second approach in identifying cause-effect linkages would develop a basis for predicting the indicator at successive points in time through establishing the interrelations at one

point in time. Intensive cross-sectional studies would be made using both the measures comprising the time series and other variables. Thus, an indicator of achievement in a subject might be predicted through multiple regression methods, as was done in Equality of Educational Opportunity (Coleman, et.al., 1966: 292-334). Such cross-sectional analyses lead to the identification of important cause-effect linkages affecting the criterion indicator. By introducing the new measures so identified into the system of social indicators in time series, the basis for prediction is enhanced.1/

In summary, the purpose of this volume is to present a number of indicators of change in the educational system. This assembly is intended to provide a basis for monitoring education (within the limits of currently available statistics). Such monitorship should detect changes in important indices that reflect the adequacy of education in the United States. It also should lead to identifying linkages between leading, or lagging, indicators, particularly in cases where some systemic relationship between the two is theoretically reasonable. Such linkages may be identified through analysis of changes in indicators across time and through cross-sectional studies which establish a basis for predicting a dependent variable (a criterion indicator) upon the basis of a set of independent variables.

The Interpretation of Trends

If a change occurs in an indicator, what has caused the change? To isolate the relationship between cause and effect gives society the basis for adjusting the system so that the desired rather than the undesired end comes about. Knowing the cause-effect relationships sometimes is easy: the return of veterans to school under the G.I. Bill of Rights after World War II stimulated an increase in degrees. Discovering why degrees thereafter continued to increase, after a brief decline, however, is not quite as easy. Did an increase in the population of college age, or an increase in the graduation rate, or both cause the increase? This problem is explored in chapter 5.

In analyzing the basis for changes in the educational system, measures of the resources going into the system and of the results coming from the system provide a model with a great deal of appeal, logically and practically. Such system analysis, however, requires knowledge of the interactions within the system and measures of the relevant variables. One of the disappointments of this study is that such a comprehensive use of the data was not possible. We have a few, and very few, measures of "input" and even fewer measures of "output," but we know almost nothing about interaction within the system. This is perhaps the most important single consideration for those who might wish to develop educational statistics into the needed tools for planning and evaluation. To begin such a development, knowledge first of interrelations among variables in the most elemental unit is needed, interaction in the classroom and the school.

Even so, limited input-output considerations are presented and more undoubtedly may be developed from the data presented herein. Measures of college graduates in relation to first-time enrollment four years earlier is a simple input-output measure that reflects the change in "inputs" needed to produce a given level of "output."

While trends may be interpreted in terms of the functioning of the system, trends also may be interpreted in relation to some goal. To what extent are various educational goals being achieved? To demonstrate this use, some of the (measurable) educational goals in the 1960 report of the President's Commission on National Goals were evaluated by determining the degree to which they had been achieved. This exercise could not evaluate all of the educational goals set by the Commission, for the evidence on many of them was not to be found.

Using goals as the basis for interpreting trends, however, makes social indicators of the educational system a necessary adjunct to educational planning and evaluation. Perhaps serious planning for the educational system should always be accompanied by the development or use of indicators measuring the degree to which the goal of the plan is achieved. This use of indicators however, may contribute little to our understanding of how the system functions.2/

Another basis for interpreting trends uses aggregated indicators, decomposed into their constituent parts, a topic discussed next.

Aggregated and Disaggregated Measures

A measure representing the United States, whether a rate or a simple total of those possessing a given characteristic, is an aggregate measure. While such measures may reflect important changes across time in some phenomenon, they also mask much of the variability of the phenomenon. The term, disaggregate, has been used by economists to refer to a global measure that is decomposed into parts reflecting its variability An educational indicator may be disaggegated according to the categories or types of the population composing it, for example by such traits as sex, color, geographic area, income, and others.

Disaggregation by geographic area is highly appropriate for most of the data presented in this volume. Geographic detail by state or county serve to narrow the focus on the situation or problem. However, such disaggregation was not attempted for this volume. Detail by sex, color and age are presented for a few series, where appropriate, and a few aggregates are broken down into subcategories.

Disaggregation becomes especially important, also,when the aggregated statistic exhibits a change requiring an explanation. Then, decomposition into its parts will help identify the elements associated with the change in the aggregate. Thus, the plateau reached in the indicator of educational attainment (12 or more years schooling) in 1964 by nonwhite males 20-24 years of age is explored (chapter 7) in relation to sub-levels of attainment, of smaller age groups, and in relation to the school

enrollment of the age cohorts at an earlier date. Such disaggregation, or one might call it analysis into more elemental classes, is a rather important step in the use of social indicators. When the aggregate trend presents a change of interest, the analyst proceeds to examine the more elementary bases for the change, both in time, in place, as well as according to categories of the population. Analytical steps of this kind are needed in monitoring social indicators.

Criteria for the Selection of an Indicator

No single criterion was used to select educational indicators. Several criteria were used. The state of knowledge at present is not adequate to define which indicators are most useful and which are not. Accordingly, some indicators included may prove useless.[3/]

Criterion indicators were included if the series measured a condition of the educational system thought to be desirable or undesirable from the vantage point of an effective system. As an example, a pupil-teacher ratio provides a global index of the adequacy of teacher manpower with respect to pupils to be taught. Generally, the rationale is that the lower the number of pupils per teacher the more likely is the teacher to provide an environment to stimulate sound learning. Another example is the percent of secondary school teachers with less than standard teacher's certificates, reflecting the adequacy of preparation of the secondary school teaching staff.

A number of series are included because they contribute to the development of a criterion indicator and are a necessary part of a criterion measure. Following the preceding paragraph, an example is the number of pupils and of teachers, by level. Space, however, does not permit the inclusion of all such data. The sources of data, set forth in Notes to the Series, provide the key to retrieving such aggregates as one might want to analyze further.

Some indicators were included because they appeared to forecast the future. While school enrollment by age-sex-color groups is a valuable indicator in itself, it also forecasts the educational attainment of a future age-sex-color group. Consequently, if a series appeared to indicate a situation requiring a future adjustment, it was included. Whether or not a forecast is realized in the future depends upon whether an active effort is made to alter the assumptions. Thus, a prediction of a shortage in the supply of teachers may be followed by efforts to increase the supply, efforts that cause the forecast never to be realized. Other examples of indicators which are useful forecasts of the future are the number of 5-year-olds, the rate of enrollment in college, and the percentage of first-time college enrollment in junior colleges.

A few indicators that show changes in a single state, e.g., Iowa, are presented because national measures are unavailable. If available nationally, such an indicator would provide a useful criterion of the educational system. For example, the

achievement test scores of high school seniors in Iowa, by subject, reflect the trend in the quality of learning and hence the quality of the educational system. Such measures for the nation would evaluate the system as no currently available measure does.

While these characteristics have provided general guidance in selecting data for this volume, limitations of space also placed bounds upon the number of series that could be presented. Consequently, not all series fulfilling these characteristics could be included.

Major Sources of Data

The data brought together in this volume come primarily from two sources: the U. S. Bureau of the Census, based upon the Decennial Census, the Current Population Survey, or the Census of Governments; and from the U. S. Office of Education, based upon data collected from state departments of education, directly from the institutions themselves, and upon surveys of students or faculty, etc. The virtue of these two major sources rests upon their continuous use of approximately the same data-collection methods, concepts, definitions, etc., and generally upon the length in time of the series.

While these are the chief sources, other primary sources have been used. For example, included also are test results from the Educational Testing Service, from the Minnesota testing program, data on the desegregation of schools from the Southern Education Reporting Service, results of studies from the National Education Association, and data on aspects of scientific manpower

from the National Register of Scientific and Technical Personnel of the National Science Foundation, and other sources.

The Types of Statistical Series

Six kinds of statistics are presented in the volume:

1. A simple aggregate or frequency, such as the total enrollment in elementary school or the total revenue of institutions of higher education.

2. Ratios and other quotients, expressing one aggregate in relation to another, such as the school enrollment per 100 population of school age, or the expenditure of public elementary and secondary schools per student enrolled.

3. Percentages, expressing the number in one class per 100 in the total of all classes in the set, such as the percentage of 20-24-year-old nonwhite females who have attained four or more years of schooling, or the percent male of all college faculty.

4. Rates, like percentages, expressing the number in one class divided by the total of all eligible, such as the enrollment rate of an age group.

5. Means, medians, etc., expressing the central tendency of a distribution, such as the median years of school completed by a given age-sex-color group, or the mean score of Minnesota junior year high school students on an aptitude test.

6. Contrived aggregates, based upon the sum of a number of frequencies, each weighted with a different value, such as the Academic Production Index, a summation of the product of degrees and an appropriate value for each kind of degree.

The efficacy of these measures is discussed in the context of review of the series, in the text and in the Notes to the Series. However, it should be clear that means, medians, percentages, and rates are more precise measures than ratios and contrived aggregates. In the case of ratios, it is not always certain that the members of the denominator term were eligible for the characteristic in the numerator. As an illustration, the ratio of first-time college enrollment per 100 18-year-olds is not as precise a measure as the percent of 18-year-olds who are enrolled in college. In the case of contrived aggregates, such as the A.P.I. measures, the procedure of aggregating, often involving the summing of products, produces an indicator that is more general than the detail composing it. Indeed, this usually is the reason for developing such an aggregate. The contrived measure, however, has uses beyond those of the separate parts; for example, expenditures of higher educational institutions per API provides a more interpretable measure than would the ratio of expenditures to 4-year degrees.

The Organization of the Volume

The trends in education are presented in major categories of data and, within categories, are generally organized by level of education. Enrollment of students in school is presented first and is followed by a brief chapter on teachers and another on the quality of education. Data on graduates comprise an

extensive chapter. The chapter on trends in institutional organization and finance discusses the number of institutions of various types, the sources of revenue, and the objectives of expenditures, the latter expressed in per capita terms. Then, there is a review of trends in the educational attainment of the population, considered by age, sex, and color. Finally, the concluding chapter assesses the attainment of goals for education as set forth in Goals for Americans (President's Commission on National Goals: 1960).

The statistical series themselves are organized by level and category insofar as this ordering could be conveniently followed. The major categories and the identifying letter of each, follows:

A - Elementary and Secondary, Enrollment

B - Elementary and Secondary, Teachers

C - Elementary and Secondary, Schools and Other

D - Higher Education, Enrollment and Graduates

E - Higher Education, Teachers

F - Higher Education, Institutions and Finances

G - The Population, Educational Attainment, and Enrollment and Labor Force Status

H - Miscellaneous

I - The School-Age Population, by Age and Sex

In addition to these basic statistical series, a few additional time series are introduced here and there in the text. In most instances, these series are short, containing only a few observations, or applying to a region or a state, etc.

Conventions of the Statistical Tables and Graphs

Some educational statistics are logically oriented to the beginning of the school year, such as enrollment, and others, such as graduates, are more logically calibrated to the end of the school year. For this reason, no attempt was made to cast all statistical series in relation to the beginning (fall) of the year or to the end (spring) of the school year. Consequently, the following symbols are found at the head of the statistical columns:

SYEOD: School Year Ending on Date, meaning that the statistic refers to the school year that ends on the date appearing in the row.

SYB: School Year Beginning, meaning that the statistic refers to the school year beginning on the date appearing in the row. This symbol was shortened, that is, OD (on date) was eliminated, in order to more easily distinguish it from SYEOD.

"Base year" refers to the year of the data used as the denominator of the statistic. Continuation ratios, for example, utilize data from two successive years, and are presented on the base year, that is, the year of the denominator statistic.

Depending upon his purpose, the analyst may wish to re-orient a statistical series for another year to which the data may be more relevant to his purposes.

The sources of data are presented as Notes to the Series, beginning on page 276. Here, also, will be found precautionary

notes and information on the data collection methods, etc., where such is appropriate to the series. Some of these notes are keyed to specific statistics of the series by use of a superscript which refers the reader to explanations in the Notes to the Series.

In the illustrations, the following conventions are followed:

Solid or dashed lines: Solid lines are used to connect the points in annual series. Dashed lines are used to connect points in biennial or decennial series. This convention is always followed when the series changes from one period to another, as from decennial observations to annual, or from biennial to annual. In other figures, different symbols for lines are used when several trends on the same graph must be distinguished from one another.

The year: The tables identify the approximate date the data refer to, whether fall of the year, spring of the year, or whether the data are for the school year ending on the date, etc. Graphs represent the data according to these dates. In inspecting data series or comparing one series with another, special attention should be given to the specification of the date in the tables. This applies, especially, to data based upon ratios that may involve more than one year, for in these cases the year of reference depends upon the purpose of the investigator.

Footnotes

1/ Of the 21 economic indicators originally proposed in 1931 by the National Bureau of Economic Research, only 11 are included in the 1966 set of 25 indicators thought most indicative of the American economy (Moore, 1967b: 28).

2/ A discussion of some of the pitfalls of complete reliance upon evaluation of goals as opposed to the other more comprehensive approaches (the system-model) is discussed by Etzioni and Lehman (1967: 7-8).

3/ See footnote 1.