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RESEARCH ON ACHIEVEMENT DETERMINANTS IN EDUCATIONAL SYSTEMS--A SURVEY.

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PRIMARY FINDINGS OF OVER 30 STUDIES DATING FROM 1960 TO 1967, INCLUDING RESEARCH REPORTS, PROGRAM DESCRIPTIONS, AND THEORETICAL FORMULATIONS, ARE SYNTHESIZED IN AN EVALUATION OF CONTEMPORARY LITERATURE ON THE DETERMINANTS OF ACHIEVEMENT IN PUBLIC ELEMENTARY AND SECONDARY SCHOOL SYSTEMS. FOCUS OF THE SURVEY IS ON DETERMINING INPUTS AND OUTPUTS OF EDUCATIONAL SYSTEMS, ESPECIALLY THE CAPACITY OF EDUCATIONAL SYSTEMS FOR RAISING ACHIEVEMENT LEVELS AND CHANGING DEVIANT BEHAVIOR PATTERNS OF LOW-INCOME AND CULTURALLY DEPRIVED STUDENTS. PER PUPIL EXPENDITURE AS A KEY DETERMINANT HAS BEEN GENERALLY REFUTED. OTHER VARIABLES STUDIED INCLUDE TEACHER CHARACTERISTICS, PEER ATTITUDES AND CHARACTERISTICS, SCHOOL PROGRAM, FAMILY BACKGROUND, MINORITY GROUP MEMBERSHIP, SOCIOECONOMIC LEVEL OF CITY AND SCHOOL DISTRICT, SPECIFIC SCHOOL CHARACTERISTICS, GEOGRAPHIC LOCATION, AND ETHNIC STRATA. THE SIX VARIABLES MOST CLEARLY RELATED TO ACHIEVEMENT GAINS IN TWO OR MORE OF THE STUDIES SURVEYED INCLUDE MALE TEACHER STARTING SALARIES, AVERAGE NUMBER OF YEARS OF TEACHING EXPERIENCE, NUMBER OF BOOKS IN THE SCHOOL LIBRARY, AVERAGE CLASS SIZE, PUPIL/TEACHER RATIO, AND PERCENT OF GRADUATES GOING TO COLLEGE. FURTHER CROSS SECTIONAL AND LONGITUDINAL STUDIES ARE NEEDED TO DETERMINE WHAT FACTORS AFFECT ACHIEVEMENT INCREASE AND STUDENT RETENTION. (JK)

NATIONAL CENTER FOR EDUCATIONAL STATISTICS
Division of Operations Analysis

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by

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RESEARCH ON ACHIEVEMENT DETERMINANTS IN EDUCATIONAL SYSTEMS : A SURVEY

INTRODUCTION

This note surveys research relevant to the specification of achievement models and outlines problems encountered when one looks at the needs of a particular part of the student population. A central focus of current educational concern is the capacity of educational systems for raising achievement levels and changing deviant behavior patterns of low-income and culturally deprived students. Past research relevant to this question leaves educational model-builders with an array of challenging tasks.

Two types of studies dominate the literature in this field (1) cross-sectional studies using multiple correlation to estimate the degree to which achievement (measured typically in averages) differentials are attributable to differences in school program or personnel inputs and (2) longitudinal studies following student participants over time to estimate input-output relations for pilot demonstration programs diffused across the nation. Difficulties that researchers have encountered in precisely specifying input-output relations in schools are numerous.

For example, accounting for inter-school differences based on regional urban-rural, and socioeconomic factors, leaves little explanatory power for school input variable per se. The interaction, as a child progresses through school, between socioeconomic characteristics of his home and socioeconimic characteristics of his school environment is a process relating to his achievement. Isolating the precise nature

and estimating the importance of this relationship is not easy.[1/] Another example is that variations in per pupil expenditures within states are limited to a narrow range. A California study found that districts in that state tended to adjust local effort to approach the state average overtime, regardless of migration, fund sources or other localized change.[2/] Many states have state programs whose purpose is to equalize per pupil expenditures among their school districts. Hence, efforts to aggregate effects of spending on achievement are thwarted by the fiscal trends within states and by the way in which data is collected. Longitudinal studies to date have the advantage of following students through time rather than using cross-sectioned, surrogate measures of causation and change. They have related only to limited groups (i.e., a few states or cities) or single projects.

A striking characteristic of Congressional testimony given prior to the passage of Elementary and Secondary Education Act in 1965 is its lack of quantitative estimates of which, among a multitude of variables, are those which yield highest productivity in terms of achievement differentials. A survey of research funded by the Office of Education and catalogued in Educational Resources Information

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1/ Gorfinkel, Maury H., et al., Cost-Benefit Model to Evaluate Educational Programs (Prepared for NCES, Contract OEC 4-7-000010-0010), Menlo Park, California: Stanford Research Institute, April, 1967, pp. III-22.

2/ Spiegelman, R., et al., Entitlements for Federally Affected School Districts Under Public Laws 874 and 815, SRI (Monograph), Menlo Park, California; Stanford Research Institute, May, 1965, pp. 116-176.

Center, reveals that the greatest proportion of studies prior to 1965 were designed to answer one or more of the following questions:

1. How are poverty, cultural deprivation, and other such terms best defined?

2. What behavioral and attitudinal patterns maximize the ability of middle-class adults to relate productively to learning styles of underachievers (or low-income youths) in a school setting?

3. What behavioral norms characterize low-income underachievers? "Good" achievers?

4. How can predictive testing instruments be designed for culturally different student groups?

5. How should compensatory education programs be evaluated?

6. How can motivation of underachieving children be maximized?

7. How can the school setting compensate for initial socioeconomic differences of students?

The emphasis in research on educational psychology and sociology as opposed to economics is exemplified by the fact that ERIC Indexes for 1956-63 contain no category called "low income" and list no funded research projects under the category "economic." Social class differences are those which differentiate participants in compensatory education programs from nonparticipants. Those relatively few research projects before 1965 which dealt with economic features of educating low income youths make establishing baselines for Elementary and Secondary Education Act program evaluation difficult. A look at these pieces of research will reveal why.

RESEARCH ON DETERMINANTS OF ACHIEVEMENT

A summary by the National Education Association of programs for the disadvantaged in 1963 cited programs in 42 out of more than 26,000 districts in the nation. These were pilot demonstrations in a few schools within these 42 districts.[3] The research funded by the Office of Education in this field prior to 1965 focused on many of these single district projects. In 1960 an Office of Education publication presented profiles of finance programs for 1957-58 which emphasized sources and distributions of funds by state.[4] While cost accounting data presented in this volume disclose foundation program and special purpose grant program funds expended by program type, only rough estimates of the level of fiscal effort devoted specifically to low-income youths are derivable. For example, the largest percentage of state funds were granted to districts in special purpose flat-grant distributions. Theoretically conducive to local initiation of educational services to meet needs not specified in these grants, flat grants are complemented by equalization grants designed to raise support levels of financially weaker districts in the State. Vocational education and programs for physically handicapped and mentally retarded youths were the most common special purpose flat

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3/ National Education Association, School Programs for the Disadvantaged, Circular No. 2, 1963, Washington: NEA Educational Research Service, February, 1963.

4/ Munse, Albert R., McLoone, Eugene P., Public School Finance Programs of the U.S., 1957-58, OE 22002, No. 33, U. S. Department of Health, Educational and Welfare, 1960.

grants relevant to the disadvantaged, as the chart on page 5a shows.[5] Eligibility for participation in these programs does not include low-income level in any state. The participation rates by income category are unavailable. Gross amounts of money expended for these purposes are included for 1957-58, but are of little help in estimating output per unit of input, which is the critical economic question. A complete definition of school output as measured by incremental achievement should include gains in academic achievement, social competence, citizenship and responsibility, judgment, self-confidence, and creativeness. A definition of efficiency for a particular curriculum component is maximum increased achievement, measured on instruments valid for that curriculum component and student group, per unit of funds expended for that component.

This definition, however, assumes that per pupil expenditures are the key determinant of pupil achievement. Studies both before and after 1965 refute this notion. Project Talent's well-known finding that in some types of cities the relationship between achievement and expenditure per pupil (defined either in Average Daily Attendance or Average Daily Membership terms)[6] is hard to interpret since these effects are not adjusted for family background or school environment

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5/ The chart was assembled from separate state profiles in Albert R. Munse, Eugene P. McLoone, op. cit.

6/ A strong relation was found in: Cities over 1½ million in population with generally low incomes, Northwestern cities with less than 250,000 persons, low income Western cities with less than 250,000 persons, Southeastern cities with moderate income, and small Western towns, Project Talent One Year Follow-up Studies, University of Pittsburgh, School of Education, 1966.

PRE 1960 PROGRAM FUNDS CATEGORICALLY GRANTED FOR DISADVANTAGED-RELATED EDUCATION PROGRAMS[1]

	Vocational Education	Physically Handicapped[2]	Mentally Retarded[3]	Adult Education
Alabama	x			
Arizona	x			
Arkansas	x	x		
California		x	x	
Colorado	x	x	x	
Connecticut	x	x	x	x
Delaware		x	x	
Florida	none			
Georgia	x			
Idaho	x			
Illinois	x	x		
Indiana	x	x		
Iowa	x	x		
Kansas	x	x	x	
Kentucky	none			
Louisiana	x	x		x
Maine	x	x	x	x
Maryland		x	x	x
Massachusetts	x	x	x	
Michigan	x	x	x	x
Minnesota	x	x		
Mississippi	x	x		
Missouri	x	x		
Montana	x			
Nebraska	x	x		
Nevada	x	x		
New Hampshire	x			
New Jersey	x	x		x
New Mexico	none			
New York		x		x
North Carolina	x			
North Dakota	x	x		
Ohio	none			
Oklahoma	x	x		
Oregon	x	x	x	
Pennsylvania		x	x	x
Rhode Island	x	x		
South Carolina	x			x
South Dakota		x	x	
Tennessee	x		x	
Texas	none			
Utah	x			
Vermont	x	x		
Virginia	x	x		x
Washington		x		
West Virginia	x	x		
Wisconsin	x	x	x	x
Wyoming	none			
Alaska	x	x		
Hawaii	none			

1/ Readers should not deduce that compensatory education other than those types listed in these categories was not offered by any state. The only inference which is appropriate is that monies so spent were part of the foundation program.

2/ Inclusive of homebound and institutionalized children in most states.

3/ In 75 percent of those states not having special purpose flat grants for mentally retarded youths, monies for the physically handicapped could be used for teaching the educable mentally retarded.

factors discussed in the 1966 Educational Opportunity Survey.[7] It was found that only a small percent of total achievement variations are represented by achievement variations between schools, but it was also found that the inter-school differences that do exist are greater for Negro than white children. Minority children's performance is highly related to teacher and peer characteristics, but related to per pupil expenditures only in the South at grades, 6, 9, and 12. The high degree of intercorrelation among the variables inhibits the drawing of definitive conclusions regarding the unique impact of expenditure per pupil, teacher characteristics, peer attitudes and characteristics, or school program. Controlling for family background weakens the effect of school expenditures since family characteristics are related to expenditure in motivational and fiscal capacity terms. Project Talent researchers found that school variables explain more of achievement variance if students are classed according to the size and predominant socioeconomic level of their city and school district. Pupils of low socioeconomic status in highest expenditure local districts performed at much lower achievement levels than high socioeconomic status youths in lowest expenditure districts. It is not established from Project Talent whether large increments in expenditures are more, less or equally efficient when compared to relatively small doses.[8]

7/ Coleman, James S., Ernest Q. Campbell, Carol J. Hobson, James McPartland, Alexander M. Mood, Frederic Weinfeld, Robert L. York, Equality of Educational Opportunity, Washington, D C.: OE-38001, 1966, pp. 310-325, U.S. Department of Health, Education and Welfare.

8/ Project Talent One Year Follow Up Studies, op. cit.

The body of research, less comprehensive than these studies, which indicates that per pupil expenditure increases do not account for major achievement increases as much as do other factors, is impressive.[9/] Yet, Herbert Kiesling's study of New York's districts concluded that in districts with over 2,000 pupils additional expenditures of $80 per pupil were associated with an additional month of achievement measured by achievement test scores.[10/] For small districts, increased expenditures were not related to measured achievement gains. A quadratic function fitting Kiesling's data indicates that through low ranges of expenditure categories, test scores rose with incremental expenditure increases. Test scores fell at highest expenditure ranges. One cannot conclude that for low income youths the $80 - one month relation is valid, since it is aggregative across socioeconomic classes. The conclusion that higher returns are to be expected from expenditures, ceteris paribus, in districts now spending relatively less per pupil is warranted.

9/ Burkhead, Jesse, Fox, Thomas G., and Holland, John W., Input and Output in Large City High Schools, Syracuse: Syracuse University Press, 1967.
Crandall, James H., A Study of Academic Achievement and Expenditures for Instruction, Ed. D. dissertation, University of California, Berkeley, 1961.
Ross, Donald H., et al, Administration for Adaptability, Vols. I-IV, New York: Columbia University, 1951.

10/ Kiesling, Herbert, Measuring a Local Government Service, A Study of Efficiency of School Districts in New York State, Ph. D. dissertation, Economics Department, Cambridge, Massachusetts: Harvard University, September, 1965.

Teacher quality was found to explain achievement changes best for low income children in California.[11] Expenditures were inter-related however, since teacher quality was defined in terms of certification and salary. In other studies showing high correlations between expenditures and quality (defined as achievement gains or adaptability to changing conditions), quality measures are related to expenditures.[12]

The problem of separating expenditures from teacher quality and from peer-home-community characteristics is foreboding. An interesting cross-section study tried to hold certain home and community effects constant to test the hypothesis that if factors of educational demand and ability to pay are held constant among districts, the variation in organizational structure for financing education will explain expenditure variations.[13] Sampling 107 of the 119 largest school districts in the United States in 1960, and including districts in 36 states, the study confirmed the hypothesis. The basic structure of budget and expenditure decisions in most big cities assumes continuance of existing programs. Smaller cities are more likely to to make budget decisions at the margin on a program basis. Large city

11/ California State, "State and Local Fiscal Relationships in Public Education in California," Report of the Senate Fact-Finding Committee on Revenue and Taxation, Sacramento, March, 1965.

12/ Mort, Paul R., Reusser, Walter C., and Polley, John W., Public School Finance, New York: McGraw-Hill, 1960, chapter 5.

13/ James H. Thomas, Kelly, James A., and Gorms, Walter I., Determinants of Educational Expenditures in Large Cities of the U.S., Cooperative Research Project 2389, U.S.O.E., Stanford University School of Education, 1966.

budget-makers for schools focus on proposed additions to their program, rather than on the basic program itself. Expenditure variations for basic program changes are explained by the degree of centralization in the budget-making process in large city school districts. The use of distributional formulas for determining fund levels needed for particular budget categories encourages centralization in the budget-making process. It neutralizes many professionals with program expertise from participation in the process. The greater the degree of centralization, the lower the tendency for expenditures to vary from past program levels. This study concluded that the much-discussed dichotomy of fiscal independence versus dependence is unrelated to educational expenditure level or mix. The form of governmental arrangements has consequence for school expenditures insofar as it determines the dynamics of budget decision-making processes. Another finding that the higher the unemployment rate in a district, the higher the per pupil expenditure level may reflect lags in governmental response to economic change. This study concluded, tentatively, that the general price level in a state may determine expenditure levels. The highest percentage of variance in expenditure level was explained when three classes of variables were included; ability-demand, governmental, and price level variables. The categorization of ability-demand variables, confirmed as valid by the researchers, enabled them to hold demand for education constant. Variables describing fiscal capacity or ability of cities studied are distinguished from those indicating demand for education.

The ability-demand schema and conclusions based upon it provide no better ability to control for the three factors (per pupil expenditure, teacher quality, home-peer-community characteristics) cited above than previous research efforts yielded.

One piece of work which attempted to separate these factors, prior to the Educational Opportunities Survey, was funded by the Office of Education and completed in 1963.[14] Setting out to identify every obtainable item of data with any apparent relation to educational finance, this study of 104 Wisconsin school districts and of 3 other states began with 161 variables reflecting economic and social characteristics of local districts. Intercorrelation computations reduced the number of variables to 70 correlates of expenditure per pupil. Following the earlier work of Shapiro, using 1920-40 and 50 data with 1960 census data, the objective was to isolate the socio-economic determinants of educational expenditure and to estimate their relative importance. Of the 70 variables remaining, 26 related to ability to support education and 44 related to need for services. These were clustered into twelve ability factors and eight needs factors and subjected to discriminant analysis.[15] This showed that:

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[14] Peterson, LeRoy, Rossmiller, Richard A., North, Stewart and Wakefield, Howard, Economic Impact of State Support Models on Educational Finance, Cooperative Research Project No. 1495, U.S.O.E., University of Wisconsin, School of Education, 1963.

[15] Ibid., chapter VIII.

1. No single measure of wealth currently in use describes fiscal capacity for education adequately, but personal income tax paid is the most suitable available.

2. Relative wealth of local community is unrelated to municipal school support and to population size.

3. Dropouts vary positively with percentage of teachers with less than 4 years of professional preparation and negatively with mean teacher salary. No correlation was found between dropout and ability of student body, class sizes or course of study distributions.

4. State-support programs have equalized educational opportunities but (a) education has been isolated from other local services; (b) fiscal capacity measures are not accurate estimates or predicators of the substance and quality of education which a locality will offer.

While this study would lead one to conclude that increased expenditures (on teacher salaries) will reduce dropout rates, it says nothing about achievement increases as causally related to increased expenditures. While the incremental achievement growth rates of increased expenditures in Higher Horizons Programs in New York City (and in the Demonstration Guidance Program preceding Higher Horizons) were fairly large in reading comprehension, they were negligible in arithmetic reasoning. No definitive conclusions about the outputs derivable per unit of increased per pupil expenditure can be made from the Higher Horizons experiment. The first-year Title I Elementary and Secondary Education Act expenditure level for New York City alone was 5-6 times the Higher Horizon level. It may well be that expenditures were not raised enough or that they were not utilized on the optimum service mix to yield significant achievement

results.[16] The St. Louis study of droput prevention via increased per pupil expenditures showed large retention rate increases but no significant achievement level increments.[17]

A reasonable conclusion seems to be that only slow and small increases in achievement should be expected per unit of expenditure increase. Rather than massive spending increases per se, increases in an appropriate combination of services yield greater achievement pay-offs. Gordon's recent survey of compensatory education inclusive of federally supported programs concludes, however, that the appropriate mix of services for any given low-income group is unknown.[18] The fact is that less instructional time has gone to the low-income child due to higher absenteeism and larger percentages of class time spent on discipline. Flexible scheduling and collateral services to combat these factors are part of the "best mix" idea.[19]

The discontinuity of research prior to 1965 characterizes more recent research as well. Some strains of evolution toward greater

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16/ Wrightstone, J.W., et al., Evaluation of the Higher Horizons Program for Underprivileged Children," Cooperative Research Project No. 1125, U.S.O.E., Board of Education of the City of New York,1964.

17/ The School and Community Work Related Education Program: A Ford Foundation Project, Activity and Progress Report, 1961-62, Shaw School, St. Louis, 1962.

18/ Gordon, Edmund and Wilkerson, Doxey, Compensatory Education for the Disadvantaged: Programs and Practices: Preschool Through College, College Entrance Examination Board, New York, 1966.

19/ Clowad, Richard and Jones, James, Social Class: Educational Attitudes and Participation, New York: Columbia School of Social Work, Columbia University, 1962.

communality of approach are detectable, providing grounds for believing that a comprehensive theory of the input-output behavior of educational systems is forthcoming. A look at results of major recent studies prefaces the articulation of conclusions about the most valid theoretical propositions which one can make about (1) the determinants of increments in measured achievement; (2) the relative importance of increases in per pupil expenditures on achievement increments; (3) the specific school characteristics which most directly affect achievement gains; (4) the implications of these findings for low-income students; and (5) work toward integration of these factors. Eric Thornblad studied public housing students in Chicago residing in three four-square mile areas with concentrations of high, middle and low-income families respectively. His objective was to determine whether there were maldistributions of funds expended for low-income relative to other income group students. Thornblad found absolute differences between expenditures in only two regards: teacher salary expenditures and maintenance of school buildings. He found that administrative expenditures were equally distributed among areas of different income levels. The policy of a voluntary transfer rather than required continuance of teachers in originally assigned schools enables teachers to transfer from low-to-high-income schools. More experienced teachers with correspondingly high salary expenditures were in middle and upper income schools within the city of Chicago, explaining 50 percent of gross expenditure differences. The remaining half of spending differences were explained by the fact that public housing concentrations

of low-income youths forced the construction of newer and larger school plants. These plants, Thornblad found, required lower unit maintenance costs than buildings 10-12 years older in higher income areas. He found no significant expenditure discrimination regarding instructional supplies. The rationale for policies allowing experienced teachers to transfer within the inner-city district to middle from lower income schools is that experienced teachers might be lost to suburban districts if transfer requests were disregarded. Thornblad's conclusion is that prior to Federal aid for low-income youths there was no expenditure discrimination against low-income youths. He found, in fact, a greater concentration of school construction in low-income areas, but this was counteracted by higher maintenance costs for buildings in higher-income areas. Pupil/teacher ratios were not uniformly different between low and other income class students. Although he didn't control for quality of school plants, his impression was that significant qualitative differences were nonexistent.[20] He did not test for relations between expenditures and achievement.[21]

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[20] Thornblad, Eric, Fiscal Impact of High Concentration of Low Income Families Upon the Public Schools, Ph.D. dissertation, Department of Education, University of Illinois, 1966. Also telephone conversation by the author with Mr. Thornblad, July, 1967.

[21] For a study using a similar technique on primary schools with surprisingly similar fiscal conclusions, see Katzman, Martin, Distribution and Production in Big City Elementary School Systems, Ph.D. dissertation, Economics Department, Yale University, 1967.

Shaycoft's recent analysis of Project Talent data, using a variety of statistical techniques, is inconclusive about the growth of cognitive skills in secondary school as related to expenditures per pupil. No expenditure data is included, so it is of no help in assessing whether or how much a given expenditure increase may affect achievement. The precise set of school characteristics which relate to school achievement differences after initial student ability and socioeconomic status are controlled cannot be extracted unambiguously from the data. Many "aptitude" measures, for example, were highly correlated with the amount of course work taken in certain subjects. Some evidence indicates that reading competence fails to increase for vocational students of comparable aptitude as much as it does for college preparatory students in high school. If further research is conclusive on this point, a revision of vocational curricula may be indicated.[22] The point is that no hard conclusions can be made regarding affectors of achievement gains in students from this study.

The Educational Opportunity Survey,[23] designed to see how well achievement is explained by factors traditionally considered good measures of school quality, included as variables per pupil expenditure per school system, class size, teacher experience and training, curricula, facility quality, collateral school services (e.g., counseling, health, arts, athletics, etc.), and student body characteristics. These dependent

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22/ Shaycoft, Marion F., Project Talent: The High School Years: Growth in Cognitive Skills, Pittsburgh: School of Education, University of Pittsburgh, 1967.

23/ Coleman, James S., et al., op. cit.

variables were related to achievement as measured on three types of instruments: (1) basic skills (reading comprehension and mathematics ability); (2) general information; (3) verbal and non-verbal ability tests.[24] Analyses of the relation between dependent variables and the achievement factor were done using samples of 1,000 students for grades 1, 3, 6, 9 and 12. Eight geographical strata (five metropolitan and three nonmetropolitan) for Negro and white pupils and four ethnic strata not disaggregatable geographically (Mexican, American Indian, Oriental, and Puerto Rican) composed the final working tape. Multiple partial regressions to which independent variables of special interest were added yielded the unique-variance accounted for by each special independent variable. The unique-variance contribution of the student body quality variable is higher for ethnic and racial minorities than for the white majority. Thus the study concluded that peer group attributes explain more achievement variation among minority group youths than school facility or staff attributes. This does not mean, however, that school characteristics are unimportant. A set of three attitudinal indices accounted for more achievement variance than any other set of variables included in the study. These indices were:

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[24] Study of these tests using factor analysis revealed that a five-component factor provided the best index of achievement. Weights for components of the achievement factor were: Non-verbal Ability .76, Verbal Ability .92, Reading Comprehension .87, Mathematics Achievement .85, General Information .91. See Mayeske, George W., Weinfeld, Frederic D., Factor Analyses of Achievement Measures From the Educational Opportunities Survey, Technical Note No. 21, Division of Operations Analysis, National Center for Educational Statistics, Office of Education, Department of Health, Education and Welfare, January 18, 1967.

1. Student interest in school and reading outside school;

2. Student self-concept as related to school success; and

3. Student sense of control over his own self-destiny.

The implication is that schools have great importance in that they affect these attitudes. The influence of school facilities, curriculum and staff that is independent of family background is small yet teacher characteristics, after family background influence has been controlled, explain most of the differences in school factors which are related to achievement. The strong association of family background with achievement does not diminish as children grow older.[25/] Schools interact with peer and home factors to affect attitudes which in turn affect achievement. Future studies in the Division of Operations Analysis using this survey data will provide additional insights into the relative strengths of those independent variables most strongly affecting achievement.

The Most Effective Schools program in 21 New York City schools, expending $859 per pupil in 1964-65 exceeded regular school expenditures by $425 per pupil. This magnitude of expenditure increase yielded reading ability scores of student recipients at or above the national norm. Though the program reaches only five percent of the city's slum students, program experience to date does indicate that enough expenditure increase is associated with achievement gains. Not only were

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25/ Mayeske, George W., Educational Achievement Among Mexican-Americans: A Special Report From the Educational Opportunities Survey, Technical Note Number 22, Division of Operations Analysis, National Center for Educational Statistics, Office of Education, Department, of Health, Education and Welfare, February 1, 1967, p.9.

class sizes reduced in these 21 schools, a host of new services were offered to integrate the students' home, community and social life with his school life. Hence the "best mix" of services, rather than funds per se, explain achievement gains.

The quality assessment battery devised by Educational Testing Service for Pennsylvania Board of Education was administered in that state to establish input-output norms against which Pennsylvania schools might evaluate themselves.[26] The need to incorporate into such evaluations a variable of test-taking motivation is clear. Extrinsic rewards promised to low-income students yielded effort sufficient to produce significant increases in achievement scores. Middle and upper-income students did not expend increased effort. They are reported to try hard on tests whether or not extrinsic rewards are offered.[27] The results of Educational Testing Service efforts in the development and administration of this test battery offers promise for input-output evaluations of educational efficiency. It is comprehensive in the range of qualitative changes it measures.[28]

26/ Educational Testing Service, A Plan for Evaluating the Quality of Education Programs in Pennsylvania, vols. I-III, A report from ETS to the State Board of Education, June 30, 1965.

27/ Ibid., vol. I, p. 87.

28/ Ten output measures (Goal Attainment Indices), having been ranked for reliability, validity, and homogeneity are measures of self-understanding, tolerance, basic skills, attitude toward school, citizenship, health, creativity, vocational preparation, intellectual achievement and preparation for change. In some of these categories instruments are insufficiently reliable but are being revised.

The question of whether responses on paper and pencil or verbal tests typify behavior is one which ETS will explore in on-going research. A schema, using 70 criteria for output evaluations for each school of each type, makes the battery comprehensive and flexible. One finding from the pilot use of this battery was that mean scores of the sample in which each student was tested twice were consistently higher than for those tested only once.[29/] This suggests that the best input-output evaluations will come from those schools where testing is comprehensive and frequent. Unfortunately, testing procedures differ across districts so much that this is almost impossible to find. Research properly disaggregated is directed more productively to places where achievement data is best. Properly disaggregated research might use the school district as the unit of analysis but should facilitate inter-school comparisons. Educational Testing Service found that inter-school comparisons varied widely depending on whether schools are judged according to gains adjusted for differences in the scholastic ability of students.[30/] Where the latter approach was used, many schools were equal whereas with the former approach, major output differences seemed to exist. Ideally the latter should be used for economic analysis. The data for such computations is not easy to acquire, indicating another constraint on selection of research locales.

29/ Ibid., vol. II, p. 21.

30/ Ibid., vol. II, p. 26.

The Educational Testing Service summary of school and community influences affecting achievement and aptitude scores, as reported in the literature, corroborates the contention that despite recent signs of research integration, discontinuities and ambiguities still exist.[31] Only one surveyed study found a direct relationship between per pupil expenditure as such and achievement change.[32] Most studies have not defined per pupil expenditure so that it is independent of other quality variables (e.g., teacher's salary). The six variables directly relating to achievement gains in two or more of the studies surveyed are: male teacher starting salaries, average number of years of teaching experience, number of books in the school library, average class size, pupil/teacher ratio, and percent of graduates going to college.[33] The first five of these variables compose part of per pupil expenditure. If indeed these or some other set of per pupil expenditure components affect achievement, an hypothesis worth testing would be that achievement-affecting components of per pupil expenditure explain more of the variance in actual per pupil expenditures than its components NOT related to achievement. Preparation and experience determine the salary for which a teacher qualifies. Hence teacher quality as measured by preparation, experience, and/or salary becomes a component of expenditure. To the extent that quality of school plant depends on cost of plant, facility quality becomes a component of expenditure. If one finds, for example, that teacher quality significantly correlates with

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31/ Ibid., vol. III, pp. 369-374.

32/ Kiesling, Herbert, op. cit.

33/ Ibid., p. 371.

pupil achievement, while facility quality does not, one might ask which variable has greater power in explaining how much money is spent for education. Expenditures not strongly related to pupil achievement might dominate total expenditure patterns in a given school district. Policy changes might follow if decision-makers seek to maximize student achievement through the level and distribution of funds.

A promising format for economic analysis of input-output relations, appears in a study recently completed by Jesse Burkhead and his colleagues.[34] Although Burkhead reports the data problems to be acute, the two years spent in Atlanta and Chicago by this team yielded high analytic pay-off. Grouping variables into input, status, process, and output categories, the study's chief constraint is a universal one. That is, economists cannot resolve issues in learning theory on the relative values to be attached to educational outputs. One such issue revolves around the question of whether a distinctly separate sub-culture exists among low-income groups, the children in which are called "culturally deprived." One theory, of which Frank Riessman is chief exponent, holds that such sub-cultures exist.[35] Children from

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[34] Burkhead, Jesse, Fox, Thomas G., and Holland, John W., op. cit.

[35] Riessman, Frank, The Culturally Deprived Child, New York: Harper & Row, 1962. Also see Riessman, Frank, "Teachers of the Poor: A Five Point Plan," in Urban Education and Cultural Deprivation, Ed. C. W. Hunnicutt, Syracuse: Syracuse University, School of Education, 1964, pp. 15-31.

these sub-cultures have learning styles distinctly different from children who are part of the dominant cultures. Samuel Shepard exemplifies the opposing theory and contends that the learning style of "culturally disadvantaged" children is not basically different from the style exhibited by other youths.[36/]

The format used by Burkhead for large city cross-section studies is not used with facility on small community high schools. Inputs measured in terms of socioeconomic backgrounds of students by census tracts are too aggregative since in small communities much hetorgeneity of family incomes within each attendance area exists. Comparability of data for small communities requires a student-by-student survey. Since the Burkhead model is static, parameters indicative of the structure of the urban economy are not conducive to educational demand predictions implying specific curricular changes. His surrogates for demands placed on schools by the urban economy are status measures of family income, a composite index of housing quality, social and educational characteristics of the population, income distribution of student population, and strength of private school enrollment by income category. Growth patterns of sectors of the urban economy, in addition to these status measures, place demands on schools for curriculum change.

36/ Shepard, Samuel, "Working With Parents of Disadvantaged Children," Urban Education and Cultural Deprivation, op. cit., pp. 33-50.

For further comparisons of these points of view, see Jerome S. Bruner, Toward A Theory of Instruction, Cambridge: Belknap Press, 1966, and John Holt, "A Little Learning," The New York Review, April 14, 1966, pp. 8.

Dynamic models could account for these forces. The conclusion of Burkhead's study of Atlanta and Chicago is that socio-economic factors, not expenditures per se, almost wholly determine school outputs. The most important in-school variables center on teacher characteristics.[37] The conclusions represent a unifying thread in research in this field.

Current educational systems modeling promises to integrate the manpower demand-oriented approach with the earlier educational supply approach.[38] Manpower models isolate demand for labor by occupational or skill category and translate projected labor demanded into demand for education. Project METE, A Study of Manpower, Education, Training and Employment in the National Center for Educational Statistics, is using industrial employment projections in Standard Metropolitan Statistical Areas to generate Occupation/Education coefficients.[39] When multiplied by projected industry employment and summed across SMSA's, these coefficients yield projected educational demand by type of education. Forthcoming applications of this technique will relate

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37/ Burkhead, Jesse, op. cit., p. 75.

38/ See, e.g., early supply models exemplied in: Tinberger, Jan, "Quantitative Adaptation of Education to Accelerated Growth" in Herbert Parnes (Ed.) Planning Education for Economic and Social Development, Paris: OECD 1962.
UNESCO, "Perspective of Educational Development in Asia: A Draft Asian Model," Conference of Ministers of Education and Ministers Responsible for Economic Planning of Member States in Asia, Bangkok, November 22-29, 1965.

39/ Griest, Jeanne and Morsch, William C., Occupation Education Requirements Analysis, Technical Note No. 37, National Center for Educational Statistics, Division of Operations Analysis, Office of Education, Department of Health, Education and Welfare, May 16, 1967. This note applies to vocational education only.

many types of education to more disaggregated industrial breakdown of the economy. Another plan of attack on the demand side of educational modeling focuses on demography. Work is under way to model student-teacher population growth.[40] A national aggregative model, DYNAMOD II, represents the educational population and yields to analysis of effects of changes in birth and death rates. Some initial work with DYNAMOD showed that changes in student retention rates had greatest impact in the college sector of the education system. However, the teaching sector was more sensitive than the student sector to changed retention rates. The analysis produced the conclusion that where student-teacher ratios are too high but student population growth is expected, the ratio is controlled best by increasing teacher retention rates first. These conclusions may interest inner city educators whose schools receive increasing numbers of in-migrants with low achievement levels. Teachers in schools servicing low-income populations exhibit high turnover rates. Their students exhibit high dropout rates. Educators trying to keep student-teacher ratios from rising as in-migration occurs can achieve quickest success by first adopting policies to retain their existing faculties and reduce turnover among new staff. Subsequently, policies to increase student retention rates are indicated.[41]

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[40] Okada, Tetsuo, Methods of Projecting Births, Technical Note No. 36, National Center for Educational Statistics, Division of Operations Analysis, Office of Education, Department of Health, Education and Welfare, May 31, 1967.

[41] Hudman, John T., Okada, Tetsuo, Zabrowski, Edward K., Zinter, Judith R., Student-Teacher Population Growth Model: DYNAMOD II, Technical Note No. 34, Division of Operations Analysis, National Center for Educational Statistics, Office of Education, Department Health, Education and Welfare, May 29, 1967.

Supply-oriented modeling must specify the capacity of the educational system to meet demands for goods and services which maximize achievement.[42] Alternative supply mixes whose desirability is dependent on projected levels and types of demand for education have trade-off values (i.e., marginal rates of substitution) which vary depending on which components of the educational population are involved. That is, such trade-offs between supply mixes depend on the unit of effective demand used. A framework for cost estimation for alternative program mixes in large urban schools has been developed. A model which estimates space and staff requirements, given the size of student population, is a second sub-model developed as part of the Urban Studies Project. Both supply-oriented, they will assist in evaluating educational part complexes in terms of achievement increments.[43] Studies of fiscal capacity and independence of local school districts also exemplify supply-oriented research. A recent study of six cities used three measures of school district innovation as dependent variables rather than achievement. Using this measure of school output assumes that adaptability of a school district

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42/ For aggregate estimates of attainment in years of schooling terms and related concepts of educational capacity, see Wisler, Carl E., Methodology for an Educational Attainment Model, Analytical Note No. 68, Division of Operations Analysis, National Center for Educational Statistics, Department of Health, Education and Welfare, September 5, 1967.

43/ O'Brien, Richard, Cost Model for Large Urban Schools, Technical Note Number 30 and, School Submodel for Urban Schools, Technical Note Number 38, Division of Operations Analysis, National Center for Educational Statistics, Department of Health, Education and and Welfare, April 26, 1967 and June 21, 1967, respectively.

is its most important characteristic.[44] Concluding that increased expenditures are a function of the level of innovation in a local district, the authors hold that innovation is the result only of strong community participation in school affairs plus the power to generate new programs and requisite fund raising. Political independence of a school board is not guaranteed by fiscal independence but by the board's capacity to develop power through community support.

44/ Gittell, Marilyn, Hollander, F. Edward, Vincent, William S., Investigation of Fiscally Independent and Dependent School Districts, Cooperative Research Project No. 3237, U. S. Office of Education, Department of Health, Education and Welfare (Administered by City University Research Foundation, Columbia University, New York, New York), 1967.

CONCLUSIONS

This research survey concludes that the important question is not what determines expenditures in schools; rather, what determines achievement increase and retention of students? Out-of-school factors are far more significant than in-school factors according to research results. Experience of the teacher seems to have major positive impact on reading scores and to be more important as an output determinant than class size or teacher formal education, for districts with relatively small ranges of variation in expenditures. In such districts school characteristics other than teacher quality seem relatively insignificant in output determination. Further research might focus profitably on comparisons of districts with large variations in variables of expenditure.

A great need exists for educational experiments from which longitudinal data can be obtained. Researchers need to know, for example, not just whether a school has a library and how many books it has, but the frequency of student use of library facilities over time. Intra-school comparisons with helpful educational policy implications require such data.

We need better ways to understand and analyze the interactions between students and school staff, students and peers, and school and home. No quantitative analysis can capture the essence of such interpersonal interactions. Better understanding of those processes in education which <u>are</u> quantifiable will result from progress in quantitatively approximating the strength of these essentially intangible interactions.

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