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Decision-Making: A Model For Optimization Of Input-Output Relationships In Urban Compensatory Education Programs.

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DECISION-MAKING: A MODEL FOR OPTIMIZATION OF INPUT-OUTPUT RELATIONSHIPS IN URBAN COMPENSATORY EDUCATION PROGRAMS

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To Peggy, who kept on insisting on it, day after day.

DECISION-MAKING: A MODEL FOR OPTIMIZATION OF INPUT-OUTPUT RELATIONSHIPS IN URBAN COMPENSATORY EDUCATION PROGRAMS

Abstract of Dissertation

The problem of this study was to develop a model for (1) statistical analysis of arrays of input in urban Compensatory Education programs, and (2) prediction of optimum arrays of such input as an adjunct to decision-making in future program formulation. The ultimate purposes of the research engaged in were: (1) improvement of administrative and curricular strategies in urban education by elimination of effort-duplication and expenditure-duplication; and (2) development of a statistical device with applicability to both decision-oriented and conclusion-oriented research for ongoing program improvement.

The population was approximately 40 schools serving 25,858 elementary school children eligible for ESEA Title I Compensatory Education services in the Oakland Unified School District, Oakland, California. The derived sample was made up of 19 public elementary schools containing 8,606 ESEA-eligible children who participated in ESEA programs in the 1972-73 school year.

The procedure of the study involved investigation of the analytical and predictive capabilities of three multiple linear regression models. Mean gain scores for Reading Grades 2-3, Reading Grades 4-6, Mathematics Grades 2-3 and Mathematics Grades 4-6 served as criterion variables for each model. Independent variables were both continuous and categorical, and were based on requirements of California State Compensatory Education Guidelines.

The findings may be summarized as follows: (1) The six-variable model, based on expenditure categories only, failed to function as an efficient tool for analysis and prediction over all four criterion variables. (2) The four-variable model, based on Efficiency of Implementation ratings of four support components, was wholly inefficient in terms of analysis and prediction, failing to meet statistical criteria as defined in the study. (3) The twelve-variable model was an effective one from the standpoints of analysis and prediction. (4) The regressions indicated that there was considerable redundancy in intercorrelations between independent variables, which suggested further that there may have been duplication of effort intrinsic to the current California State Compensatory Education model as it was implemented within the study district. (5) The twelve-variable model offered an effective adjunct to decision-making for future program formulation by sharply delineating a hierarchy of importance of independent variables. (6) The twelve-variable model has promise as an analytical device in process-monitoring of ongoing Compensatory Education programs.

The recommendations are: (1) That districts similar to the one in this study should investigate resource alignments in Compensatory Education programs to avoid effort-duplication. (2) That action research should be policy within school districts. (3) That a similar study should be conducted, employing more schools and more plausible independent variables.

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

The Elementary and Secondary Education Act of 1965 (ESEA), which had as its prime rationale the delivery of quality education to students from lower socioeconomic backgrounds, ushered in an entirely new concept in education. The fundamental thesis undergirding this legislative milestone was the plausible connection between low socioeconomic status and low educational attainment.

In a study conducted by the United States Office of Education, funded under the Civil Rights Act of 1964 and implemented under the leadership of James Coleman of Johns Hopkins University, it was found that a significantly high proportion of American school children had failed to keep pace with national growth averages in education.[1]

Educators were immediately at a loss as to how to meet the resultant challenge put forth by the Congress of the United States: to bring these identified students up to national norms in vital subject areas which are held by many educators to be the first requisites in the quest for quality education.

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[1]James S. Coleman, Equality of Educational Opportunity (Washington: United States Government Printing Office, 1966), p. 21.

Quality education was defined as variously as there were groups, political and otherwise, juxtaposed to the Elementary and Secondary Education Act. One observer of the Congressional hearings on ESEA commented that:[2]

> One of the intriguing dimensions of the education story in 1965 is just how this bill was made to appear as different things to different people. Each of the various groups and interests that were actively engaged in the debate over this bill was able to see in it what it wanted to see.

President Lyndon B. Johnson viewed the impact of the ESEA bill in broad terms:[3]

> I believed that a program that eliminated poverty - or even reduced it - would strengthen the moral and economic fiber of the entire country. It was on that basis that I prepared to move forward and commit the resources and prestige of a new administration.

In a message to Congress in early 1965, Johnson identified ignorance as the "taproot of poverty." Thus, Johnson used the link between the need for federal aid to education and the economic strengthening of the nation to appeal for support of his education policies. In discussing the deficiencies in reading, writing, spelling and arithmetic of children in 15 of the nation's largest school systems, he pointed out:[4]

> ...the consequences of poor education for the country

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[2]E. Eidenberg and R. Morey, An Act of Congress. (New York: W.W. Norton and Company, 1969), p. 243.

[3]Lyndon B. Johnson, The Vantage Point. (New York: Holt, Rinehart and Winston, 1971), p. 72.

[4]Ibid., pp. 206-207

were frightening, but states and communities suffering from strained fiscal resources could not meet the challenge of expanding population.

The deficiencies noted by Johnson and the Congress narrowed down the educational objectives, thereby removing - temporarily at least - various other criteria for the definition of quality education; criteria that had been defined in some quarters in terms of physical, numerical and spatial characteristics and in other quarters in terms of curricular and pedagogical approaches. The momentum toward focus on achievement criteria in measurable skill areas was intensified by the findings of the Coleman Report[5] which inferred that general measures of school resources have little relationship to student achievement. The report did not nor did it intend to investigate qualitative curricular and pedagogical procedures and approaches; however, it did investigate, to a thorough extent, Verbal, Non-Verbal, Reading, Mathematics and General Information scores of a broad spectrum of students of various racial and ethnic groups. The results of that investigation have been controversial, but despite the polemics of that controversy, they influenced the nature of legislation that emanated from the Congress of the United States.

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[5]Eidenberg, op. cit., p. 21.

At the outset of Compensatory Education programming at the national level in 1965, educators groped for a plausible, concrete definition of "Compensatory Education"; moreover, the expected outcomes as expressed by the body politic were ambiguous to these educators, thereby producing, in turn, inappropriate educational approaches and evaluations.[6]

This confusion manifested itself in teaching approaches - hardly based on concepts - that revolved around teaching machines, factory-produced hardware, programmed learning materials, para-professional support in classrooms, food and clothing programs that bordered on simple welfare programs, athletic programs, art and music programs and highly-involved teacher inservice and staff development practices.[7]

However, legislative pressures mounted, and educators found themselves in the position of attempting to quantify relationships between dollars spent and student achievement. This quest for quantification forced educators in California and other states to focus on assessment of growth in elementary and secondary language

[6]David K. Cohen, "Politics and Research: Evaluation of Social Action Programs in Education," Evaluating Action Programs: Readings in Social Action and Education, ed. Carol H. Weiss, (Boston: Allyn and Bacon, Inc., 1972), pp. 137-162.

[7]United States Congress, House, Committee on Education and Labor, Hearings before Subcommittee on Education, 89th Congress, 1st Session, on the Elementary and Secondary Education Act of 1965, September 12 - September 19, 1966, (Washington: Government Printing Office, 1966), pp. 191-211.

and mathematics.[8]

In March 1969, Dr. Ruth L. Holloway, then Director of Program Development in the California State Bureau of Compensatory Education, State Department of Education, addressed the California assemblage of Compensatory Education Directors (ACACE), and the address spoke to the need for embracing the cognitive-affective duality in education, all within a framework of quantification:[9]

> In the previous three years of Compensatory Education programming, much latitude has existed in local school districts and their choice of content in Compensatory Education programming.
>
> Many programs have existed which in effect bore little or no relationship to the overall goal of delivering quality education to disadvantaged students. The merit of such programs is quite subjective and leaves much to be desired in terms of measurement of effectiveness.
>
> New legislative interest in California revolves around the establishment of measurable relationships between money spent and pupil outcomes.
>
> To this end the Bureau of Program Development has defined the following six components in Compensatory Education: Language Development, Mathematics, Auxiliary Services, Parent Involvement, Staff Development and Intergroup Relations.

This address by Dr. Holloway showed clearly that educators were being forced into an arena of interest previously considered the domain of the private sector: quantification of input-output relationships.

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[8]California State Department of Education, Guidelines: Compensatory Education, (Sacramento: Bureau of Publications, 1972), pp. 33-36.

[9]Address by Dr. Ruth L. Holloway at the annual meeting of the Association of Compensatory Education Administrators, Los Angeles, March 9, 1969.

It is important to discuss further the "new legislative interest" referred to by Dr. Holloway, along with its implications for education in general and its pertinence to the central focus of this investigation. In 1967 the California Legislature manifested interest in Planning, Programming and Budgeting Systems (PPBS) as a means of getting greater quantification of education-money relationships, among other expected outcomes - not the least of which was greater operational efficiency. AB 606, the Educational Improvement Act of 1969,[10] was enabling legislation that provided "seed" money for a pilot investigation of "cost-effectiveness" analysis in education, a means of studying ways of getting greater output for each education dollar invested. This legislation was accompanied by the requirement that all California school districts operationalize PPBS by the start of the 1973-74 school year.[11] To ease the transition of school districts into PPBS, certain districts were chosen as pilot districts for operational testing of PPBS in consultation with the independent consulting firm of Peat, Marwick, Mitchell and Company.[12]

This firm defined its goal quite clearly: that PPBS was for

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[10]The California State Assembly, Education Improvement Act of 1969, (Sacramento: Bureau of Publications, 1969).

[11]Peat, Marwick and Mitchell, Inc., An Educational and Planning Guide for California School Districts, (Los Angeles: Peat, Marwick and Mitchell, Inc., 1971), pp. I-1, I-6.

[12]Ibid.

the purpose of developing, within each school district, a comprehensive approach that could be used by those districts to improve their effectiveness in providing opportunities for growth of students, efficiency in planning, analyzing, performing, evaluating and communicating with the public.[13]

Thus, the simultaneous emphases by the Congress of the United States and the California State Assembly, among others, served as a major catalyst that focused on educational improvement through quantification of input-output relationships in education.

I. THE PROBLEM

Statement of the Problem

The problem researched in this study was that of developing a statistically-defensible methodology which could serve as a rational adjunct to decision-making with respect to allocation of resources in Compensatory Education in urban school systems.

Rationale for the Study

In the past, educators have approached the design and implementation of both general education and Compensatory Education programs from a highly subjective perspective; that is, program choices often

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[13] Ibid.

bore little or no relationship to successful or unsuccessful program history in preceding years. Educational evaluation has been, in large part, conclusion-oriented rather than decision-oriented. Cronbach and Suppes[14] argue that while decision-oriented research is neither better than nor desirable to conclusion-oriented research, its function is to provide the decision-maker with information, giving an organized account of relevant facts with the possibility of forecasting the probable outcome of each of the possible alternative actions. These authors go on to distinguish between the types of decision-oriented research. They define two types: (1) operational or institutional research, and (2) product or developmental research. Operational research, obviously decision-oriented, has as its prime objective the establishment of routine procedures for monitoring certain aspects of the system, and uses them to identify trouble-spots deserving administrative attention.

An additional contention of these authors is that product research in education, often called "development," is not "development" at all; rather, it is some procedure or material that has been adopted simply on the basis of general notions as to what will be effective.[15]

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[14]Lee J. Cronbach and Patrick Suppes, eds., Research for Tomorrow's Schools: Disciplined Inquiry for Education, The Report of the Committee on Educational Research, National Academy of Education. (New York: The Macmillan Company, 1969), p. 26.

[15]Ibid., p. 27.

Arguing for both formative and summative evaluation, Scriven[16] distinguishes between the two, equating formative research to process research and summative research to outcome research.

Another dimension to the rationale undergirding this investigation is the current emphasis on accountability in education and the parallel adoption of well-defined goals and objectives to achieve that accountability. The California State Department of Education, Division of Compensatory Education, mandates submission of goals and objectives defined in measurable terms for six program components (Reading, Mathematics, Parent Involvement, Staff Development, Intergroup Relations Activities and Auxiliary Services), to be reported on a school-by-school basis. The two cognitive components, Reading and Mathematics, are measured by means of pretest-posttest differentials, fall to spring. This evaluation mandate by the state, in combination with the parallel requirement of well-defined objectives, lends itself to a very central aspect of this investigation.[17]

The foregoing educational research aspects were mentioned in the context of this investigation because it was the intention of this investigation to provide a research methodology that could be: (1) conclusion or decision-oriented, (2) formative or summative, and (3) compatible with the framework of current educational interest

[16]Michael Scriven, "The Methodology of Evaluation," in Ralph W. Tyler, Robert M. Gagne and Michael Scriven, eds., Perspectives of Curriculum Evaluation (Chicago: Rand McNally and Company, 1967), pp. 39-83.

[17]California State Department of Education, op. cit., pp. 33-35

in accountability. Equally important, it was also the intention of this investigation to: (4) provide a methodology for analysis of arrays of expenditure inputs and prediction of optimum arrays of such inputs for future program formulation; and (5) provide a system for measuring efficacy of program implementation and predicting optimum direction(s) of personnel energies for maximum achievement output.

A more specific rationale for this investigation is found in the Compensatory Education context itself: school districts participating in Compensatory Education programs are required to develop school-site programs as a result of systematic needs-assessment procedures based on meeting student needs in six aforementioned areas (Reading, Mathematics, Parent Involvement, Staff Development, Intergroup Activities and Auxiliary Services).[18] Programs subsequent to and as a result of needs assessment are required to contain program aspects which presumably address themselves to the discrepancies surfaced by the needs-assessment procedure. It is important to note, however, that despite the distribution of or intensity of those discrepancies, the State Division of Compensatory Education still requires programmatic attention to <u>all six activity components</u>.[19]

The fundamental rationale on which this investigation is based

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[18] <u>Ibid.</u>, pp. 12-17.

[19] <u>Ibid.</u>

derives from the need to know whether there is hierarchical importance to the array of components mandated by the State; that is, does there exist an ideal array of expenditure percentages in each mandated component, so that maximum achievement in Reading and Mathematics results? Is there hierarchical importance to the program components in terms of the way they are implemented?

Finally, it should be pointed out that this study was intended to be considerably more than a mere fact-finding exercise; it was also intended to serve as a model which would permit districts to conduct ongoing and terminal assessments of student programs. Also expected from the study were important conclusions that could act as meaningful decision-making adjuncts in the design of subsequent programs in Compensatory Education. It was hoped that this study would: (1) provide a reliable basis for alerting local educators and interested laymen to overall Compensatory Education concerns; (2) establish a benchmark against which local budget decision-making may be evaluated in similar studies; and (3) develop a reliable basis for decision-making which is less dependent on pressure groups, telephone feedback and random discussion(s) with constituents in the education community.

The Importance of the Study

Very few problems in the field of education are as forbidding

and cumbersome as the problem of delivering quality education to students of low socioeconomic backgrounds. An adequate attack on the problems of students from these backgrounds requires that educators be armed with defensible techniques for analyzing weaknesses in their educational planning, combined with equally powerful techniques in educational planning, thus maximizing developmental opportunities for students.

Current Impact of Compensatory Education Evaluations. Oversight Hearings on Compensatory Education programs reveal that legislators have manifested an interest in discontinuing the programs. It would be naive to assume that the desire to discontinue ESEA Title I and other Compensatory Education programs is motivated solely by unfavorable evaluation reports, however. Many of the problems of ESEA Title I in this regard are attributable to the fact that Title I is subject to social and political forces which are quite apart from the measured effectiveness of the federal program.[20] But there are problems of evaluation of ESEA Title I and other Compensatory Education programs. Unfortunately, those responsible for evaluation designs for Title I have assumed a passive, if not defensive and unimaginative role in the development of their designs. Local and state evaluation agencies do not provide information that could, should Congress become

[20]Cohen, op. cit., pp. 137-162.

interested in making the decision, provide an adequate and rational basis for the decision to continue or discard Title I. It is the intent of this investigation to develop a methodology which is at once statistically defensible and immediately usable as an adjunct to such decision-making and evaluation design.

Hypotheses

The conceptual hypotheses undergirding this investigation derived from the following experience-based observations: (1) expenditures in Compensatory Education sub-categories should show a plausible relationship to achievement outcomes in Reading and Mathematics; (2) indices of efficiency of school-site implementation should show logical relationship to measured achievement gains in Reading and Mathematics; (3) school program size affects comprehensiveness of ESEA programs, and hence should affect achievement outcomes; and (4) identifiable school-site teaching approaches should show some relationship(s) to student achievement.

Limitations

The following are important limitations which should be considered during analysis and interpretation of specific outcomes, statistical procedures and summaries within the present study:

Correlational Research. Isaac[21] has identified the following limitations of correlational research: (1) it only identifies what goes with what and does not necessarily identify cause-and-effect relationships; (2) it is less rigorous than the experimental approach because it exercises less control over the independent variables; (3) it is prone to identify spurious relational patterns or elements which have little or no reliability or validity; (4) the relational patterns are often arbitrary and ambiguous; and (5) it encourages the throwing-in of data from miscellaneous sources, defying any meaningful or useful interpretation.

Initial Budgets vs. Final Budgets. All budget data used in the present study are based on initially budgeted categories. Budgets are often changed during the school year. However, these changes are slight in the instance of the present study because school-site Compensatory Education budgets averaged 86 percent for salaries and hence are fixed in that category. Changes invariably occurred in the "Other Costs" category, but their totals were negligible because those changes were limited by district policy to 15 percent per line-item.

Independent Rater Questionnaires. The present study used a summated rating scale for information relative to efficiency of implementation of components. Five independent raters were used. Three

[21]Stephen Isaac and William B. Michael, Handbook In Research And Evaluation, (San Diego: Robert R. Knapp, Publisher, 1971), p. 21.

important limitations must be mentioned with respect to the use of rating scales: (1) the over-rater error, the tendency toward rating subjects on the side of leniency; (2) the under-rater error, the tendency to rate subjects on the side of severity or unfavorableness; (3) the central tendency error, a tendency to rate subjects toward the middle of the scale.[22]

II. DEFINITIONS OF TERMS USED

Auxiliary Services

Those supportive services in Compensatory Education programs which have as their rationale the improvement of the general health and psychological well-being of the participating student.[23]

Behavioral Objective

A precise statement of a single meaningful unit of behavior that will satisfy an instructor that a student can perform a task that is a desired outcome of a course of instruction.[24]

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[22] Ibid., p. 58.

[23] California State Department of Education, op. cit., p. 35.

[24] Paul Harmon, "Curriculum Cost-Effectiveness Evaluation," Audiovisual Instruction, XV (January 1970), 24.

Budgeting

The process of allocating the available resources of an organization among potential objective activities in order to best attain the overall objectives of the organization; planning for the use of resources.[25]

Comparability

The federal mandate that equitable distribution of resources and services should be made to all schools of a district, target-area and non-target-area alike, to insure that a school district provides comparable educational experiences.[26]

Compensatory Education

Programs which seek to help children from disadvantaged backgrounds overcome certain educational deficiencies. Compensatory Education is based ona commitment to Equal Educational Opportunity.[27]

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[25]California State Department of Education, Planning, Programming Budgeting Manual for California School Districts, (Sacramento: Bureau of Publications, 1970), p. 26.

[26]California State Department of Education, Guidelines, op. cit., p. 35.

[27]Ibid., p. iii.

Cost-benefit Analysis

A method for determining the economic value of a program by establishing a ratio of costs to benefits. The objective is to maximize benefits at the lowest possible cost. Both costs and benefits are measured and analyzed in monetary terms.[28]

Cost-effectiveness Analysis

A method of determining the most efficient mix of activities to achieve a specified objective. Total costs are related to anticipated effects. Costs are measured in dollars, and effectiveness is expressed in terms other than dollars.[29]

Decision-making

The process of choosing among alternative courses of action with the best available knowledge of the costs and benefits associated with each.[30]

Direct Costs

Those costs which can be charged directly as part of the cost of a product or service, or of a department, or of an operating unit; these are distinguished from overhead and other indirect costs which must be prorated among several products or services.[31]

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[28] Ibid., p. 96.
[29] Ibid., p. 96.
[30] Ibid., p. 97.
[31] Ibid., p. 97

Evaluation

The process utilized to determine whether, or to what extent, an objective has been met; evaluation findings frequently provide the basis for activities undertaken to improve the programs of a school district.[32]

Expenditures

Amounts paid for liabilities incurred for all purposes. Accounts kept on an accrual basis will include all charges whether paid or not. Accounts kept on a cash basis will include only actual cash disbursements.[33]

Factor Analysis

Any of several methods of analyzing the intercorrelations among a set of variables such as test scores. Factor analysis attempts to account for the interrelationships in terms of some underlying "factors," preferably fewer in number than the original variables; and it reveals how much of the variation in each of the original measures arises from, or is associated with, each of the hypothetical factors. Factor Analysis has contributed to our understanding of the organization of the components of intelligence, aptitudes and personality;

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[32] Ibid., p. 97.

[33] Ibid.

and it has pointed the way to the development of "purer" tests of the several components.[34]

Goal

A general statement, not in itself measurable, which expresses the intention of an organization or individual to accomplish some end or purpose.[35]

Indirect Costs

Those costs necessary in the operation of a school district, or in the performance of a support service, which are of such nature that the amount of applicable allocation to each instruction program cannot be determined readily and accurately.[36]

Input

Resources - human, financial and material - that are used to achieve an objective.[37]

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[34]Julian C. Stanley and Kenneth D. Hopkins, Educational and Psychological Measurement and Evaluation, (Englewood Cliffs: Prentice-Hall, Inc., 1972), p. 450.

[35]Price Waterhouse Company, Recommendations To Improve Management Effectiveness - Oakland Unified School District, (San Francisco: Price Waterhouse Company, 1970), p. 1.

[36]Ibid., p. 61.

[37]Ibid., p. 15.

Instructional Management Systems

A system of published activity materials which are designed along a continuum of objectives derived from local or national teacher consensus. The system operates on the basis of the concept of families of skills which can themselves be ranked hierarchically. Instructional management systems are orderly combinations of Criterion Referenced tests (diagnostic in nature) and related learning materials and activities which result from diagnoses surfaced by the tests. Such Criterion-Referenced tests are (1) very short, (2) oriented to a small portion of the curricular sequence, (3) based on content immediately preceding and following their administration, and (4) based on percentage mastery of specified content. The related activities, in tandem with the test, form a "test-teach-test" sequence and are designed to accomplish a criterion or established learning objective.[38]

Instructional Aides

Community paraprofessionals who provide direct services related to the Compensatory Education instructional endeavor either by providing services for teachers in order to allow those teachers time to provide additional assistance to eligible children or support ac-

[38]Oakland Unified School District, Individualizing Instruction-Book One, (Oakland: Division of Compensatory Education, 1971), p. viii.

tivities which eventually result in benefits to eligible children. Direct assistance to children must be over and above that which the pupils would normally receive from the teacher and must not substitute for pupil-teacher contacts.[39]

Intergroup Relations Activities

Those activities designed to foster interaction between and among groups of children from different racial, cultural and socio-economic backgrounds, and may include but are not limited to, desegregation and integration, planned human relation activities, ethnic studies, and pupil exchanges.[40]

Mean Grade Equivalents

The grade levels for which a given mean score is the real or estimated average.[41]

Model

An abstract representation of reality through which actual problems may be simulated for evaluation and prediction. Models trace the relationship between inputs and outputs, resources and objectives, of the alternatives compares so that officials can predict the relative consequence of choosing any alternative.[42]

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[39] California State Department of Education, Guidelines, op. cit., p. 10.

[40] Ibid., pp. 14-15.

[41] Stanley and Hopkins, op. cit., p. 451.

[42] California State Department of Education, PPBS Manual, op. cit., p. 97.

Opinion

A conclusion or judgment held with confidence, but falling short of positive knowledge. An opinion may be either a judgment in a matter of objective fact or truth, or it may express one's feelings in what is a matter of evaluation rather than fact.[43]

Parent Involvement Activities

School-site activities designed to improve communications between the school and the poverty area community. Parent involvement and participation includes activities designed to make parents aware of the school's instructional endeavors and their children's progress and to assist parents in helping their children in the learning process.[44]

Planning, Programming and Budgeting Systems (PPBS)

Management systems which incorporate all the procedures necessary to identify, plan, execute, and review the activities and resources required to achieve identified objectives. It provides for periodic review and refinement of long and short-range goals and objectives in order to meet the changing needs of the environment.[45]

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[43]Standard College Dictionary, (New York: Harcourt, Brace and World, Inc., 1963), p. 947.

[44]California State Department of Education, Guidelines, op. cit., pp. 15-16.

[45]California State Department of Education, PPBS Manual, op. cit., p. 98.

Staff Development Activities

A planned series of ongoing activities, tailored to meet the needs of the project staff. Planning for staff development should involve those persons who are to participate in order to insure that the content is practical and is related to the needs and interests of the participants.[46]

Standardized Test

A systematic sample of performance obtained under prescribed conditions, scored according to definite rules and capable of evaluation by reference to normative information.[47]

III. ORGANIZATION OF THE DISSERTATION

Chapter I has dealt with the general nature of the problem with which this study is concerned. The need for the research was discussed along with a rationale for a study of systematic statistical methodologies appropriate to optimizing the allocation of resources in Compensatory Education programs in order to elicit maximum cognitive gain in the vital areas of reading and mathematics. The limitations inherent in this investigation were described, followed by a section defining the terms used throughout the study.

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[46] California State Department of Education, Guidelines, op. cit., p. 16.

[47] Stanley and Hopkins, op. cit., p. 458.

A review of the literature pertinent to the investigation will be presented in Chapter II. Chapter III will focus on the methodology of this study, including the description of and rationale for selection of the population studied, background information, and data collecting and collating procedures.

The presentation and the treatment of the data obtained will be considered in Chapter IV and the discussion of the findings of this study will be presented in Chapter V. Chapter V will conclude the dissertation with a summary, along with conclusions and recommendations. Contained in the Appendices is supplementary information and a sample of the statistical computations used for computing the data.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

Four broad areas are germane to an adequate appraisal of the literature of educational planning in Compensatory Education, its process and hoped-for outcomes. First, quite specific to the present study, is a survey of the literature relating to the concept of Equal Educational Opportunity, its history and sociology, the attempts to analyze its existence or non-existence in American schools, and its current status. Grasp of the concept of Equal Educational Opportunity is prerequisite to understanding of the fundamental rationale on which Compensatory Education is based.

The second broad area relates to Compensatory Education itself: its history and its administrative and curricular practices. The third broad area surveyed is a history of allocations of resources in education with particular emphasis on evidence of attempts to systematize allocations of resources.

Fourth, a history of multiple regression as a statistical tool in education is examined, the rationale being evaluation of the plausibility of the statistical device as an investigative tool in terms of the experiences of previous applications in education.

I. A HISTORY OF EQUAL EDUCATIONAL OPPORTUNITY

Thomas Jefferson held the view that the school was expected to provide the technical skills and basic knowledge necessary for work and economic survival, that it was from newspapers, books and from participation in politics that people were to be really educated. It is highly possible that it never occurred to Jefferson that schooling would become the chief educational influence on the young of America. But the Jeffersonian concept of utilitarian education prevailed, becoming the mode in the growing acceptance of universal educability. This concept extended well into the middle of the nineteenth century in America, and a "liberal" education was considered a relatively useless luxury.[1]

The wide acceptance of the Jeffersonian utilitarian viewpoint may have had the effect of salvaging education for Negroes in the Reconstruction Period immediately following the Civil War. Educational facilities for black people and other poor people expanded slowly, under the banner of technical or vocational training, which was for its time a victory. But the neglected concern for the "liberating" study of the arts and sciences made this a victory from which true equality of educational opportunity has yet to recover.[2]

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[1] Edmund W. Gordon, "Defining Equal Opportunity," On Equality of Educational Opportunity, F. Mosteller and Daniel P. Moynihan, eds., (New York: Random House, 1972), p. 425.

[2] Ibid.

By the middle of the twentieth century it was legally established that in American society separate schools were intrinsically unequal, a decision which was a reversal of a previously-held legal position by the Supreme Court. Before that 1954 decision, however, it was becoming clear that racially-mixed schools do not automatically insure education of high quality. Although the performance of minority-group children in some of those schools was superior to that of such children in segregated systems in the south, differences in achievement and in the characteristics of their schools were notable.[3]

Much of the impetus toward equal educational opportunity occurred during the 1960's. Gordon states that[4]

> Some school systems responded to the militant and legal thrusts with plans for the redistribution of school populations in efforts to achieve a higher degree of ethnic balance. Others introduced special enrichment programs intended to compensate for or correct deficiencies in the preparation of children or the quality of the schools. Neither of these efforts at achieving integrated education nor at developing compensatory education resulted in success. The result was a priority-shift in the late 1960's, to that of control of those schools, serving such children, by groups indigenous to the cultures and communities in which they live. Hence the demand for "black schools run by black people."

Woven into the foregoing, however subtly, is an ongoing dichotomy: desegregation versus Compensatory Education. This di-

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[3] Ibid., p. 426.

[4] Ibid.

chotomy suggests that, in many instances, Compensatory Education programs have emerged as a device in the interest of quality education but in opposition to desegregation. This point will not be pursued here as it is not pertinent to the current investigation.

Major Findings of the Coleman Report

The Coleman Report, entitled "Equality of Educational Opportunity," has dual significance for the current investigation, both from the standpoint of its findings and from the perspective of some of its statistical sophistication and weaknesses. The latter aspect(s) will be considered later in this investigation.

Following are some of the major findings of the Coleman Report, selected as they are relevant to this investigation:

(1) Racial bias existed during the process of allocation of resources among northern urban elementary and secondary schools in 1965, but it was slight relative to the variation due to other factors. The Coleman report states:[5]

> Generally, compared to white pupils, Negroes go to older, larger, more crowded buildings with fewer laboratories and library books, auditoriums and gymnasiums, although they have available more remedial classes and correctional personnel.

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[5]James S. Coleman, et. al., Equality of Educational Opportunity, (Washington: Government Printing Office, 1966), p. 203.

(2) Where schools with economically and racially similar students were compared, differences in school policies and resources were rarely associated with statistically significant differences in verbal achievement.[6]

(3) Whether black or white, lower socioeconomic status students showed achievement that was strongly related to the socioeconomic level of their classmates.[7]

The foregoing points, taken from the Coleman Report, argue for desegregation of schools as a solution. The desegregation controversy still rages, and is outside the purview of this investigation. However, the Coleman Report, in addition to suggesting the foregoing, argues (although indirectly) for adequate Compensatory Education programs of quality. The following points are relevant:

(1) Except for one minor case, all white averages in educational achievement are above all Negro averages.[8]

(2) All city-dwelling groups score above all country-dwelling groups of similar race and region.[9]

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[6] Ibid., pp. 290-330.

[7] Ibid.

[8] Daniel P. Moynihan, "Sources of Resistance to the Coleman Report," Equal Educational Opportunity - Harvard, (Cambridge, Mass: Harvard University Press, 1969), pp. 25-38.

[9] Ibid.

(3) All Northern groups (and Western) score above all Southern groups of similar race and origin.[10]

(4) Almost all groups show a tendency for achievement to decline where the father is not present.[11]

It is the opinion of the writer that the Coleman Report argues loudly for programs in Compensatory Education and their variations. Point (1) supports general Compensatory Education; point (2) and (3) likewise; and point (4) reinforces the importance of Auxiliary services, Parent Involvement and the affective aspect of Staff Development.

There has been considerable reaction from various quarters to the sociological, psychological, legal and economic aspects of the Coleman Report. Moynihan[12] groups all reactions as emanating from three "establishments:" Educational, Research and Reform. He charges the Education establishment with lack of a tradition of basing educational practice on research findings, and resistance to research findings on institutional grounds. Secondly, he charges that the "Research" establishment is composed primarily of persons with "distinctive interests and sensitivities that make findings such as Coleman's particularly difficult to assimilate." Thirdly, Moynihan

[10] Ibid.

[11] Ibid.

[12] Ibid.

contends that the Reform Establishment tended to concentrate on Coleman's findings rather than their implications, with the result that the report became negatively perceived rather than becoming a powerful social science case for school integration.[13]

Despite criticisms from educational, sociological and research perspectives, the Coleman Report remains a powerful document which argues loudly for Equality of Educational Opportunity. The findings of the Coleman Report were instrumental in influencing national movement toward Compensatory Education as a means of achieving Equality of Educational Opportunity.[14]

II. A HISTORY OF COMPENSATORY EDUCATION

On April 11, 1965, President Lyndon B. Johnson signed into law the Elementary and Secondary Education Act (ESEA), Public Law 89-10, which provided that 1.3 billion dollars be distributed through five major titles of the act, all of which were designed to enhance the quality of education in America. Specifically, the passage of ESEA was:[15]

> ....to serve two ambitious and challenging goals: (1) to achieve Equality of Educational Opportunity by targeting funds

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[13] Ibid.

[14] Lyndon B. Johnson, The Vantage Point: Perspectives of the Presidency, 1963-1969, (New York: Holt, Rinehart and Winston, 1971), pp. 206-212.

[15] J.S. Berke and M. Kirst, Federal Aid To Education, Who Benefits? Who Governs? (Lexington, Mass: D.C. Heath, 1972), p. 21.

> for the education of children from low-income families and (2) raising the quality of all education by supporting experimentation and innovation.

ESEA Title I, which was to assist education in low-income areas, affecting those with families receiving less than $2000 in yearly income, was allocated the major portion of the authorization - $1.06 billion dollars, to be distributed to approximately 94 percent of the school districts of the nation, providing supplementary educational resources, staff, classroom construction, equipment and other materials, all of which were to be directed at the nation's first full-scale effort at the compensatory education of its educationally disadvantaged youngsters.[16]

When President Lyndon Johnson signed the bill on April 11, 1965, he declared:[17]

> "As President of the United States I believe deeply no law I have signed, or will ever sign, means more to the future of America."

The greatest concentrations of the funds of ESEA Title I of the act went to rural areas of the South and to the core areas of big cities, and in the first year over 22,000 projects were approved. Almost two-thirds were for Language Arts instruction and Remedial

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[16] E. Eidenberg and R. Morey, An Act of Congress, (New York: W.W. Norton and Company, 1969), p. 243.

[17] Stephen J. Knezevich, Administration of Public Education, (New York: Harper and Row, 1969), p. 182.

Reading. The major portion of the funds (51.6 percent the first year and 57.6 percent the second year) were for instructional services. Food services, particularly hot breakfasts and lunches at school, accounted for more than 2 percent of Title I funds. It is estimated that 8.3 million educationally-deprived children in 50 states were reached during the first year.[18]

Another Compensatory Education program enacted almost simultaneously was "Project Headstart," enacted separately under the aegis of the Economic Opportunity Act of 1964, under the rationale of providing comprehensive health, nutritional, educational and social services to children from lower socioeconomic groups who have not reached the age of compulsory school attendance, so as to aid these children in attaining their full potential and providing for the direct participation of parents of these children in the development, conduct, and overall program direction at the local level.[19]

The "Follow Through" program, additional compensatory effort, was also authorized by the Economic Opportunity Act of 1964, as amended in 1972. This aspect of the Economic Opportunity Act had as its rationale:[20]

> "...focus primarily on children in kindergarten or elementary school who were previously enrolled in Head Start or similar

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[18] Ibid., p. 183

[19] Congress of the United States, The Economic Opportunity Act of 1964, As Amended, (Washington: Government Printing Office, 1973), p. 30.

[20] Ibid., p. 32.

> programs and designed to provide comprehensive services and parent participation activities as described in paragraph...which the Director (of OEO) finds will aid in the continued development of children to their full potential.

There were also legislative attempts at Compensatory Education in California. In 1963, the California State legislature enacted Senate Bill 28, popularly known as the McAteer Act after its author, Senator Eugene McAteer of San Francisco. This act contained provisions for pilot studies in dropout prevention, demonstration programs in Compensatory Education in Language Development and Mathematics, reduced class-size in identified schools in selected poor neighborhoods and a building augmentation program to accompany such class-size reduction.[21] Assembly Bill 938, legislation that continued many of the provisions of the McAteer Act, incorporated the demonstration Compensatory Education aspect into the Education Code.[22]

Approaches to Compensatory Education have been myriad, all purporting to lead to the goal of delivering quality education to students selected for participation. However, as was mentioned earlier, the definition of quality education itself depends on who defines it.

Legislative pressure has influenced the prime aims and objectives of Compensatory Education programs in the direction of measu-

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[21]California State Senate., Senate Bill 28, (Sacramento: Bureau of Printing, 1963).

[22]California State Assembly, Assembly Bill 938, (Sacramento: Bureau of Printing, 1968).

rable cognitive achievement. Congressman Albert H. Quie, in response to a statement made by an educator during Oversight Hearings on the Elementary and Secondary Education Act by the House Committee on Education and Labor, said:[23]

> "That may be well and good, that you see change in motivation and you feel better and the parents feel better and I don't doubt at all it's true. But it doesn't sell up here because a well-motivated child with happy parents that still can't read really has not accomplished as much as we want."

The stateement by Mr. Quie, couched in lay language and made as an individual member of the committee, suggests that there is pointed legislative interest in measurable achievement as far as federal aid to education is concerned.

Compensatory Education programs at the state level in California reflect attention to the concern addressed by Mr. Quie. In a three-year survey of Compensatory Education programs and their effectiveness, the Bureau of Compensatory Education reported:

> The data most frequently used in describing the educational achievement of pupils were the test scores from standardized achievement tests; also, general scholastic ability

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[23]United States Congress, House, Committee on Education and Labor, Oversight Hearings on Elementary and Secondary Education, Hearings before Committee, 92d Congress, 2d Session on HR 12695, September 26 - October 11, 1972 (Washington: Government Printing Office, 1972), p. 299.

[24]California State Department of Education, Highlights of Effective Compensatory Education Programs, (Sacramento: Bureau of Publications, 1969), pp. 21-32.

test scores and grade distribution reports in specific areas were frequently used.

III. CURRICULAR PRACTICES IN COMPENSATORY EDUCATION

The literature with respect to curricular practices in Compensatory Education on the national level is concentrated in the years 1969 to the present, a logical time-span in the opinion of this observer, in view of the fact that it took a minimum of three years before significant longitudinal studies in Compensatory Education lent themselves to analysis and publication. Published literature in Compensatory Education is lacking in suggestion(s) of cause-effect relationships. This void may have been brought about due to the feverish push by manufacturers of educational software and hardware to get their products on the market immediately after the passage of Public Law 89-10 in 1965. That furious push resulted in a proliferation of materials, methods, systems, devices, programs, gimmicks and gadgets in the field of beginning reading and mathematics.[25]

Aukerman[26] identified more than 100 manufactured approaches to beginning Reading alone. That these varied experiences are available is both positive and negative; positive in the sense that free competition permits latitude in the development of variegated

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[25] United States Congress, Oversight Hearings, op. cit., p. 171.

[26] Robert C. Aukerman, Approaches to Beginning Reading, (New York: John Wiley and Sons, 1971), pp. 1-7.

approaches; negative in the sense that many of these approaches were marketed without thorough preliminary experimentation that might have established their worth in the context(s) for which they were designed.

Although there has been a rush of manufactured hardware and software due to the massive federal funding of Title I and other categories, outstripping the experimental literature of Compensatory Education, that literature, published and unpublished, is on the upswing. There have been several important studies which have emerged.

Six and Vugrin[27] conducted a longitudinal study which established the relationship between participation in preschool Compensatory Education programs and subsequent educational development. Investigation of the relationship of preschool participation in the Chula Vista, California, Public Schools and (1) Kindergarten readiness, (2) reading readiness at the beginning of First Grade, (3) reading achievement at the end of first grade, (4) reading achievement at the end of second grade, (5) social skills and attitudes that contribute to success in school, and (6) parent attitudes toward school revealed that: (1) preschool participation has an overall positive influence on school readiness and reading achievement,

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[27]Leslie W. Six and John F. Vugrin, "The Relationship Between Participation in Unruh Preschool Compensatory Education Program and Subsequent Educational Development" (unpublished joint Doctoral Dissertation, United States International University, San Diego, 1971), pp. 246-251.

(2) the trend of positive gains in academic achievement on preschool participants persists in the second grade, (3) the greatest gains in achievement as a result of participation in the preschool program were made by non-Spanish-surnamed children, (4) in terms of academic achievement the program helped but did not compensate children with Spanish surnames to the degree of non-Spanish-surnamed children; (5) two-year preschool participation when compared with one-year participation benefits children with Spanish surnames more than children with non-Spanish-surnames; (6) there was no significant effect of program participation on the self-concepts of the participants; (7) actively participating parents expressed a more positive attitude toward school than parents who did not participate; and (8) children from environments similar to the environments of the preschool participants but who did not have the experience of preschool continued to show lower achievement than either the participants or the sampling from a normal population. The evidence presented in this study along with other evidence that is accumulating regarding the worth of preschool programs suggests that these programs will be effective when moved into the mainstream of education as standard school practice.

Parallel to the current investigation was an investigation by Frelow[28] in which methods of resource allocation in Compensatory Education were compared to methods of resource allocation in desegregation implementation, all within the Berkeley Unified School District, Berkeley, California. This study revealed that while services to children of lower socioeconomic groups increased significantly as a result of the application of funds from both sources, separately and jointly, the achievement gap between children from lower and upper socioeconomic neighborhoods was not closed. Frelow noticed slight decreases in Compensatory Education services to eligible children as desegregation proceeded. This study was significant in that it pointed out a recurrent peril in the application of federal funds: a decrease in basic services (the locally-funded effort) as federal funds are applied, a practice which is illegal.[29]

Three comparable Compensatory Education programs were investigated in the Fresno, California School District by Taylor:[30] Follow-Through, the Fresno District "Keep-Up" program, and the traditional Kindergarten program of that district. Using the Weschler Preschool

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[28]Robert D. Frelow, "A Comparative Study of Resource Allocation: Compensatory Education and School Desegregation" (unpublished Doctoral Dissertation, University of California, Berkeley, 1970)

[29]California State Department of Education, Guidelines, op. cit., p. 28.

[30]Vera Cook Taylor, "An Evaluation of Three Compensatory Education Programs," (unpublished Doctoral Dissertation, University of Southern California, Los Angeles, 1970), pp. 152-161.

and Primary Tests of Intelligence (WPPSI) in a pretest-posttest methodology, Taylor found that the Follow-Through children had the lowest pretest mean of the three groups of children, but made the greatest gains. Significant differences in gains made by black and Spanish-speaking children were not established, but boys performed significantly higher than girls. No significant differences were established between children who had had preschool and those who had no preschool experience. Significant differences between black and Spanish-speaking children were not established. The study argues for both federally-funded (Follow-Through) and district-funded (Keep-Up) Kindergartern programs, because although Follow-Through children had highest gains, they started from a lower base-line. The Keep-Up program, a compensatory program for children not eligible for Follow-Through, showed both higher pretest and posttest means than Follow-Through.

In a similar but distinct experiment, Truex[31] sought to elicit gains in language usage among disadvantaged children through "experiential intervention" over a short-term period of ten weeks. The experiential training was conducted on a one-to-one basis outside of the regular classroom, and each student received two weekly half-hour

[31]Milton Harold Truex, "A Study of Gains From Preschool and Early Elementary Compensatory Training" (unpublished Doctoral Dissertation, Case Western Reserve University, Cleveland, 1970).

sessions of training for ten weeks. Two groups, designated control A and control B at the Kindergarten level were set up, with the B group receiving "experiential intervention" training. It was found that for 90 students in Group B, gains for intervention training at the primary and intermediate levels exceeded the gains at the Kindergarten level. Experimental groups at all levels made statistically significant gains in language usage, cognitive functioning and achievement motivation as measured by the test instruments chosen for the study. The instruments for the three purposes were, respectively, the Iowa Test of Preschool Achievement, the Stanford Binet and the Rotter-Battle I-E Test.

More closely related to Compensatory Education, per se, and containing both curricular and administrative implications, was the analysis performed by Vruggink[32] who conducted an exhaustive survey of the factors affected by the existence of Compensatory Education programs within a large urban school district. It was found that: (1) the rate of transiency of children in inner-city schools has not changed since 1963; (2) the average age of teachers in schools in disadvantaged neighborhoods has fallen from 41 to 35 since 1963; (3) I.Q. scores show very little change when compared with those

[32]E. H. Vruggink, "A Study of the Contribution of Compensatory Programs in a Large Urban School System" (unpublished Doctoral Dissertation, Ohio State University, Columbus, 1970), pp. 154-166.

of 1963; (4) schools with majority black enrollments show the same patterns as the schools with majority white enrollments; (5) compared to 1963, first grade students in 1969 showed a slight improvement in readiness on the Metropolitan Readiness Test; (6) pupil-teacher ratios in inner-city schools fell from 27.3 in 1963 to 21.1 in 1970; (7) inner-city schools do not have a higher percentage of first-year teachers; (8) significant gains in I.Q. and achievement scores were shown when a highly structured language arts and mathematics program was tried with preschool and Kindergarten children; and (9) teachers and principals feel that Compensatory programs are helping children achieve better today than five years ago.

In addition to the above, Vruggink found significant innovations brought on by the presence of Compensatory Education funds. These innovations were in terms of: differentiated staffing, nongraded classes in elementary school, concerted staff development programs, curricular innovations, greater parent participation, expanded health services, greater interagency cooperation, and stronger evaluation activities along the lines of structured objectives. He concluded that future needs should be: (1) more lead time in Compensatory Education planning; (2) de-emphasis on achievement test results as a single tool in evaluation; (3) greater involvement of

teachers and building principals in program planning; and (4) more emphasis on teacher education with such education directed to working in disadvantaged areas.

Ruth L. Holloway[33] supported the contention of Vruggink with respect to the influence of experimentation and innovation in Compensatory Education programs on general education.

Kirby[34] reviewed the effect of ESEA Title I and Follow-Through programs in the state of Texas and found successes in the areas of program comprehensiveness, parental involvement, staff concern and dedication, and teacher competency. His ultimate conclusion was that despite lack of convincing national data on pupil achievement, the Compensatory Education movement has been worthwhile and should be continued and expanded.

Delving into a relatively remote but important aspect of Compensatory Education, Perino[35] contrasted four methods of training paraprofessionals as a means of analyzing their relative effective-

[33]Ruth L. Holloway, "The Impact of Compensatory Education on the Further Developments of a General Education" (unpublished Doctoral Dissertation, United States International University, San Diego, 1970)

[34]William N. Kirby, "Compensatory Education: A Review of Selected ESEA Title I and Project Follow-Through Models and Implications for Change" (unpublished Doctoral Dissertation, University of Texas, Austin, 1972)

[35]Anthony R. Perino, "A Comparison of Four Paraprofessional Training Techniques" (unpublished Doctoral Dissertation, Southern Illinois University, Carbondale, 1971)

ness. The four training programs investigated were: (1) an integrated basic Helping Skills Program; (2) Programmed and Self-Instruction; (3) Experiential; and (4) Lecture. Though Perino found that he could not evaluate the relative merits of the approaches using cognitive classroom outcomes, he did find that, using four Affective instruments (The Affective Sensitivity Scale, The Personal Orientation Inventory, The Discrimination Index and the Truax Accurate Empathy Scale), significant differences at the .05 level were found among three of the four approaches. His ultimate conclusion was that the Integrated Basic Helping Skills Program was most effective in training paraprofessionals for both statistical and practical reasons. The results of his study have high relevance for Compensatory Education because the well-trained paraprofessional is now a key figure in school-site Compensatory Education programming and operation.

Roby[36] used grade promotion, attendance and holding power of the school as criteria in the evaluation of successful Compensatory Education programs. He found that after using the three criteria in examining two groups of disadvantaged children (one group exposed to

[36]Wallace R. Roby, "Grade Promotion, Attendance and Holding Power as Evaluative Measures of Compensatory Education" (unpublished Doctoral Dissertation, The University of Connecticut, Storrs, Connecticut, 1972)

and one not exposed to Compensatory Education programming), the three indices were not useful singularly or in combination. He concluded that these three criteria should be used in conjunction with other school, community and home variables that have bearing on the attainment of Compensatory Education pupils.

In the area of achievement itself, there have been several significant studies in Compensatory Education. Maytubby[37] sought to compare social class differences and academic performance criteria using subjects of similar intelligence as a means of predicting academic achievement. Using a total of 53 students and dividing them into two more or less equal groups (Group I, I.Q. ranges 90-105 and Group II, I.Q. ranges 110-125), he then subdivided these groups into "disadvantaged" or "middle class" using the characteristics of the neighborhoods from whence they came as an index for division. He found that in spite of the greater range of knowledge and experiences available to middle class children, the middle class children within the study failed to perform significantly better than the lower social-status children on most variables as determined by a test of significance.

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[37]Willard Dorse Maytubby, "Comparative Prediction of Academic Achievement Among Disadvantaged and Middle Class Children" (unpublished Doctoral Dissertation, St. Louis University, St. Louis, 1971)

Smith[38] explored the impact of Compensatory Education on reading and mathematics of pupils in the middle elementary grades. Using a broadly-based population of 2,697 ESEA Title I pupils, he set about the problem of finding out (1) the effectiveness of the Columbus, Ohio program of Compensatory Education; (2) the character of the students affected; and (3) the nature of the program's performance. Using fourth, fifth and sixth grade students in the ESEA-eligible schools of Columbus, he found that two tests, The California Tests of Basic Skills and The California Tests of Mental Maturity applied to the experimental half and the control half of the sample revealed the following:

(1) the reading and mathematics components in the ESEA schools of Columbus are significantly associated with pupil achievement.

(2) The mathematics component is significantly associated with pupil achievement success in reading, but the reverse is not true.

(3) Neither component is associated with achievement success among pupils of high intelligence.

(4) Successful achievers in reading and/or mathematics re-

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[38]Calvin M. Smith, "An Exploratory Study of the Effects of Compensatory Education on the Reading and Mathematics Achievement of Intermediate Grade Pupils" (unpublished Doctoral Dissertation, Ohio State University, Columbus, 1971)

tained those skills learned over a summer interim without further formal instruction.

(5) Pupil achievement success associated with reading and mathematics success is not homogeneously distributed over all schools studied.

Isenberg[39] hypothesized that there would be no significant differences among disadvantaged children as a result of their exposure to an ESEA Title I program designed for grades one through five, using reading, arithmetic and motor skills as criteria. Experimenting with 270 children evenly divided into five grade levels, he found significant achievement differences in the experimental group of 135 girls and 135 boys at all five grade levels.

Goldner[40] included the Affective Domain along with the Cognitive in his measurement of the impact of Compensatory Education programs. He examined two separate groups of 120 children each, using the Iowa Tests of Basic Skills to measure language development and the Survey of Study Habits and Attitudes to measure the Affective aspect. One group was exposed to additional instruction in reading skills and

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[39] R. L. Isenberg, "A Comparison of Achievement Scores in Reading, Arithmetic and Motor Skill Development Among Three Instructional Programs with Different Levels of Supportive Services for Elementary School Compensatory Education Students" (unpublished Doctoral Dissertation, Brigham Young University, 1972)

[40] L. R. Goldner, "A Study of the Effects of Compensatory Education Instruction in Language Arts and in Arithmetic on Achievement, Study Habits and Selected Attitudes of Eighth Grade Students in a Depressed-Area School" (unpublished Doctoral Dissertation, New York University, New York, 1972)

the second group to additional instruction in mathematics skills. A third control group of 90 pupils received no compensatory instruction. He found lack of support for rejection of his null hypothesis; however, it was found that experimental groups maintained their pretest levels on the Study Habits and Attitudes scale.

Strictly in the Affective Domain, Ingram[41] explored 290 urban Michigan students. Of these students, 105 were involved in the Upward Bound program and the others were not. Many of these students had been Compensatory Education students. Instruments used to measure the internal versus external locus of control and self-esteem of these students were the Social Reaction Inventory Scale, the Self-Concept Ability Scale and the Rosenberg Self-Esteem Scale. Although the quest for gender identity and grade-level distinctions were not major objectives in the study, the data were scrutinized for such distinctions. Female students were found to be more "internal" than their male counterparts on the Intellectual Achievement Responsibility Scale, suggesting that female students of disadvantaged backgrounds had a deeper sense of responsibility for achievement success in school. Conversely, the male students' locus of control disposition reflected an external orientation. In short, they believed that some-

[41]Jesse H. Ingram, "Locus of Control and Self-Esteem of Compensatory Education Students" (unpublished Doctoral Dissertation, University of Michigan, Ann Arbor, 1972)

one else was responsible for their successes or failures in school. However, Upward Bound students, male or female, showed greater internalization of loci of control.

Published literature relating to Compensatory Education leans heavily to the political dynamics of Compensatory Education. While such polemics are outside the purview of this investigation, it appears important to investigate learned opinions of the socio-psychological milieu in which the disadvantaged child operates. Several important studies and opinions follow.

The aforementioned nationwide study on Equality of Educational Opportunity (The Coleman Report) did much to describe the school context in which the disadvantaged child is found. Some of the data of the Coleman Report focuses on testing programs, caliber and attitudes teachers and quality of the physical plant(s).

In reporting test information, Coleman[42] offered the following qualifier about standardized tests:

> What they (standardized tests) measure are the skills which are the most important in our society for getting a good job and moving up to a better one, and for full participation in an increasingly technical world.

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[42]James S. Coleman, Social Climates In High Schools, (Washington: Government Printing Office, 1971), p. 20.

Additionally, the Coleman Report uncovered data which had for a long time been suspected by educators and sociological observers. Some of his data related directly to the sociological characteristics of teachers of middle class and disadvantaged students. Using admittedly rough indicators of teacher quality such as type of college attended, years of teaching experience, salary, educational level of mother and a score on a 30-word vocabulary test, it was found that the average black student attends a school where a greater percentage of the teachers appear to be somewhat less able than teachers in the schools of the average white student. It was also found that fifty-one percent of the average white student's teachers would not choose to change schools while only forty-six percent of the average black student's teachers had the same attitude.[43]

In attempting to identify the school characteristics which account for the most variation in achievement, it was found that curriculum and facilities count for little, that the quality of teachers (their verbal skills and educational background) bore a strong relationship to achievement. A final conclusion was that the educational backgrounds and aspirations of other students in the school could exert a powerful effect on student achievement.[44]

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[43] Ibid.

[44] Ibid., p. 21

Other investigators have examined the role played by the teacher on student achievement. Repeatedly, the influence of teacher expectations has been reported. Crowl and MacGinitie[45] reported that when white teachers were asked to evaluate the content of taped answers to two questions, given by six white and six black Ninth grade students, the responses of the black students were rated significantly lower than those given by the white students. What is of startling interest is that the students' responses for both groups contained the exact same wording. The ratings given by the teachers were not found to be associated with the teachers' age, sex, teaching experience, grade levels taught or percentages of black students previously taught.

The foregoing argues on behalf of two important supportive components within Compensatory Education programs as practiced in California: (1) Staff Development, for the purpose of developing awareness within teachers of the importance of the self-concept of the child, and (2) Intergroup Relations, which deals directly with the self-concept of the minority child from the perspectives of History, Sociology and Psychology.

The writings of Kenneth B. Clark, the eminent social-psycholo-

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[45]Thomas K. Crowl and Walter H. MacGinitie, "White Teachers' Evaluations of Oral Responses Given by White and Negro Ninth Grade Males," Proceedings of the Annual Convention of the American Psychological Association, Miami, 1970, pp. 635-636.

gist, reflect the same concern for teacher focus on the Affective Domain along with the Cognitive Domain in dealing with minority children. Clark presented a very telling argument against the frequently heard rationale of teachers, that the schools alone cannot overcome the (negative) influences of the home and family in Harlem. Pointing out that the achievement data in the Harlem schools shows that major deterioration in learning takes place between third and sixth grade, he contended that the children fail to learn because they are taught ineffectively by incompetent teachers who do not believe that the students can learn, do not expect them to learn, and are unable to empathize, understand or identify with them. He holds further that:[46]

> The 'clash of cultures' in the classroom is essentially a class, a socio-economic and racial warfare being waged on the battleground of our schools, with middle-class and middle-class aspiring teachers provided with a powerful arsenal of half-truths, prejudices and rationalizations, arrayed against hopelessly outclassed working-class youngsters. This is an uneven balance, particularly since, like most battles, it comes under the guise of righteousness.

Two other dimensions relevant to learning processes in Compensatory Education-type children were introduced by Riesmann,[47] who held that the reasoning processes of culturally disadvantaged children

[46] Kenneth B. Clark, Dark Ghetto, (New York: Harper and Row, 1965), p. 129.

[47] Frank Riesmann, The Culturally Deprived Child, (New York: Harper and Row, 1962), p. 91.

are typically inductive rather than deductive, and Bloom[48] who contended that the disadvantaged student has difficulty developing abstract concepts and making generalizations. The literature does not support the positions of these two writers with intellectually honest evidence; to the contrary, certain linguists offer indirect refutation to these positions by suggesting that the verbal or communicative style of the disadvantaged child presents a communications gap that is not bridged so readily by the middle class teacher; that is, if Clark's contention that the "onus" is on the teacher is a plausible and valid one, then the teacher's inability to interpret the linguistic framework within which the child operates may be the determining factor for low achievement of disadvantaged children rather than those posited by Riesmann and Bloom.

This communications factor is supported by linguists Fasold and Wolfram[49] who hold that:

> The Negro dialect, then, as the term is used here is a cohesive linguistic system which is substantially different from standard American English dialects...It is a fully formed linguistic system in its own right, with its own grammar and pronunciation rules; it cannot simply be dismissed as an unworthy approximation of standard English.

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[48] Benjamin S. Bloom, Allison Davis and Robert D. Hess, Compensatory Education for Cultural Deprivation, (New York: Holt, Rinehart and Winston, 1965), p. 203.

[49] Ralph W. Fasold and Walter A. Wolfram, "Some Linguistic Features of Negro Dialect," in Contemporary English: Change and Variation, David L. Shores, ed., (New York: J.B. Lippincott and Company, 1972), p. 54.

The two writers give a poignant, meaningful example of the confusion that may exist between middle-class teachers and children who speak the Negro dialect:[50]

> "For example, a television advertisement for a brand of powdered soup contained the line 'Is it soup yet? and was intended to mean something like 'Has it become soup yet? and was no doubt understood by the standard English-speaking audience, except possibly in parts of the South. But speakers of Negro dialect might well understand the same sentence as something like 'Is there any soup yet?'"

Davis saw a parallel, if not similar, problem with Spanish-speaking children who encounter many difficulties in language development, and added an account of the psychology of the child and resultant lack of motivation due to feelings of alienation because of isolation brought by a completely different language.[51] Miles Zintz[52] saw the American Indian child as being in still another similar position.

Recurrent in the literature of linguistic isolation was the theme of Kenneth Johnson:[53] that as long as the "non-standard" language or dialect is functional for the child, it will not be re-

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[50] Ibid., p. 84.

[51] A.L. Davis, "English Problems of Spanish Speakers," in Contemporary English: Change and Variation, David L. Shores, ed., (New York: J.B. Lippincott and Company, 1972), p. 123.

[52] Miles V. Zintz, "American Indians," in Reading for the Disadvantaged, Thomas D. Horn, ed., (New York: Harcourt, Brace and World, Inc., 1970), pp. 41-48.

[53] Kenneth R. Johnson, "Blacks," Readings for the Disadvantaged, Thomas D. Horn, ed., (New York: Harcourt, Brace and World, Inc., 1970), p. 36.

placed. Johnson stresses education of teachers in the phonology and structure of the non-standard dialect(s) of children as well as in second-language teaching techniques. He added that instructional materials should be prepared consistent with the special linguistic and cultural features of the group.

Mathematics represents the other half of the Compensatory Education spectrum with respect to skill development. However, Mathematics education, unlike Reading, has experienced many successes in Compensatory Education in the state of California as measured by standardized tests.[54]

The main objective of the Mathematics component in Compensatory Education in California was to increase the average achievement level of students. The most frequently used approach to accomplishing that objective was a highly individualized diagnostic prescriptive program of instruction. Generally, students were pretested with a standardized test, and detailed information was recorded on diagnostic profiles for each student. Staffs generally consisting of resource teachers, specialists, classroom teachers and instructional aides worked together to design individualized programs

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[54]California State Department of Education, Evaluation of ESEA Title I Projects of California Schools: Annual Report, 1971-72. (Sacramento: Bureau of Publications, 1972), p. 18.

in Mathematics.[55]

Various combinations of aforementioned staffs provided students with both concrete and abstract intellectual experience in Mathematics in the form of puzzles, mathematical forms and tools. Mathematical games were used so that students could learn through experience.[56]

On a statewide basis in California, the greatest student gains in Mathematics at the elementary school level were made by students in grades three, four and five. At those grade levels, 75 percent or more of the participants achieved at least a month of growth for a month of instruction. The least gain was made by students in grades one, seven and eight. The small amount of growth shown for pupils in grade one was determined to be due to the nature of testing and measuring Mathematics achievement at that level.[57]

Published and unpublished literature in Compensatory Education Mathematics is conspicuously absent. This may be attributed to many factors, the prime one being the aforementioned success of Mathematics education in Compensatory Education, coupled with the statewide stress on Reading Achievement in Compensatory Education.

[55] Ibid., p. 18.

[56] Ibid.

[57] Ibid.

Specific Mathematics approaches used in schools in the present study will be presented in a later section.

The Reading Instruction Program of Schools in the Sample

Diagnosis, prescription and treatment formed the basis of the reading programs of the schools in the present study. This was implemented as a constant and overlapping process. The diagnosis led to a prescription and treatment that, in turn, called for a reassessment and an altered prescription which was again analyzed diagnostically. Teachers' observations and evaluations were constant sources of data for the process. The techniques of diagnosis, prescription and treatment were developed through inservice activities and the increasing use of the ESEA developed Criterion-Referenced measures and prescriptive materials. A variety of methods and approaches were used to teach reading. Encouraged was a multi-disciplinary, multi-sensory, multi-media approach which would lend itself to the varied achievement levels and learning styles of individual students. In a limited number of classrooms, special programs such as the Initial Teaching Alphabet, Words in Color, SRA Kits, Commercially prepared games, SWRL materials and Listening Posts were used in conjunction with teacher-made materials.[58]

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[58]Oakland Unified School District, Language Development Evaluation Report, 1972-73, ESEA Title I, (Oakland: Research Department, 1973), pp. 5-21.

The Mathematics Instruction Program(s) of Schools in the Sample

During the 1972-73 school year, heavy emphasis was placed on individualized instruction as the primary strategy to be used in teaching Mathematics. To this end, the majority of teachers incorporated a diagnostic - prescription evaluation approach into their classroom programs. Teacher observation, standardized test results and the locally-developed Criterion-Referenced Mathematics Tests were used by teachers to determine each student's skill needs, learning style, rate of learning and special interest. This diagnostic information was used for planning the various lessons best suited to the students' needs.[59]

The most popular classroom strategies employed to carry out individualized instruction included: small teams organized for learning specific skills, learning centers containing activities to be pursued independently, cross-age tutoring with older children tutoring younger children, and contracts whereby the student would agree on a particular unit of work to be completed at his own rate with teacher supervision.[60]

Commercially-developed software and hardware materials included: McGraw-Hill Programmed Mathematics, Harcourt Brace and World Mathematics Enrichment Workbooks, SRA Kits, Cuisenaire Materials, Unitex Cubes, Sullivan Programmed Mathematics, The Cyclo-Teacher,

[59]Oakland Unified School District, Mathematics Evaluation Report, 1972-73, ESEA Title I, (Oakland: Research Department, 1973), p. 2.

[60]Ibid., p. 3.

System 80, Computer Assisted Instruction and SWRL Materials.[61]

Program Planning

A dichotomy often exists in Compensatory Education planning which creates friction and program confusion, often polarizing instructional personnel into opinion camps. Harmer[62] argued that planning in Compensatory Education should proceed in the following sequence: (1) appropriate research on Reading and the disadvantaged; (2) analysis of successful and unsuccessful past programs; (3) developing appropriate methods and materials; (4) identifying levels of problems in teaching Reading; and (5) teaching the four aims of discourse. With an opposite, Affective-oriented approach, York[63] contended that program planning should proceed along the lines of: (1) preserving old values and teaching new; (2) building a positive self-concept; (3) meeting special needs such as health and financial needs of children; and (4) building positive expectations.

The actual program planning for schools in the study is based on California State Guidelines and discussed in Chapter III.

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[61] Ibid., p. 5.

[62] William R. Harmer, "Implications for Teachers: Intermediate Level," in Reading for the Disadvantaged, Thomas D. Horn, ed., (New York: Harcourt Brace and World, 1970), pp. 191-198.

[63] L. Jean York, "Implications for Teachers: Primary Level," in Reading for the Disadvantaged, Thomas D. Horn, ed., (New York: Harcourt Brace and World, 1970), pp. 179-190.

IV. A HISTORY OF RESOURCE ALLOCATION IN EDUCATION

With the Industrial Revolution and the resultant increased urbanization of cities at or about the turn of the century, a number of significant budgetary reforms occurred in urban budgeting, in city offices and school districts.[64] The first such changes in budgetary procedures occurred in New York City in 1906 when the New York City Health Department prepared what they called the first "scientific" budget in America. Doubtless this budget referred to was a budget with nothing new except detailed line-item specificity, with no reference to the manner by which the amounts were determined. This precedent-setting action was autonomous, but of doubtful value outside the general concern of public credibility. After World War I, however, more than half the states established systematic budgets,[65] arbitrary or not, and in 1921 Congress enacted the Budgeting and Accounting Act which had the triple purpose of: (1) requiring a comprehensive presidential budget for the executive branch; (2) establishing a Bureau of Budget to assist the President in preparing his budget; and (3) establishing a General Accounting Office to function as the auditing agency of the government, responsible to the Congress

[64] Charles S. Benson, The Economics of Public Education, (Boston: Houghton-Mifflin Company, 1961), pp. 476-480.

[65] Arthur Smithies, The Budgetary Process in the United States, (New York: McGraw-Hill Book Company, 1955), p. 50.

of the United States.

After this federal precedent, municipal reform in budgeting became easier, with a similar movement occurring in school districts. This parallel movement in school districts heightened the legal authority of school superintendents to an extent that they had very broad discretionary authority in budget formulation.[66]

Because of public focus on budget specificity, however, there was little censure of superintendents about the qualitative nature of the school budget,[67] but with the ever-increasing complexity of urban school districts, coupled with the persistent arbitary budgetary allocation process, there emerged as a tangential result of the Hoover Commission investigations of 1949 an interest in "Performance Budgeting," which slowly spilled over into Education quarters.

"Performance Budgeting" was an idea which sought to relate measurable performance to cost, but it did not catch on readily, perhaps because it was threatening in that it could strip possessors of highly arbitrary powers which were, in many instances, not at all related to the duties of their offices. It was not until 1965 that the concept became the official policy for the Executive Branch of the

[66] Ibid.

[67] Jesse Burkhead, "The Budget and Democratic Government," Public Administration and Democracy: Essays in Honor of Paul H. Appleby, (Syracuse: Syracuse University Press, 1965), pp. 87-96.

federal government.[68]

In October 1966, the California legislature followed the recommendation of Speaker Jesse Unruh and establish an Advisory Commission on School Budgeting and Accounting. That citizens' commission appeared to be the first step in state-mandated installation of PPBS in California's 1,056 school districts, but seven years later, the California legislature made a move and abandoned PPBS. The reasons for the demise of PPBS in California are largely in the political arena, outside the purview of this investigation.[69] The long-term success or failure of this system of relating inputs to outputs in education remains to be seen.

The big-city school budgeting process is a complex one, and in order to analyze it properly, it is necessary to divide it into three steps: (1) preparation, (2) determination, and (3) execution. Operating within a legislatively-determined time-frame, this procedure usually consists of extrapolation from the budget of the preceding year and incorporating anticipated projections in cost based on national or local data (preparation); "base-touching" with all of the legally-defined decision-making points in the budget process (determination); and administration of the budget once it

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[68]Daniel Seligmann, "McNamara's Management Revolution," Fortune, LXXII, No. 1 (July 1965), pp. 116-120.

[69]Michael W. Kirst, "The Rise and Fall of PPBS in California," Phi Delta Kappan, LVI, No. 8 (April 1975), pp. 535-538.

is adopted.[70]

In the determination stage there are certain realistic constraints or boundaried faced, constraints set principally by the financial resources of a community and the character of its population. Beyond these constraints, it is unrealistic to expect educational administrators and school boards to move existing governmental arrangements. In addition to these boundaries, there are also legal and traditional ones. There are federal, local and state laws which limit alternatives available to educational decision-makers involved in the school budget process; court decisions on the rights of property and human rights; legislative actions; fiscal restrictions and municipal controls. All take precedence, thereby reducing discretionary authority for decision-making in public schools. There is also the intrinsic tendency of large school systems to let administrative arrangements become so rigid that they often impair the functioning of the institution and reduce its adaptibility.[71]

There are also indirect constraints on the budget process. An example is the urban taxpayer resistance to bonded indebtedness. No legality is involved, yet that resistance seriously ties the hands of the budget formulator(s).

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[70] H. Thomas James, James A. Kelly and Walter Garms, Determinants of Educational Expenditures in Large Cities of the United States, (Stanford: Stanford University Press, 1966), pp. 55-59.

[71] Ibid., p. 54.

Cities vary in the school budgeting process. In some cities there are patterns of wide formal involvement, starting with the building principals who fill in budget requests forms. These forms flow upward through channels of authority on strict schedule, pausing at various review stations along the way. When all requests as modified by various approving agencies along the way have been compiled, the superintendent and his staff develop a budget presentation for the board of education. Other cities operate along the lines of a relatively informal process; that is, there is participation by a few key staff members only. Budget preparation is delegated by a superintendent to a staff assistant, who adjusts the budget of the preceding year by adding amounts which reflect increased price levels, salary changes and increased school enrollments. The superintendent then reviews the draft of the budget and passes it on to the board of education for approval, often with little or no changes.[72]

Forces bearing on the board's decision to adopt the budget as presented are: (1) the relationship of the superintendent to the board; (2) teachers' organizations; (3) community pressures; and (4) overall financial resources of the school district.[73]

Central to the rationale for this investigation, the literature fails to reveal ample evidence of decision-making based on pre-

[72] Ibid., p. 57.

[73] Ibid., pp. 55-69.

vious educational success(es). For too many years, big city school systems have had the quality of their services determined by the revenues available - not by the needs they served. This would appear to be poor public policy that needs reversing if the troublesome trend in urban education would be reversed.[74]

V. USE OF MULTIPLE REGRESSION ANALYSIS IN EDUCATION

With the cataclysmic changes in private enterprise brought about by the Industrial Revolution, the simple low-investment-high-profit ratios sought by private entrepreneurs no longer met the requirements of business. Profit maximization often gave way to the concept of satisfice[75] or optimization of the total business posture. For example, large businesses sought to maximize profits in one area of endeavor and minimize them in another. Additionally, such businesses often sought to simply maintain a competitive position in a hierarchy of similar businesses, perhaps because of a unique tax position or capitalization requirement that would be undesirable during a given time period.[76]

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[74] Ibid., p. 69.

[75] Joe Kelly, Organizational Behaviour, (Homewood, Illinois: Richard D. Irwin, Inc., 1969), p. 256.

[76] Ibid., pp. 258-259.

Contemporary organizations are concerned with multiple goals, a concern which forces strategies for job integration, group unification and maintenance of productive drive, all while the profit picture is optimized.[77] As organizations increase in size and complexity, there is a commensurate increase in complexity of input-output relationships. Factors such as investment return, plant location, depreciation, risk elements and multi-year projections all lend themselves to principles of multivariate analysis, but defy simple analysis as performed by small entrepreneurs.

The high-speed computer has made it possible to analyze large quantities of complex data with relative ease. The basic conceptualization of data analysis, too, has advanced, although perhaps not as rapidly as computer technology. Much of the increased understanding and mastery of data analysis has come about through the wide propagation and study of statistics and statistical inference and especially from the analysis of variance. Analysis of variance epitomizes the basic nature of most data analysis: the partitioning, isolation, and identification of variation in a dependent variable due to different independent variables.[78]

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[77] Ibid., p. 259.

[78] Fred N. Kerlinger and Elazar J. Pedhazur, Multiple Regression in Behavioral Research, (New York: Holt, Rinehart and Winston, Inc., 1973), p. 2.

Kerlinger and Pedhazur[79] clarify the confusion that often exists about the role of multiple regression as a multivariate analysis tool:

> Strictly speaking, the expression "multivariate analysis" has meant analysis with more than one dependent variable. A univariate method is one in which there is only one dependent variable. We prefer to consider all analytic methods that have more than one independent variable or more than one dependent variable or both as multivariate methods. Thus, multiple regression is a multivariate method.

As it is regularly used in the business sector, multivariate analysis, specifically that of multiple regression, can be used[80]

> ...effectively in sociological, psychological, economic, political and educational research. It can be used equally well in experimental or non-experimental research. It can handle continuous and categorical variables. It can handle two, three, four, or more independent variables.

Planning, Programming and Budgeting Systems (PPBS) are currently being used in public education. PPBS has three major purposes: (1) the quantification of educational outputs; (2) the analysis of optimum resource combinations for attaining specified outputs such as goals and objectives; and (3) provision of a basis for multi-year funding.[81]

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[79] Ibid., p. 2.

[80] Ibid., p. 3.

[81] Michael W. Kirst, The Rise and Fall of PPBS, op. cit., p. 535

A simple application of multiple regression analysis to PPBS, similar to the methodology of the current investigation, would be identification of minute school-by-school expenditures (as is done in PPBS)[82] and equating those expenditure variables to achievement criteria which is expressed as continuous data. Such applications can be retrospective or in-process; that is, it is either possible to look backward at a given operating year for a number of schools, or to repeat the same procedure during the school year in order to gain an assessment of the effectiveness of, say, instruction currently in progress.

Unpublished literature contains relevant research and procedural information, some of which is close to the rationale and methodology of the present study. Webster[83] compared the appropriateness of using the least-squares method to the selected-ratio method of regression analysis in predicting future educational attendance patterns and found the least-squares method to be the most advantageous within the context of the demographic characteristics of his data.

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[82]California State Department of Education, Planning, Programming, Budgeting System Manual for State of California School Districts, (Sacramento: Bureau of Publications, 1970), pp. 77-89.

[83]William J. Webster, "The Applicability of Selected Ratio and Least-Squares Regression Analysis Techniques to the Prediction of Future Educational Attendance Patterns" (unpublished Doctoral Dissertation, Michigan State University, East Lansing, 1969).

Using the questionnaire method, Jurs[84] polled teachers in schools receiving ESEA Title I funds in an attempt to find what variables contributed best to reading achievement at ESEA Title I schools. Variables investigated were the nature of the home, the family, the school and the Title I program. The research was not oriented to the efficacy of instructional approaches; rather, it was steeped in the research methodology itself. Findings were that (1) the factor-analytic structural regression technique needs further investigation before it can be used for decision-oriented research, and (2) regression analysis provided no information that the Title I program under investigation improved the reading achievement of participants.

Matzke[85] sought to develop a linear programming model for purposes of optimizing objective functions of a state-support program in Iowa, and found that his model was usable for that state with only minor modifications in the descriptions of objectives and the resultant array of resources.

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[84]Stephen G. Jurs, "Factor Analysis Structural Regression of Data from the 1968-69 Compensatory Education Evaluation," (unpublished Doctoral Dissertation, The University of Colorado, Boulder, 1970)

[85]Orville R. Matzke, "A Linear Programming Model to Optimize Various Objective Functions of a Foundation-Type State Support Program," (unpublished Doctoral Dissertation, The University of Iowa, Iowa City, 1971)

In the area of improvement of instruction, Carruth[86] developed a relatively simple multiple regression model using eight predictor variables against success in a Computer-Assisted Arithmetic program. The arbitrarily-selected variables were: (1) intelligence, (2) race, (3) socioeconomic background, (4) pretest computation score, (5) pretest concepts score, (6) pretest applications score, (7) reading score, and (8) average of all Computer Assisted Instruction drill scores. He found that previous level of achievement in Mathematics had the strongest effect, followed by intelligence. Additionally, he found that the effect of socioeconomic background had a limited effect, and race had little or no effect.

In a broader application of multiple regression, Gustafson[87] sought to find correlational relationships between community characteristics and the manner in which federal aid to school districts was distributed in the state of Connecticut. He found that the best predictors were percentages of children on Aid to Dependent Children (ADC)

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[86]Edwin D. Carruth, "A Multiple Linear Regression Analysis of Computer-Assisted Elementary Arithmetic Achievement," (unpublished Doctoral Dissertation, The University of Southern Mississippi, State College, Miss, 1970)

[87]Richard A. Gustafson, "The Development of Regression Models Using Community Characteristics as Predictors of Federal Aid Allocations to Connecticut School Districts," (unpublished Doctoral Dissertation, The University of Connecticut, Storrs, 1970)

and the percentage of students from low-income families. Both were "need" variables. Interestingly, he found that community participation was not a significant predictor variable.

Two studies in the published literature loom large, both from the standpoint(s) of their applications of the statistical technique of multiple regression and their impact(s) on educational thought. These studies are the famous study on Equality of Educational Opportunity[88] (The Coleman Report) and the study by James, Kelly and Garms[89] on "Determinants of Educational Expenditures in Large Cities of the United States."

One of the basic purposes of the Coleman investigation was to explain school achievement, or, more accurately, inequality in school achievement. The most important dependent variable was verbal ability or achievement (VA), as measured by various tests. Some 60 independent variables believed to be directly or indirectly related to achievement were correlated with Verbal Achievement. One of the most controversial points made in the Coleman Report was that the differences between schools had little relation to verbal achievement compared to the relations between verbal achievement and the

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[88] James S. Coleman, et. al., Equality of Educational Opportunity, (Washington: United States Government Printing Office, 1966).

[89] H.T. James, J.A. Kelly and W.I. Garms, Determinants of Educational Expenditures in Large Cities of the United States, (Stanford: Stanford University Press, 1966).

child's background.[90] Weaknesses of the report were: (1) inadequate responses; (2) information on schools was obtained from teachers and administrators; (3) information on pupils' backgrounds was obtained from the pupils; and (4) basic regression statistics, vital to proper analysis, were often omitted.[91]

Using 19 variables thought to be predictors of expenditures per-pupil, James, Kelly and Garms investigated the arrays of those independent variables in 107 school districts in various regions of the United States. Despite the arbitrary manner in which the independent variables were selected as predictors (or determinants) of educational expenditures in large cities in the United States, the regression procedure obtained a multiple correlation coefficient of .89 for an accounted-for variance of 80.5 percent. Seven of the 19 variables were found to be significant at or above the .05 level.[92]

These two well-known studies are here cited because of their ability to illustrate the capacity of multiple regression to handle tremendous volumes of data and yield statistics which are themselves relatively easy to interpret. The use of multiple regression is limi-

[91] Kerlinger and Pedhazur, op. cit., p. 429.

[92] James, Kelly and Garms, op. cit., p. 140.

ted only by the user's grasp of the phenomena and fields of study.[93]

VI. SUMMARY

This review of the scientific literature concerning the dual dimensions of education, specifically Compensatory Education and the applicability of multiple regression as an analytical tool therein, exemplifies the types of findings significant and pertinent to this study.

With respect to the concept of Equality of Educational Opportunity, the literature appeared to establish more than sufficient justification for the Compensatory Education programming that occurred after the passage of ESEA Title I in 1965. However, the literature does not reveal attempts at systematic allocations of resources based on previous educational experience, either in general education or Compensatory Education.

This review of the literature substantiated, fairly well, that multiple linear regression is a statistical tool well adapted to the social sciences, including education, particularly because of its ability to handle many variables. Concomitantly, this review of the literature revealed that the limiting aspect of the use of the technique of multiple regression is the familiarity of the user with theoretical impact(s) of the variables on a given criterion.

93 footnote source

Finally, the review of the literature seems to point to the applicability of multiple regression as a statistical technique feasible within the present study, as both an analytical and predictive device. Additionally, the review of the literature seems to illustrate the possibility that multiple regression can be used in the multi-year planning aspects of utilizing a Planning, Programming and Budgeting System. This point shall be discussed in Chapter V.

CHAPTER III

THE DESIGN AND PROCEDURE OF THE STUDY

The design and methodology of the study will be presented here in detailed format within the following sections: (1) the setting of the study, (2) hypotheses to be tested, and (3) the research design and statistical procedures.

I. SETTING OF THE STUDY

The context chosen for this study was the Oakland Unified School District, Oakland, California. Oakland is the metropolitan center of the East Bay, eight miles from San Francisco. Its population currently approaches 400,000 and its public school district, the Oakland Unified School District, had approximately 59,000 average daily attendance, K-12, for the study year.

The total general purpose revenue of the Oakland School District, exclusive of federal and state categorical funds, was, for the study year, $73,689,853, for a per-pupil expenditure of $1,063. Compensatory Education projects, including ESEA Title I, totalled $4,279,369.[1]

[1]Oakland Unified School District, Statistical and Financial Data. (Oakland: Oakland Public Schools, 1972), pp. 7-28.

The district has 88 educational facilities: 65 elementary, 15 junior high and 8 high schools. In addition, the district maintained 6 adult school facilities with a total adult average daily attendance of 2,027 for the study year. Financial support of the Oakland Schools for the study year derived from the following sources: (1) City and County taxes based on an assessed valuation-per-pupil of $25,555 elementary (K-8) and $62,227 for grades 9-12; (2) state support under equalization criteria (20.6 per cent of the budget) for a total of $13,035,603. Total tax levies for schools in the city of Oakland was $5.494 per $100 assessed valuation, a total tax rate which constituted approximately 41.5 per cent of the total taxation of the city. The Oakland District received a total of $12,636,363 from 27 separate federal, state and foundation categorical grants which accrued to it because of both eligibility criteria.[2]

IDENTIFICATION OF THE POPULATION

Forty-seven of 65 elementary schools of the Oakland Unified School District enrolled significantly high numbers of students who met criteria for inclusion in programs of Compensatory Education. It was estimated that the total number of such students

[2] Ibid., p. 16.

was 23,858.[3] From this student population, the investigator delimited a more specific population for participation in the study. Delimiting criteria derived from characteristics of the schools remaining after application of criteria used in selection of eligible schools according to United States Office of Education Guidelines.[4] Remaining were the 19 public elementary schools in this study, attended by 8,606 eligible students.

Selection of Schools in the Sample

The sample investigated in this study is 19 public elementary schools participating in the Oakland Unified School District Compensatory Education effort. The Oakland Unified School District Compensatory Education effort included seven (7) non-public schools; however, they were not included in the present sample because small numbers of eligible pupils within them failed to generate sufficient funds (at $330 per pupil) to design programs which were comprehensive and hence comparable.

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[3]United States Congress, Oversight Hearings on ESEA, op. cit., p. 6.

[4]United States Office of Education, Title I ESEA: Selecting Target Areas. (Washington: United States Government Printing Office, 1971), pp. 1-35.

Table 1 below exhibits relevant demographic data of the schools in the sample:[5]

TABLE 1

PERTINENT CHARACTERISTICS OF SCHOOLS INCLUDED IN THE PRESENT SAMPLE

School	Enrollment	Percent ESEA Eligible	Average Family Income	Percent Below Grade Level
Bunche	266	96	$6,193	67
Clawson	325	74	$6,043	68
Cole	243	81	$5,974	68
Durant	620	77	$6,122	61
Garfield	817	57	$7,130	62
Golden Gate	733	59	$6,880	59
Hawthorne	638	61	$7,364	66
Highland	858	60	$6,577	54
M. L. King	504	61	$5,981	51
Lafayette	420	52	$5,916	57
Lazear	349	75	$6,340	68
Lockwood	1150	62	$6,110	62
Melrose	335	46	$6,674	71
Prescott	565	62	$5,433	59
Willow Manor	112	94	$5,578	49
Woodland	403	68	$7,500	63
Kaiser	104	100	$7,010	42
Redwood Heights	101	100	$6,700	41
Sequoia	63	100	$6,883	39

[5]Oakland Public Schools, Evaluation Report, ESEA Program of Compensatory Education, 1972-1973, (Oakland: Oakland Unified School District, 1973), pp. 26-103.

Criteria and Selection Procedures. The schools in which the 8606 pupils of the schools in the sample were found were selected according to federal guidelines.[6] These guidelines give eight basic rules for determining ESEA-eligible schools and areas:

1. Selection of sources of data for determining concentrations of children from low-income families.

2. Collection of the necessary data from the sources chosen.

3. Transformation of the data to correspond to the school attendance areas.

4. Determination of the weighting factors among the data sources (if multiple sources are used).

5. Combination of the data on children from low-income families (using the weighting factors if necessary) and determination of both the number of children from low-income families and the percentage of such children residing in each attendance area.

6. Ranking attendance areas both by percentages and by numbers of children from low-income families.

7. Determination (for the district as a whole) of the average number of children from low income families and the average percentage

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[6] United States Office of Education, Title I ESEA: Selecting Target Areas. (Washington: Government Printing Office, 1971), pp. 1-35.

of children from such families.

8. Determination of the eligible attendance areas from among those that have either percentages or numbers of children from low-income families greater than the district average.

Indices of poverty recommended for use are census-data income sources, AFDC data, free-lunch eligibility criteria and other defensible data which clearly delineates the eligible school target areas. After selecting target schools, eligible students within those schools must be identified for purposes of concentrating services in Compensatory Education.

Identification of eligible students is simple, based on the criterion of placement below national norms in reading and/or mathematics as measured by standardized tests. These guidelines also provide for identification of eligible children through the use of non-cognitive criteria such as health services needs or psychological services needs, all under the general criteria of educational disadvantage. In general, selection criteria encompass the rather broad concept of likelihood of exhibiting a lower level of educational functioning because of linguistic, social, cultural and economic isolation.

Excluded from the ESEA-eligible sample were TMR, EMR and

Educationally Handicapped children, due to substantial state support.[7]

Procedures for Allocation of School Site Expenditures

California State Compensatory Education guidelines[8] determine the general method by which expenditures were allocated to school sites. Each school received $330 per eligible pupil[9], to be spent within the framework of six mandated components: Language Development, Mathematics, Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities and Auxiliary Services Activities, with emphasis on individualized instruction as the instructional mode. Language Development and Mathematics were considered prime components and the other four components were considered supportive components.

After receiving school site budgetary allocations, Principals were responsible for accomplishing the following procedures in order to determine the specific arrays of school-site budget items (See Appendix A, Specific School-Site Budgets). These steps were:

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[7] California State Department of Education, Guidelines, Compensatory Education, Revised May 1972. (Sacramento: Bureau of Publications, 1972), p. 6.

[8] Ibid., p. 7.

[9] Ibid., p. 8

(1) establishing the School-Site Advisory Committee, (2) conducting inservice training for the Advisory Committee selected, (3) selection of school-site staff members for participation in the ESEA Project, (4) defining goals for project outcomes, (5) development of the project, along with staff and parents, within the framework of the six mandated components, (6) diagnosis of pupil needs through quantified needs-assessment procedures, and (7) developing component activities related to defined needs and goals.[10]

HYPOTHESES

The following null hypotheses were tested during the present study:

Hypothesis 1: There is no correlation between the combined independent variables (expenditure percentages for Reading, Mathematic, Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities and Auxiliary Services) and the dependent variable, Reading Achievement, Grades 2-3.

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[10] Ibid., pp. 7-26.

Hypothesis 2: There is no correlation between the combined independent variables (expenditure percentages for Reading, Mathematics, Parent Involvement Activities, Staff Development Activities, Intergroup Activities and Auxiliary Services) and the dependent (criterion) variable, Reading Achievement, Grades 4-6.

Hypothesis 3: There is no correlation between the combined independent variables (expenditure percentages for Reading, Mathematics, Parent Involvement Activities, Staff Development Activities, Intergroup Activities and Auxiliary Services) and the dependent (criterion) variable, Mathematics Achievement, Grades 2-3.

Hypothesis 4: There is no correlation between the combined independent variables (expenditure percentages for Reading, Mathematics, Parent Involvement Activities, Staff Development Activities, Intergroup Activities and Auxiliary Services) and the dependent (criterion) variable, Mathematics Achievement, Grades 4-6.

Hypothesis 5: There is no correlation between ratings of efficiency of implementation of four independent variables (support components: Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities and Auxiliary Services) by five independent raters and the dependent (criterion) variable, Reading Achievement, Grades 2-3.

Hypothesis 6: There is no correlation between ratings of efficiency of implementation of four independent variables (support components: Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities and Auxiliary Services Activities) by five independent raters and the dependent (criterion) variable, Reading Achievement, Grades 4-6.

Hypothesis 7: There is no correlation between ratings of efficiency of implementation of four independent variables (support components: Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities and Auxiliary Services Activities) by five independent raters and the dependent (criterion) variable, Mathematics Achievement, Grades 2-3.

Hypothesis 8: There is no correlation between ratings of efficiency of implementation of four independent variables (support components: Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities and Auxiliary Services Activities) by five independent raters and the dependent (criterion) variable, Mathematics Achievement, Grades 4-6.

Hypothesis 9: There is no correlation between the combined 12 independent variables (expenditure percentages for Reading, Mathematics, Parent Involvement Activities, Staff Development Acti-

vities, Intergroup Relations Activities, Auxiliary Services Activities; efficiency of implementation ratings of Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities and Auxiliary Services; and Program Size and Teaching Approach) and the dependent (criterion) variable, Reading Achievement, Grades 2-3.

Hypothesis 10: There is no correlation between the combined 12 independent variables (expenditure percentages for Reading, Mathematics, Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities, Auxiliary Services; efficiency of implementation ratings of Parent Involvement Activities, Staff Development Activities, Intergroup Activities and Auxiliary Services; and Program Size and Teaching Approach) and the dependent (criterion) variable, Reading Achievement, Grades 4-6.

Hypothesis 11: There is no correlation between the combined 12 independent variables (expenditure percentages for Reading, Mathematics, Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities, Auxiliary Services; efficiency of implementation ratings of Parent Involvement Activities, Staff Development Activities, Intergroup Activities and Auxiliary Services; and Program Size and Teaching Approach) and the dependent (criterion) variable, Mathematics Achievement, Grades 2-3.

Hypothesis 12: There is no correlation between the combined 12 independent variables (expenditure percentages for Reading, Mathematics, Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities, Auxiliary Services; efficiency of implementation ratings of Parent Involvement Activities, Staff Development Activities, Intergroup Activities and Auxiliary Services; and Program Size and Teaching Approach) and the dependent (criterion) variable, Mathematics Achievement, Grades 4-6.

III. THE RESEARCH DESIGN

It was the intention of this investigation to develop an economical, plausible and robust model which is at once defensible from the standpoint of statistical analysis and ease of practical application, while yielding measurable data which will aid the decision-making process in urban Compensatory Education planning quite apart from the predispositions of the decision-makers. It was hoped that the model would yield statistical procedures which would identify variables which operate singly or in combination with others to elicit significant correlations to measured achievement in Reading and Mathematics at the elementary school level, Grades

2-6.

In order to accomplish the aspect of practical application, the dimension of prediction was considered vital. Additionally, the pragmatics of applicability, of usefulness to generalized situations of similar size, demography and socioeconomic milieu were considered.

In view of the foregoing, the statistical vehicle chosen was that of multiple linear regression, because it offers both the dimensions of analysis and prediction; analysis for the purpose of interpreting the relative powers of inputs in programs and prediction for the purpose of re-alignment of such inputs in future program formulation according as they do or do not influence achievement.

Before moving to discussion of the actual research design herein, it is necessary to consider three instruments which measured data in the study, two nationally-normed standardized tests which measured Reading and Mathematics Achievement (the criterion variables) and a rating instrument which formed the basis for the data for four independent variables in the study (Efficiency of Implementation ratings of Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities and Auxiliary Services Activities). The following is a brief discussion of relevant characteristics of these instruments.

Instruments

Students in schools involved in the present study were tested

with two standardized tests, with forms varying as needed appropriate to grade levels tested. The two standardized tests used were the Cooperative Primary Tests, Educational Testing Service, used in Grades 2-3 and the Comprehensive Tests of Basic Skills (CTBS), California Test Bureau, used in Grades 4-6.

Ratings of Efficiency of Implementation were derived by a scale-type questionnaire. Four versions of this questionnaire were used, one each for Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities and Auxiliary Services Activities (see Appendix C, Figures 3 - 6).

The Cooperative Primary Tests. The Cooperative Primary Tests provide measures of five broad areas of instruction for Grades 1 - 3: Reading, Writing, Listening, Word Analysis and Mathematics. It was normed in the period October 1965 to April 1966, using norm samples taken from a national cross-section of children. Approximately 1800 children at every grade level were tested fall and spring in districts of various sizes, with equal representation in four major geographical divisions of the United States.[11]

Internal Consistency Coefficients were computed using the Kuder-Richardson Formula 20. Of the 46 Internal Consistency Coeffi-

[11] Educational Testing Service, Handbook: Cooperative Primary Tests. (Princeton, New Jersey: Educational Testing Service, 1967), pp. 5-30.

cients of internal consistency presented in the manual, 14 are .90 or greater, 15 are in the range .85 to .89, 16 are in the range .80 through .84 and one is .79. The median reliability for the 26 coefficients for Reading, Word Analysis and Writing Skills is .90, with a range from .86 to .93. Coefficients for Mathematics were somewhat lower, with a median of .83 and a range from .81 to .89. Coefficients for Listening had a median of .81 with a range from .79 to .83. Coefficients for Writing Skills range from .80 through .84.[12]

The publishers caution against generalizations from one alternate form to the other because of inconsistent results from norming samples. Intercorrelations between forms show ranges, respectively, for Listening, Mathematics and Reading of .72 - .82, .77 - .84, and .82 - .91.[13]

A brief discussion of content validity offered the statement that[14]

> Content validity is best insured by entrusting test construction to persons well qualified to judge the relationship of test content to teaching objectives.

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[12] Ibid., pp. 56-57.

[13] Ibid., p. 57.

[14] Ibid., p. 58.

The Comprehensive Tests of Basic Skills. The standardization of CTBS was designed to provide norms for the nation as a whole, and for large cities defined as urban centers with school populations greater than 95,000 in the school year 1964-1965. A sample of approximately 170,000 students was requested for national norms and an additional sample of 50,000 students from the 23 largest districts was selected. All 50 states and the District of Columbia were represented in the survey, as well as all types of school districts and schools.[15]

Four skill areas are tested in the CTBS: Reading, Language, Arithmetic and Study Skills. Reading is further divided into Vocabulary and Comprehension; Language into Mechanics, Expression and Spelling; Arithmetic into Computation, Concepts and Applications; and Study Skills into Reference Materials and Graphic Materials. Coefficients of Internal Consistency were in the following ranges for Reading and Arithmetic respectively: .81 to .92 and .84 to .93.[16]

Efficiency of Implementation Questionnaires. For four separate activity components of the Oakland Compensatory Education

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[15]California Test Bureau, Comprehensive Test of Basic Skills, Bulletin on Technical Data, No. 2. (Monterey: CTB/McGraw-Hill, 1960), pp. 39-42.

[16]Ibid., pp. 7-16.

program, scale-type questionnaires (Appendix C, Figures 3 - 6) were responded to by five independent raters. Raters were all supervisors in the area of Compensatory Education within the subject district. One was a Coordinator of Compensatory Education; one was a Language Supervisor; two were Project Development Coordinators and one was a retired Mathematics Supervisor who had worked in all of the schools during the study year.

A response continuum from 1 to 10 was offered opposite the name of each school. Above the continuum, descriptions were evenly divided, two scores at a time, using five expressions: Not Effective, Poor, Average, Good and Very Effective. Criteria for evaluation consisted of the Oakland District goals for Compensatory Education for the study year. Such goals were plainly stated on the questionnaires.

Quantitative ratings for each support variable (Parent Involvement, Staff Development, Intergroup Relations and Auxiliary Services) were determined by summing and averaging the ratings from each rater, yielding a mean rating score for each component. Ghiselli[17] offers that

> Since all raters use the same rating method, all the ratings are comparable; hence a simple sum or average would be considered acceptable.

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[17]Edwin E. Ghiselli, Theory of Psychological Measurement. (New York: McGraw-Hill Book Company, 1964), p. 178.

Two reliability indices were calculated as estimates of the reliability of the raters: (1) estimate(s) of the reliability of a single rater, and (2) estimate(s) of the reliability of the mean of all five raters. These statistics follow. An example of the calculation procedure, offered by Winer[18] is given in Appendix C.

TABLE 2

RELIABILITY INDICES FOR FIVE RATERS OF FOUR SUPPORT COMPONENTS

Component	Reliability of A Single Rater	Reliability of Mean of All five Raters
Parent Involvement	.7418	.9331
Staff Development	.6711	.8512
Intergroup Activities	.7303	.9004
Auxiliary Services	.7017	.8989

[18] B.J. Winer, Statistical Principles In Experimental Design. (New York: McGraw-Hill Book Company, 1971), pp. 283-289.

Organization of the Research Design

The research design was divided into three broad phases, each of which was subdivided into four separate procedures, resulting in 12 separate statistical operations. All phases and procedures contain the twin dimensions of analysis and prediction where feasible.

Phase I examined the relative contributory strengths of six state-mandated Compensatory Education variables: expenditures for Reading, Mathematics, Parent Involvement, Staff Development, Intergroup Activities and Auxiliary Services, in terms of their impact on achievement levels in Reading and Mathematics, Grades 2-6. The predictive capabilities of these inputs were explored in terms of prediction equations.

Phase II investigated the influence of four independent variables, ratings (by five independent raters) of efficiency of implementation of four support components (Staff Development, Intergroup Activities, Parent Involvement and Auxiliary Services) on achievement levels in Reading and Mathematics, Grades 2-6. The predictive abilities of these four inputs were also explored.

Phase III examined the predictive capabilities of 12 independent variables, adding the variables Program Size and Teaching Approach to the 10 variables in Phases I and II.

Phase 1

This phase investigated a model for determining optimum expenditures in state-of-California mandated categories (Reading, Mathematics, Parent Involvement, Staff Development, Intergroup Relations and Auxiliary Services) under the fundamental assumption that there is a direct relationship between cost and educational achievement, and that certain costs in Compensatory Education bear more heavily than others on achievement.

A second fundamental assumption was that the independent variables do not act singly; that is, the dependent variables depend upon or "regress to" the independent variables. It was, however, also important to this investigation to assess the impact of individual variables for the purpose of establishing a hierarchy of variables in terms of importance.

It should be pointed out that the statistical procedures described in Phase 1 apply to all three Phases of the investigation. It was hoped to obtain a prediction equation of the form

$$Y' = K + b_1X_1 + b_2X_2 + \ldots\ldots b_nX_n$$

where the coefficients b_1, b_2, $\ldots\ldots b_n$ were chosen so that the residual e was as small as possible; that is, so that when e^2 was averaged over all observations, the expected value would be as

small as possible.

Differential Calculus was used in the solution, employing principles of maxima and minima to obtain a solution for the weights in the linear function that minimized the average squared error of prediction. Error, e, which is the discrepancy between the actual and predicted score for every individual, was to be minimized:[19]

$$f(e) = \sum_i (z_{mi} - z'_{mi})^2$$

where e = error,

z_{mi} = actual standard score

and z'_{mi} = predicted standard score

If the symbolic linear combination of predictors that defines z'_{mi} is substituted in the equation above, the function becomes

$$f(e) = \frac{1}{N}\sum[z_{mi} - (\beta_1 z_i + \beta_2 z_{2i} + \ldots\ldots \beta_{m-1} z_{(m-1)})]^2$$

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[19] W.W. Cooley and P.R. Lohnes, Multivariate Procedures For The Behavioral Sciences. (New York: John Wiley and Sons, 1962), pp. 33-35.

When the partial derivative of the function with respect to β_j is taken, a system of (m-1) normal equations in m-1 unknowns is formed. They have the form

$$\begin{aligned}
&\beta_1 + r_{12}\beta_2 + r_{13}\beta_3 + \cdots\cdots + r_{1(m-1)}\beta_{m-1} = r_{1m} \\
&r_{12}\beta_1 + \beta_2 + r_{23}\beta_3 + \cdots\cdots + r_{2(m-1)}\beta_{m-1} = r_{2m} \\
&\vdots \qquad\qquad \vdots \qquad\qquad \vdots \qquad\qquad\qquad\qquad \vdots \qquad\quad \vdots \\
&r_{1(m-1)}\beta_1 + r_{2(m-1)}\beta_2 + r_{3(m-1)}\beta_3 + \cdots + \beta_{m-1} = r_{(m-1)m}
\end{aligned}$$

Solution for the values of $r_{123\ldots}$ followed by solution for b using the formula

$$b_j = \beta_j\left(\frac{S_y}{S_j}\right)$$

where S_y = the standard deviation of Y

and S_j = the standard deviation(s) of the independent variable(s),

yields a multiple regression equation in deviation score form:

$$y = b_1x_1 + b_2x_2 + \cdots\cdots\cdots\cdots + b_nX_n$$

But $x_j = (X_j - M_j)$,

and substituting, a raw score prediction is obtained:

$$y' = b_1(X_1 - M_1) + b_2(X_2 - M_2) + \ldots . b_n(X_n - M_n)$$

or $$Y' = b_1X_1 + b_2X_2 + \ldots\ldots\ldots b_nX_n + K$$

Prediction follows when projected values of X_1, $X_2 \ldots X_n$ are substituted into the prediction equation. One last step remains in prediction: calculation of the Standard Error of Estimate, SE_{est}.

The standard error of estimate is the square root of the residual variance,

$$SE_{est} = \sqrt{\frac{SS_{res}}{N}}$$

computed by dividing the residual sum of squares SS_{res} by sample size N to obtain the average of squared residuals, followed by taking the square root of the quotient. The standard error of estimate gives a plus or minus tolerance value to be added to the predicted value of Y.

Computer capability was used for all computations in the current investigation. A Control Data Corporation 6400 Computer, located at the University of California, Berkeley, was employed.

The routine for Multiple Linear Regression and the sub-routine for Stepwise Multiple Linear Regression of the Statistical Package For The Social Sciences (SPSS) was used.[20]

Computer capability yielded the following statistics necessary for analysis and prediction in all phases of the investigation:

Multiple R, or the Multiple Correlation Coefficient, is an index of the magnitude of the relation between Y, the dependent variable, and a least-squares composite of X_1, X_2 ,....X_n, the independent variables.[21]

R Square is an estimate of the proportion of the variance of the dependent variable Y accounted for by the independent variables X_1, X_2,....X_n. It is also referred to as the Coefficient of Determination.[22]

Simple r is the individual correlation of a designated independent variable X with Y.[23]

Entry F is the statistic employed to determine whether a variable makes a significant contribution to the stepwise regression procedure.[24]

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[20]N.H. Nie, C.H Hull, J.G. Jenkins, K. Steinbrenner, D.H. Bent, Statistical Package for the Social Sciences. (New York: McGraw-Hill Book Company, 1975), pp. 320-367.

[21]Fred N. Kerlinger, Foundations of Behavioral Research. (New York: Holt, Rinehart and Winston, Inc., 1973) pp. 616-617.

[22]Ibid., pp. 618-621.

[23]Ibid.

[24]Nie, op. cit., pp. 358-359.

Overall F is an assessment of the cumulative significance of all variables thus far entered in the stepwise regression procedure.[25]

b is the regular weighted regression coefficient which corresponds to the weight to be given to an entered variable in formulation of the prediction equation.[26]

Analysis and Prediction

Kerlinger[27] offers that there is no absolute way to interpret regression coefficients for purposes of analysis of data, because of correlations both among the independent variables as well as joint correlations of independent variables to the dependent variable. The higher the intercorrelations between independent variables, the more unstable the interpretation situation. The ideal predictive situation occurs when the correlations between the independent variables (taken jointly) and the dependent variable is high and the intercorrelations between independent variables is low.

Other interpretation problems are cited by Kerlinger.[28] One is the problem of beta weights, called standard partial regression

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[25] Nie, op. cit., p. 359.

[26] Kerlinger, op. cit., pp. 613-614.

[27] Ibid., pp. 622-626.

[28] Ibid., p. 624.

coefficients. Such beta weights are deceiving because the other variables are held constant in the equation in standard form. An additional feature is that there is limited usefulness in adding an unlimited number of variables to the regression equations; that is, if 3 or 4 variables are found to be substantially correlated with the criterion, it becomes more and more difficult to find other independent variables that are not redundant in effect.

Ghiselli[29] uses the formula $\sigma_{0.1} = \sigma_0\sqrt{1 - R^2}$ to express the relationship between the size of the coefficient of correlation and the error of prediction. When the coefficient of correlation is high, the error of prediction is small, and when the coefficient is low the error is large.

The analyses in all phases herein will proceed by (1) testing hypotheses, using tabled F at the .05 level with appropriate degrees of freedom, (2) assessing the size of R and the amount of variance accounted for by R^2, using the combined effects of variables that enter within the F criterion above and (3) writing prediction equations using (a) partial regression coefficients, b, that enter the stepwise regression procedure at the required level of significance and (b) the constant term corresponding to the final significant variable. The Standard Error of Estimate, SE_{est}, will be offered whenever a prediction equation is written.

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[29]Edwin E. Ghiselli, Theory of Psychological Measurement. (New York: McGraw-Hill Book Company, 1964), p. 328.

Phase 1 uses the following mean achievement scores (gain scores) as dependent variables in four successive procedures, in sequence: Reading Achievement, Grades 2-3; Reading Achievement, Grades 4-6; Mathematics Achievement, Grades 2-3; and Mathematics Achievement, Grades 4-6.

Phase 2

Under the assumption that educational "inputs" involve much more than expenditure considerations, that human levels of endeavor are also valid "inputs" in education, it was sought to determine the relative contribution(s) of such inputs to achievement in Reading and Mathematics, as rated by five independent raters. It was also the intention of Phase 2 to examine the predictive capability of the combined variables.

Such inputs in this instance were the four support components in ESEA Title I Compensatory Education programs in California: Parent Involvement, Staff Development, Intergroup Activities and Auxiliary Services. These components were explained in Chapter I of this investigation.

Ratings of "Efficiency of Implementation" were done, as has been explained, by five independent raters who worked in the subject schools during the study year. Figures 3-6, Appendix C, illustrate the questionnaires executed by the raters.

Phase 2 used the following mean achievement scores (gain scores) as dependent variables in four successive procedures, in sequence: Reading Achievement, Grades 2-3; Reading Achievement, Grades 4-6; Mathematics Achievement, Grades 2-3; and Mathematics Achievement, Grades 4-6.

The statistical procedures and analyses for Phase 2 were identical to those of Phase 1.

Phase 3

Using the same statistical procedures and analyses as those of the preceding Phases, Phase 3 combined the independent variables of Phase 1 and Phase 2 with two additional ones: Program Size and Teaching Approach. Program Size was a continuous variable. Teaching Approach was a categorical variable, identifying two broad teaching methods. It was "dummy-coded" for the regression routine. The two broad Teaching Methods, Self-Contained Classrooms and "Pull-Out" Programs, were identified from the ESEA Evaluation Report of the Oakland Unified School District.

The combination of variables used in Phase 3 resulted in regression equations of the following form:

$$Y_1 = A_1X_1 + B_1X_2 + \ldots\ldots\ldots\ldots + L_1X_{12} + e$$
$$\vdots \qquad \vdots \qquad \vdots \qquad\qquad\qquad \vdots \qquad \vdots$$
$$Y_{18} = A_{18}X_1 + B_{18}X_2 + \ldots\ldots\ldots\ldots + L_{18}X_{12} + e$$

where X_1 = expenditure percentages for Reading Instruction.

X_2 = expenditure percentages for Mathematics Instruction.

X_3 = expenditure percentages for Parent Involvement.

X_4 = expenditure percentages for Staff Development.

X_5 = expenditure percentages for Intergroup Relations Activities.

X_6 = expenditure percentages for Auxiliary Services Activities.

X_7 = composite ratings of efficiency of implementation of Parent Involvement by five raters.

X_8 = composite ratings of efficiency of implementation of Staff Development by five raters.

X_9 = composite ratings of efficiency of implementation of Intergroup Activities by five raters.

X_{10} = composite ratings of efficiency of implementation of Auxiliary Services by five raters.

X_{11} = Program Size.

X_{12} = Teaching Approach.

IV. SUMMARY

In this Chapter the method for selection of the study sample was discussed, along with a general description of the population from whence it was derived. The overall setting of the study was described, and a detailed account was given of the methods by

which students and schools were selected for participation in ESEA Title I Compensatory Education programs.

Research techniques and methods of evaluating the data were also discussed. Procedures for data analysis were explained, specifically: (1) Phase 1, a multiple linear regression procedure for the purpose of analysis of the correlations between six expenditure variable and the criterion variable(s), the ultimate objective being the development of a predictor equation that reflected optimal relationships (weighting) between the independent variables; (2) Phase 2, a multiple linear regression procedure for purpose of analysis of the correlations between four "efficiency of implementation" variables and the criterion variable(s), the objective being the development of predictor equations that reflected optimal weighting between the independent variables; and (3) Phase 3, a combination of the independent variables in Phase 1 and Phase 2, plus the variables Program Size and Teaching Approach to form a twelve-variable regression equation, the ultimate objective being development of a prediction equation reflecting optimal weights of the coefficients of the independent variables for the purpose of predicting to achievement in Reading and Mathematics.

CHAPTER IV

ANALYSIS OF THE DATA

INTRODUCTION

As proposed in the preceding Chapters, the prime considerations in this study are: (1) statistical analyses of the relationships between mandated expenditure variables in Compensatory Education and achievement in Reading and Mathematics; (2) statistical analyses of the relationships between efficiency of implementation of program components and achievement in Reading and Mathematics; and (3) statistical analyses of the combined effects of the variables in (1) and (2) above, plus two additional independent variables, Program Size and Teaching Approach.

Presentation of the development of the statistical model contained herein will proceed in the following sequence: (1) description of the dependent (criterion) variables; (2) analysis of Phase 1; (3) analysis of Phase 2; (4) analysis of Phase 3; and (4) the summary.

I. THE DEPENDENT (CRITERION) VARIABLES

Before moving to actual statistical procedures and analyses, it is important to examine the four independent variables used in the study. Table 3 exhibits the school-site mean gain scores from which

the means of the dependent variables in this study were derived.[1]

TABLE 3

MEAN GAIN SCORES AT SCHOOL SITES

School	READING		MATHEMATICS	
	Grades 2-3	Grades 4-6	Grades 2-3	Grades 4-6
Bunche	1.10	.96	1.70	1.00
Clawson	.25	.60	1.20	.93
Cole (4-6 only)	--	.50	--	.63
Durant	.50	.80	.70	.56
Garfield	.85	.63	1.30	.60
Golden Gate	.70	1.03	1.25	.76
Hawthorne	.75	.50	.95	.63
Highland	.40	.53	.85	.56
M.L. King (K-3 only)	.90	--	.70	--
Lafayette	.50	1.00	1.45	.70
Lazear	.40	.30	1.20	.46
Lockwood	.60	.46	.95	.56
Melrose	.60	.40	1.15	.56
Prescott	1.00	.63	1.75	.83
Willow Manor	1.55	.50	2.10	.43
Woodland	.80	.83	1.05	.60
Kaiser*	1.90	1.20	1.00	.90
Redwood Heights*	1.25	.95	1.10	1.10
Sequoia	1.60	1.25	1.65	1.00

* ESEA Integration Program Schools

[1] A preliminary report from the Director of Research to the Assistant Superintendent for Compensatory Education, Inter-office memorandum, Oakland Public Schools, May 25, 1973.

I. PHASE 1

Procedure 1

The first procedure in Phase 1 was an analysis and prediction effort utilizing the method of stepwise multiple linear regression. The following null hypothesis was tested in this first procedure:

Hypothesis 1: There is no correlation between the combined independent variables (expenditure percentages for Reading [RDG/EXP], Mathematics [MATH/EXP], Parent Involvement [PI/EXP], Staff Development [SD/EXP], Intergroup Activities [INT/EXP], and Auxiliary Services [AUX/EXP]) and the dependent (criterion) variable, Reading Achievement, Grades 2-3.

In Table 4 and others that follow in this Chapter, the following statistics and their meanings obtain. The first statistic in the table, r, is that of simple or "zero-order" correlation of the independent variable and the dependent variable. Entry significance refers to an F statistic which measures whether an entering variable elicited a significant change in the coefficient of multiple correlation; that is, whether the change in R was a significant one because of the addition of the variable. R is

the multiple correlation coefficient, indicating the combined correlation of variables thus far entered with the dependent variable. R^2, otherwise called the coefficient of determination, indicates the percentage of accounted-for variance corresponding to the variable entered. The column "Sig R" (significance of R) indicates the significance of the F value of all variables thus far entered - in combination. This F value, also referred to as Overall F, is calculated as the ratio of mean squares (regression and residual). The statistic b refers to the regular regression coefficient at the time of entry into the regression procedure. K, the constant term, refers to the constant term at the time of entry into the regression.

Table 4 below provides data pertinent to a test of the null hypothesis.

TABLE 4

STEPWISE MULTIPLE REGRESSION ANALYSIS OF SIX INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN READING, GRADES 2-3

Variable	r with Reading	Entry sig	R	R^2	Sig R	b	K
SD/EXP	-.79	.000	.79	.62	.000	-13.1334	1.368514
MATH/EXP	-.42	.077	.83	.70	.000	-1.9532	1.918064
PI/EXP	-.008	.054	.87	.77	.000	-5.0262	2.575211
AUX/EXP	.16	.156	.89	.80	.000	-1.4845	3.360004
INT/EXP	-112	.776	.89	.80	.001	-2.6441	3.408968
RDG/EXP	.61	.757	.90	.80	.002	-2.5134	5.825908

Analysis. The null hypothesis of no combined correlation between the independent variables and the dependent variable was rejected. Overall F for all variables combined is 7.81550, significant at the .002 level.

Order of entry of variables into the regression illustrates one of the reasons for the current research: hierarchical importance. Staff Development Expenditures (SD/EXP) entered the regression first (operational reasons will be offered in Chapter V) with a correlation of -.79 for an R of .79, which means that 62 percent of the variance (R^2) was accounted for by that variable. Mathematics expenditures added .04 to the multiple correlation coefficient and .08 to the accounted-for variance. Four additional variables increased R to .90, accounting for 80 percent of the variance in Reading Achievement.

The second variable to enter the regression, Mathematics Expenditures, did not raise the value of R beyond chance amounts; that is, the entry probability of .07 means that there are 7 chances in 100 that the increase would have occurred by chance alone. In the stepwise multiple regression procedure, variables are added or dropped according to the statistical significance of their contribution to the prediction of the criterion.

Cooley and Lohnes[2] express reservations about the stepwise procedure and the test of significance for a standard partial regression coefficient it uses in selecting the variables to be added or dropped. Multiple Regression is a univariate model, since only the dependent variable is treated as subject to errors. Any effort to generalize from sample to population is open to serious dangers of capitalization on chance, especially since the procedure involves keeping some predictors and discarding others.

Johnson and Jackson[3] also express reservation about the "spuriousness" factor due to the danger of capitalization on chance:

> The researcher must be aware of the possibility of securing results that are altogether untrustworthy or invalid.

Analyzed in terms of the magnitudes of their zero-order correlation coefficients, the variables often elicited very little change in the magnitude of R. Reading Expenditures, for example, with an r of .61, entered the regression last, failing to meet the .05 level criterion upon entry and eliciting a change of only .01 in the multiple correlation coefficient! This is explainable in terms

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[2] W.W. Cooley and P.R. Lohnes, Multivariate Procedures For The Behavioral Sciences. (New York: John Wiley and Sons, 1965), p. 35.

[3] P.O. Johnson and R.W.B. Jackson, Modern Statistical Methods: Descriptive and Inductive. (Chicago: Rand McNally and Co., 1959), p. 384.

of intercorrelations between independent variables, where such intercorrelations cause a redundant effect upon the addition of more and more variables. (see Appendix D, Figure 7).

Only one variable (SD/EXP) entered the regression with a level of confidence (95%) sufficient for inclusion in a prediction equation. The prediction equation

$$Y' = 1.3685140 - 13.133409X_4$$

is written. The equation has a SE_{est} of .2708, obtained by dividing the residual sum of squares (SS_{res}) by the number of cases (N = 18) and taking the square root of the quotient. The SE_{est} of .2708 means that each time the prediction equation is used to predict to Reading Achievement Grades 2-3, the chances are about 2 in 3 (68%) that the predicted achievement score will not miss the actual achievement score by more than $\pm$ .2708.

All other variables were excluded from the prediction equation because they failed to meet the .05 level criterion for entry into the regression and hence could not be used in a prediction equation that could be used with 95 percent confidence. Additional data pertinent to understanding Procedure 1 may be found in Appendix D, Figure 7.

Procedure 2

The second procedure of Phase 1 differs from the first in the criterion variable used, Reading Achievement Grades 4-6. The following null hypothesis was tested:

Hypothesis 2: There is no correlation between the combined independent variables (expenditure percentages for Reading [RDG/EXP], Mathematics [MATH/EXP], Parent Involvement [PI/EXP], Staff Development [SD/EXP], Intergroup Activities [INT/EXP] and Auxiliary Services [AUX/EXP]) and the dependent (criterion) variable, Reading Achievement Grades 4-6.

Table 5 offers data pertinent to a test of this hypothesis.

TABLE 5

STEPWISE MULTIPLE REGRESSION ANALYSIS OF SIX INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN READING, GRADES 4-6

Variable	r with Reading	Entry sig	R	R^2	Sig R	b	K
SD/EXP	-.45	.060	.45	.20	.060	-4.4864	.90702
AUX/EXP	.42	.071	.60	.36	.034	1.5628	.52906
PI/EXP	-.17	.642	.61	.37	.079	-.9018	.58249
MATH/EXP	-.20	.589	.62	.38	.144	-.8778	.94999
INT/EXP	-.05	.726	.62	.39	.242	3.4896	.87209
RDG/EXP	.07	.906	.62	.39	.374	-1.0622	1.89328

Analysis. The regression procedure failed to yield a single variable which entered the procedure beyond the required .05 level. Additionally, the significance of R (the Overall Significance) failed to meet the .05 level requirement.

This analysis leads to retention of the null hypothesis of no combined correlation between the independent variables and the dependent variable. A prediction equation will not be offered here as its predictive capability would be well below the required significance level.

Procedure 3

The third procedure of this phase used the same independent variables as Procedures 1 and 2, but substituted Mathematics Achievement Scores, Grades 2-3, as the criterion variable. The following null hypothesis was tested:

Hypothesis 3: There is no correlation between the combined independent variables (expenditure percentages for Reading [RDG/EXP], Mathematics [MATH/EXP], Parent Involvement [PI/EXP], Staff Development [SD/EXP], Intergroup Activities [INT/EXP], and Auxiliary Services [AUX/EXP]) and the dependent variable, Mathematics Achievement, Grades 2-3.

Table 6 offers data pertinent to a test of this hypothesis.

TABLE 6

STEPWISE MULTIPLE REGRESSION ANALYSIS OF SIX INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN MATHEMATICS, GRADES 2-3

Variable	r with Math	Entry sig	R	R^2	Sig R	b	K
MATH/EXP	-.62	.006	.62	.38	.006	-3.6664	2.32389
PI/EXP	.55	.304	.65	.42	.015	3.1980	1.90124
SD/EXP	-.22	.514	.66	.44	.036	-1.8878	1.88396
INT/EXP	.32	.604	.67	.45	.075	6.4228	1.81030
RDG/EXP	.37	.896	.67	.45	.146	-.2144	1.91425
AUX/EXP	.06	.726	.68	.46	.239	-3.5386	5.72633

Analysis. The null hypothesis of no correlation between the independent variables and the dependent variable was rejected. Three of the six variables contributed to a multiple correlation coefficient of .66 and an overall F of 3.75191 for a significance beyond the .05 level.

Intercorrelations between the variables was a factor in reducing the ability of entered variables to significantly increase the multiple correlation coefficient (see Figure 9). Inspection of Table 6 reveals that five variables after the entry of the first variable only increased the multiple correlation coefficient by .06. Another dimension exhibiting the impact of high intercorrelations on redundancy may be found by comparison of the magnitudes of the zero-

order correlations of the independent variables and their order of entry into the regression. For example, PI/EXP with an r of .55 entered the regression second, but INT/EXP with an r of .32 and RDG/EXP with an r of .37 entered the regression procedure fourth and fifth, behind SD/EXP with an r of -.22! To repeat: the criterion for entry into the stepwise regression procedure is the ability to account for variance not yet accounted for. It is also important to bear in mind the "spuriousness" factor and the resultant possibility of capitalization on chance cited by Cooley and Lohnes.

Bearing in mind the foregoing, a prediction equation was written, involving only one variable and its accompanying constant term. MATH/EXP was the only variable that entered the stepwise regression above the .05 level, hence MATH/EXP and its constant term can predict with sufficient accuracy beyond the chance level.

The prediction equation

$$Y' = 2.323893 - 3.66644X_2$$

has a SE_{est} of .2894, obtained by dividing the residual sum of squares (SS_{res}) by the sample size (N = 18) and taking the square root of the quotient. This means that each time the prediction equation is used to predict to Mathematics Achievement, Grades 2-3, the chances

are 2 in 3 (68%) that the predicted score will not miss the actual score by more than $\pm$.2894.

Procedure 4

Procedure 4 used the same independent variables as the first three procedures. The criterion variable was changed to that of Mathematics Achievement Grades 4-6. The following null hypothesis was tested in Procedure 4:

Hypothesis 4: There is no correlation between the combined independent variables (expenditure percentages for Reading [RDG/EXP], Mathematics [MATH/EXP], Parent Involvement [PI/EXP], Staff Development [SD/EXP], Intergroup Activities [INT/EXP], and Auxiliary Services [AUX/EXP]) and the dependent variable, Mathematics Achievement Grades 4-6.

Table 7 offers data pertinent to a test of Hypothesis 4.

TABLE 7

STEPWISE MULTIPLE REGRESSION ANALYSIS OF SIX INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN MATHEMATICS, GRADES 4-6

Variable	r with Math	Entry sig	R	R^2	Sig R	b	K
AUX/EXP	.67	.002	.67	.45	.002	1.8683	.27194
SD/EXP	-.44	.022	.78	.62	.001	-2.8583	.40393
PI/EXP	-.32	.228	.81	.65	.001	-1.2535	.47820
INT/EXP	-.04	.203	.83	.70	.002	6.2007	.40193

Analysis. The hypothesis of no correlation between the combined independent variables and the dependent variable was rejected. Overall F for two of the four variables in the regression was 12.2394, significant at the .001 level.

Inspection of the table reveals that two variables, Reading Expenditures and Mathematics Expenditures, did not enter the regression at all. Exclusion was due to the criterion for inclusion used by the stepwise procedure: the statistical significance of their (the independent variables) contribution to the prediction of the criterion. The reader is reminded of the "spuriousness" factor cited earlier, and the possibility of capitalization on chance.

The multiple regression coefficient for all four variables entered was .83, which means that 70 percent of the variance was accounted for by these variables. A prediction equation involving the first two variables entered into the regression follows:

$$Y' = .40393683 - 2.858331X_4 + 1.797213X_6$$

The SE_{est} of the equation is .1206. This means that whenever the equation is used to predict to Mathematics Achievement, Grades 4-6, the chances are 2 in 3 (68 percent) that the predicted score will not miss the actual score by more than $\pm$.1206.

The prediction equation above is an illustration of the merit of stepwise multiple linear regression that permits the development of a prediction equation based on the hierarchy of importance

of the variables as they do or do not contribute to prediction capability with confidence.

III. PHASE 2

As discussed in Chapter III, it was the intention of Phase 2 of the research design to investigate the analytical and predictive capabilities of four variables based on ratings (of five independent raters) of efficiency of implementation of four support components mandated in Compensatory Education programs in California: Parent Involvement Activities, Staff Development Activities, Intergroup Relations Activities and Auxiliary Service Activities.

An analysis of the reliability of the rater responses to questionnaires was shown in Table 2, Chapter III, and the actual questionnaires are shown in Appendices C-1 through C-4, along with the method of computation of single rater and mean rater reliability indices. (see Table 18, Appendix C).

Procedures 1 through 4 of this Phase use the same independent variables as described above, varying only in the selection of criterion variables, successively, Reading Achievement Grades 2-3 and Grades 4-6, and Mathematics Achievement Grades 2-3 and Grades 4-6.

Procedure 1

Procedure 1 tested the following null hypothesis:

Hypothesis 5: Ratings of efficiency of implementation of four independent variables (support components: Parent Involvement [PI/RTG], Staff Development [SD/RTG], Intergroup Activities [INT/RTG], and Auxiliary Services [AUX/RTG]) by five independent raters manifest no combined correlation with the dependent (criterion) variable, Reading Achievement, Grades 2-3.

Table 8 below offers data pertinent to a test of Hypothesis 5.

TABLE 8

STEPWISE MULTIPLE REGRESSION ANALYSIS OF FOUR INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN READING, GRADES 2-3

Variable	r with Reading	Entry sig	R	R^2	Sig R	b	K
SD/RTG	.28	.248	.28	.08	.248	.11475	.2561671
AUX/RTG	-.23	.076	.51	.26	.103	-.23841	1.1247243
INT/RTG	.04	.465	.53	.29	.175	.12182	.7710852
PI/RTG	.18	.790	.54	.29	.303	.70559	.8237291

Analysis. The null hypothesis was retained. Overall F for the regression was 1.35399, insufficient to meet the .05 level criterion for significance. Multiple R of the regression was .54,

accounting for 29 percent of the total variance. A prediction equation was not written as such an equation could not be written with the required level of confidence; that is, the predicted score from such an equation could not be predicted with sufficient accuracy to make the chance explanation implausible.

Procedure 2

Procedure 2 used the same independent variables as Procedure 1, substituting Reading Achievement, Grades 4-6 as the dependent variable. The following null hypothesis was tested:

Hypothesis 6: Ratings of efficiency of implementation of four independent variables (support components: Parent Involvement [PI/RTG], Staff Development [SD/RTG], Intergroup Activities [INT/RTG], and Auxiliary Services [AUX/RTG]) by five independent raters manifest no combined correlation with the dependent (criterion) variable, Reading Achievement, Grades 4-6.

Table 9 presents data pertinent to a test of Hypothesis 6.

TABLE 9

STEPWISE MULTIPLE REGRESSION ANALYSIS OF FOUR INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN READING, GRADES 4-6

Variable	r with Reading	Entry sig	R	R^2	Sig R	b	K
SD/RTG	.46	.051	.46	.21.	.051	.1446161	-.1625156
AUX/RTG	.41	.148	.56	.32	.054	.1225590	-.5836262
INT/RTG	.07	.673	.57	.33	.121	-.4420524	-.4077880
PI/RTG	.38	.666	.58	.34	.214	.6789679	-.3101471

Analysis. Multiple correlation for the regression equation was .58 for a total explained variance of 34 percent. No variable entered the regression beyond the .05 level of significance, thus precluding the possibility of a prediction equation that could be written with sufficient confidence.

The null hypothesis was retained. F values for the regression were below the required .05 level for every variable in the regression.

Procedure 3

Utilizing the same independent variables as Procedures 1 and 2, Procedure 3 is different in that it used the criterion variable Mathematics, Grades 2-3, in a test of the following null hypothesis:

Hypothesis 7: Ratings of efficiency of implementation of four independent variables (support components: Parent Involvement [PI/RTG], Staff Development [SD/RTG], Intergroup Activities [INT/RTG], Auxiliary Services [AUX/RTG]) by five independent raters manifest no combined correlation with the dependent (criterion) variable, Mathematics Achievement, Grades 2-3.

Table 10 presents data pertinent to a test of the foregoing hypothesis.

TABLE 10

STEPWISE MULTIPLE REGRESSION ANALYSIS OF FOUR INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN MATHEMATICS, GRADES 2-3

Variable	r with Reading	Entry sig	R	R^2	Sig R	b	K
AUX/RTG	-.38	.113	.38	.14	.113	-.1584603	2.12998
PI/RTG	.07	.079	.55	.31	.060	.1967352	1.69402
SD/RTG	-.21	.070	.67	.46	.070	-.1888606	1.71952
INT/RTG	.03	.636	.68	.46	.066	-.8508598	1.88493

Analysis. The null hypothesis was retained. Overall F for the regression was 2.87998, insufficient for the .05 level criterion. At no point in the regression did the Overall F statistic meet the criterion.

The multiple correlation of the regression was .68, but within the range expectation of random association. The possibility of a prediction equation was negated, as no variable entered the regression within the .05 level criterion.

Procedure 4

Procedure 4 used the same independent variables, substituting Mathematics Achievement, Grades 4-6 as the dependent variable. This procedure tested the following null hypothesis:

Hypothesis 8: Ratings of efficiency of implementation of four independent variables (support components: Parent Involvement [PI/RTG], Staff Development [SD/RTG], Intergroup Activities [INT/RTG], and Auxiliary Services [AUX/RTG]) by five independent raters manifest no combined correlation with the dependent (criterion) variable, Mathematics Achievement, Grades 4-6.

Table 11 presents data pertinent to a test of Hypothesis 8.

TABLE 11

STEPWISE MULTIPLE REGRESSION ANALYSIS OF FOUR INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN MATHEMATICS, GRADES 4-6

Variable	r with Reading	Entry sig	R	R^2	Sig R	b	K
AUX/RTG	.44	.064	.44	.19	.064	.1163366	.6405940
SD/RTG	.34	.266	.51	.26	.101	.5773653	-.1495848
INT/RTG	.02	.469	.54	.26	.172	-.5574709	.7216421
PI/RTG	.41	.126	.64	.41	.116	.1684423	.3143969

Analysis. The computed value of the multiple correlation coefficient was .64, but within the chance range for this situation. No variable entered the regression beyond the .05 level of significance, thus making impossible the development of a prediction equation written with the required level of confidence.

The null hypothesis was retained. F values for the regression

were below the required .05 level for every variable in the regression.

IV. PHASE 3

This third and final phase of this investigation used a combination of the independent variables used in Phases 1 and 2, with the addition of two independent variables, Program Size and Teaching Approach. Successively, Procedures 1 through 4, following, used the dependent variables Reading Grades 2-3, Reading Grades 4-6, Mathematics Grades 2-3 and Mathematics Grades 4-6. The method of Stepwise Multiple Linear Regression was used, employing the same SPSS routine that was employed in Phases 1 and 2.

The independent variables (expenditure variables) used in Phase 1 were designated, in sequence, X_1, X_2 ...X_6 ; the independent variables of Phase 2 (ratings of efficiency of implementation) were designated, in sequence, X_7, ..X_{10} ; and the two additional variables, Program Size and Teaching Approach were designated X_{11} and X_{12} respectively.

Procedure 1

The first procedure used the aforementioned 12 independent variables. The dependent variable was Reading, Grades 2-3. The following null hypothesis was tested in Procedure 1:

Hypothesis 9: There is no correlation between the combined 12 independent variables (expenditure percentages for Reading [RDG/EXP], Mathematics [MATH/EXP], Parent Involvement [PI/EXP], Staff Development [SD/EXP], Intergroup Activities [INT/EXP], Auxiliary Services [AUX/EXP] ; efficiency of implementation ratings of Parent Involvement Activities [PI/RTG], Staff Development Activities [SD/RTG], Intergroup Activities [INT/RTG], and Auxiliary Services [AUX/RTG] ; Program Size [PS] and Teaching Approach [TA]) and the dependent variable, Reading Achievement Grades 2-3.

Table 12 provides data pertinent to a test of the foregoing hypothesis. More exhaustive data is given in Appendix D, Figure 15.

TABLE 12

STEPWISE MULTIPLE REGRESSION ANALYSIS OF TWELVE INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN READING, GRADES 2-3

Variable	r with Reading	Entry sig	R	R^2	Sig R	b	K
SD/EXP	-.79	.000	.79	.62	.000	-13.1334	1.368514
PS	-.59	.028	.85	.73	.000	-.5316	1.536103
AUX/RTG	-.16	.197	.87	.76	.000	-.8615	2.028860
AUX/EXP	.16	.302	.88	.78	.000	1.0628	1.998287
RDG/EXP	.61	.251	.89	.80	.001	2.0305	.618870
PI/EXP	-.008	.322	.90	.82	.001	-2.2859	.491409
TA	.37	.566	.91	.83	.003	.1199	-.468458
SD/RTG	.34	.621	.91	.83	.009	.4723	-.434227
PI/RTG	.18	.369	.92	.85	.015	-.1274	-.147397
MATH/EXP	-.42	.458	.92	.86	.030	12.2188	-10.443731
INT/RTG	.11	.513	.93	.87	.057	.1294	-9.526612
INT/EXP	-.12	.809	.93	.87	.120	3.7215	-12.098834

Analysis. The null hypothesis of no correlation of the independent variables with the dependent variable was rejected. The Overall F for the regression was 4.46412, statistically significant at the .05 level for 10 of the 12 variables in the regression.

R for the regression was .93, accounting for 87 percent of the total sample variance. Of the 10 variables that entered the regression and contributed to the growth of R, only two entered above the .05 level. The other eight contributed to the overall growth of the multiple correlation, but not significantly so to the extent that the chance explanation was implausible. It is important to remind the reader of the "spuriousness" factor mentioned earlier. Because of the statistical method of selecting variables for entry into the regression, there is always the chance of variables entering the regression due to capitalization on chance. The generalizability of such variables entered should be restricted.

Two variables, Staff Development Expenditures [SD/EXP] and Program Size [PS], were necessary and sufficient to develop a prediction equation because they were the only variables to enter the regression beyond the .05 level of significance. The remaining ten variables were excluded from the prediction equation

$$Y' = 1.536103 - 13.133409X_4 + .53168806X_{11}$$

because their inclusion would not significantly enhance the accuracy

of the prediction equation. The SE_{est} of the predictor was .2291, meaning that each time the equation is used as a predictor to Reading Achievement Grades 2-3, the chances are about 2 in 3 (68 percent) that the predicted score will not miss the actual score by more than $\pm$ .2291.

The ten remaining variables succeeded in raising the value of R only .08, from .85 to .93, for an increase of only .15 in accounted-for sample variance. This further illustrates the redundancy effect of the variables due to high intercorrelations among those variables.

Despite the failure of the remaining ten variables to contribute to the prediction capability of the regression, it is interesting to note their order of entry into the regression, considering the magnitudes of their zero-order correlations. Reading Expenditures (r = .68) entered the regression fourth, after Auxiliary Services Ratings (r = -.16) and Auxiliary Services Expenditures (r = .16). Teaching Approach (r = .37) entered seventh, after sixth-place Parent Involvement Expenditures (r = -.008). Two other variables with relatively large zero-order correlations (Staff Development Ratings, r = .34, and Mathematics Expenditures, r = -.42, entered the regression in eighth and tenth places respectively.

The growth of R illustrates a fundamental principle in regression analysis: as variables are added, it becomes more and more

difficult to increase R (and hence R^2) because of the redundancy of the variables in terms of their ability to account for variance not yet accounted for.

The data of Table 11 shows a clear hierarchy of importance of the independent variables, consistent with the original rationale of this investigation. That hierarchical relationship is discussed in detail from an operational perspective in Chapter V.

Procedure 2

The second procedure differed from the first only in the selection of the criterion variable, Reading Achievement Grades 4-6. This procedure tested the following null hypothesis:

Hypothesis 10: There is no correlation between the combined 12 independent variables (expenditure percentages for Reading [RDG/EXP], Mathematics [MATH/EXP], Parent Involvement [PI/EXP], Staff Development [SD/EXP], Intergroup Activities [INT/EXP], Auxiliary Services [AUX/EXP]; efficiency of implementation ratings of Parent Involvement Activities [PI/RTG], Staff Development Activities [SD/RTG], Intergroup Activities [INT/RTG], Auxiliary Services [AUX/RTG]; Program Size [PS] and Teaching Approach [TA]) and the dependent variable, Reading Achievement Grades 4-6.

As with all preceding tests of hypotheses, this test will be at the .05 level with appropriate degrees of freedom. Table 13

offers data pertinent to a test of the foregoing hypothesis.

TABLE 13

STEPWISE MULTIPLE REGRESSION ANALYSIS OF TWELVE INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN READING GRADES 4-6

Variable	r with Reading	Entry sig	R	R^2	Sig R	b	K
TA	.62	.005	.62	.39	.005	.3875	.6184615
MATH/EXP	-.20	.068	.72	.51	.004	-1.6232	1.0859431
SD/RTG	.52	.163	.76	.58	.005	.8933	.6083489
AUX/RTG	.46	.275	.78	.62	.009	.7763	.1527325
INT/RTG	.13	.127	.83	.69	.008	-.1487	1.0752388
RDG/EXP	.07	.277	.85	.72	.012	1.2623	.3236909
PI/RTG	.38	.546	.85	.73	.025	-.6131	.3175606
PS	-.36	.690	.85	.73	.052	.1013	.4057045
PI/EXP	-.17	.830	.86	.74	.102	.6900	.4305014
SD/EXP	-.45	.856	.86	.74	.183	.6313	.3239364
AUX/EXP	.42	.239	.89	.79	.177	9.8481	-10.8174031
INT/EXP	-.05	.555	.90	.81	.263	6.7714	-14.3230112

Analysis. The null hypothesis of no correlation of the independent variables with the dependent variable is rejected. Overall F for 7 of the 12 variables in the regression was 3.94306, significance at the .05 level.

The phenomena of strong intercorrelations between independent variables is vividly illustrated in the data of Table 13 (see Appendix D, Figure 16). The variable Teaching Approach entered the regression with an R of .62, well beyond the .05 criterion for entry. No other

variable in the regression met the .05 level criterion, thus precluding use in a prediction equation. The variable Teaching Approach and its accompanying constant term was necessary and sufficient to develop a prediction equation at the 95 percent level of confidence:

$$Y' = .3875384X_{12} + .61846154$$

The SE_{est} of this equation is .21474, which means that each time the equation is used to predict to Reading Achievement Grades 4-6, there is a 68 percent probability that the predicted score will not miss the actual achievement score by more than $\pm$.21474.

Procedure 3

The third procedure of Phase 3 used Mathematics Grades 2-3 as the dependent variable. Independent variables remain the same. This procedure tests the following null hypothesis:

Hypothesis 11: There is no correlation between the combined 12 independent variables (expenditure packages for Reading [RDG/EXP], Mathematics [MATH/EXP], Parent Involvement [PI/EXP], Staff Development [SD/EXP], Intergroup Activities [INT/EXP], Auxiliary Services [AUX/EXP]; efficiency of implementation ratings of Parent Involvement

[PI/RTG], Staff Development Activities [SD/RTG], Intergroup Activities [INT/RTG], Auxiliary Services [AUX/RTG]; Program Size [PS] and Teaching Approach [TA] and the dependent variable, Mathematics Achievement Grades 2-3.

Table 14 offers data pertinent to a test of the foregoing hypothesis.

TABLE 14

STEPWISE MULTIPLE REGRESSION ANALYSIS OF TWELVE INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN MATHEMATICS GRADES 2-3

Variable	r with Mathematics	Entry sig	R	R^2	Sig R	b	K
MATH/EXP	-.62	.006	.62	.38	.006	-3.6664	2.323893
AUX/RTG	-.31	.113	.69	.48	.007	-.1266	3.033621
PI/RTG	.07	.231	.73	.53	.011	.1110	2.691801
RDG/EXP	.37	.131	.78	.61	.011	-2.5006	4.308849
PI/EXP	.55	.251	.80	.65	.015	3.2109	4.052913
TA	.02	.148	.84	.71	.014	.2350	4.071136
SD/RTG	-.16	.368	.85	.73	.023	.1048	4.492021
PS	-.41	.242	.88	.77	.028	-.4460	4.991930
AUX/EXP	.06	.342	.89	.80	.042	2.6616	2.924750
SD/EXP	-.22	.382	.90	.82	.063	15.5551	-8.465406
INT/EXP	.32	.562	.91	.83	.111	7.7721	-13.923251
INT/RTG	.10	.901	.91	.83	.209	.2555	-13.886361

Analysis. The null hypothesis of no combined correlation between the independent variables and the dependent variable is rejected. Overall F for the first nine variables was 3.62985 for a

combined probability of .042 under the assumption of a true null hypothesis. It is again important to point out the impact of the F criteria used in selecting the variables to be added to the regression and the possibility of "spuriousness" or capitalization on chance that might occur, resulting in misinterpretation of the contribution of certain variables in the regression as misleadingly high.

The multiple correlation coefficient for the nine variables was .89 which means that 80 percent of the sample variance was accounted for. Again the phenomena of intercorrelation between independent variables was a factor that created a redundant effect in terms of the ability of most variables entered to add to the multiple correlation coefficient.

From the standpoint of prediction, only one variable, Mathematics Expenditures, entered the regression beyond the 95 percent level of confidence, permitting its use in a prediction equation to the exclusion of all other variables:

$$Y' = 2.3238936 - 3.66644X_2$$

The S_{est} of the prediction equation was .2894, which means that each time the equation is used to predict to Mathematics Achievement Grades 2-3, the chances are 2 in 3 (about 68%) that the predicted

score will not miss the actual score by more than ±.2894.

Procedure 4

The fourth and last procedure of Phase 3 used the same independent variables as those of the preceding three analyses. The criterion variable was changed to that of Mathematics Achievement Grades 4-6. Procedure 4 tested the following null hypothesis:

Hypothesis 12: There is no correlation between the combined 12 independent variables (expenditure percentages for Reading [RDG/EXP], Mathematics [MATH/EXP], Parent Involvement [PI/EXP], Staff Development [SD/EXP], Intergroup Activities [INT/EXP], Auxiliary Services [AUX/EXP]; efficiency of implementation ratings of Parent Involvement Activities [PI/RTG], Staff Development Activities [SD/RTG], Intergroup Activities [INT/RTG], Auxiliary Services [AUX/RTG]; Program Size [PS] and Teaching Approach [TA]) and the dependent variable, Mathematics Achievement Grades 4-6.

Table 15 on the next page offers data pertinent to a test of the foregoing null hypothesis.

Analysis. The null hypothesis of no combined correlation between the independent variables and the dependent variable was rejected. Overall F for the first 11 variables in the regression

was 5.10962, significant well beyond the .05 level.

TABLE 15

STEPWISE MULTIPLE REGRESSION ANALYSIS OF TWELVE INDEPENDENT VARIABLES PREDICTING ACHIEVEMENT SCORES IN MATHEMATICS GRADES 4-6

Variable	r with Math	Entry sig	R	R^2	Sig R	b	K
TA	.71	.001	.71	.51	.001	.3133	.6246153
AUX/EXP	.67	.001	.87	.76	.000	1.4407	.3024266
RDG/EXP	-.14	.076	.90	.81	.000	.7177	-.5596564
INT/EXP	-.04	.283	.91	.83	.000	3.7056	-.9388254
MATH/EXP	-.14	.267	.92	.84	.000	.8379	-.7236914
PS	-.43	.352	.92	.85	.000	-.1166	-.8959010
AUX/RTG	.50	.423	.93	.86	.001	.3769	-1.2982776
INT/RTG	.08	.421	.93	.87	.002	-.4752	-.8781651
PI/EXP	-.32	.605	.93	.88	.007	.9475	-1.1558263
SD/EXP	-.44	.265	.95	.90	.010	5.3070	-5.4192761
SD/RTG	.40	.888	.95	.90	.029	.6148	-5.6170422
PI/RTG	.41	.829	.95	.90	.070	-.1702	-6.2740461

The multiple correlation coefficient of the 11 variables was .95, accounting for 90 percent of the sample variance in the dependent variable, Mathematics Achievement Grades 4-6. Although only two variables entered the regression beyond the .05 level, the spuriousness factor cited earlier should be borne in mind when interpreting the growth of the multiple correlation coefficient.

The factor of strong intercorrelations between variables was illustrated by the regression: zero-order correlations of -.43, .50,

-.32, -.44, .40 and .41 entered sixth, seventh, ninth, tenth, eleventh and twelfth, after smaller zero-order correlations of -.14, -.04, -.14 and .08 which entered the regression on steps three, four, five and eight respectively. (A table of intercorrelations is shown in Appendix D, Figure 18).

Of interest also was the manner in which the amount or rate of change of R decreased; that is, the first two variables in the regression accounted for an R of .87, and the remaining 10 variables accounted for only a .08 rise in R. A parallel observation may be found by reading the column "Entry significance." From the third variable on, the "Entry significance" was below the .05 level, meaning that each added variable failed to increase R significantly.

Prediction is related to entry significance. Only the variables Teaching Approach [TA] and Auxiliary Services Expenditures [AUX/EXP] were necessary to write a prediction equation that can predict with accuracy commensurate with the 95 percent level of confidence.

That prediction equation is:

$$Y' = .25257305X_{12} + 1.440717X_{6} + .3024266$$

It should be noted that the coefficient of X_6 [TA] is different from the coefficient shown in the table, although the coefficient of X_6 [AUX/EXP] and its accompanying constant term is the same.

The explanation is that the coefficients already in the regression change as new variables are added because the relations between beta weights change also.

The SE_{est} for the prediction equation was .0947. This means that each time the equation is used to predict to Mathematics Achievement Grades 4-6, the probability is about 68 percent that the predicted score will not miss the actual score by more than $\pm$.0947.

V. SUMMARY

This Chapter was devoted to the presentation, treatment and analysis of the data obtained for the sample of schools investigated in this study. Tables showing pertinent statistics were presented. Several statistical trends were noted, and they are discussed below in terms of the patterns displayed. Their implications for educational practice will be discussed in Chapter V.

Analysis of the 12 tables presented in this chapter reveals the following trends:

(1) When expenditure variables were used as the only independent variables, Staff Development Expenditures [SD/EXP] surfaced as the most powerful variable in terms of predicting to Reading Achievement for both levels, Grades 2-3 and Grades 4-6.

(2) When expenditure variables were used as the only independent variables, Mathematics Expenditures [MATH/EXP] predicted to Mathe-

matics Achievement for Mathematics Grades 2-3. This was not true for Reading Expenditures [RDG/EXP] as related to Reading Achievement.

(3) When expenditure variables were used as the only independent variables, three variables exhibited hierarchical importance as shown by their sequence(s) of entry into the regression(s): Staff Development Expenditures [SD/EXP], Mathematics Expenditures [MATH/EXP] and Parent Involvement Expenditures [PI/EXP].

(4) Independent variables based on ratings of efficiency of implementation were not effective predictors to either Reading Achievement or Mathematics Achievement when used alone.

(5) When the 12 variables of Phase 3 were used as independent variables, several trends in power-predictors were observed:

(a) Teaching Approach [TA] was a dominant predictor for both Reading Achievement Grades 4-6 and Mathematics Achievement Grades 4-6.

(b) Program Size [PS] was a factor as a predictor in Reading Grades 2-3.

(c) The variables Auxiliary Services ratings [AUX/RTG], Reading Expenditures [RDG/EXP], Auxiliary Services Expenditures [AUX/EXP] and Mathematics Expenditures [MATH/EXP] appeared in the upper half of the 12-variable hierarchy consistently.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

This study investigated the feasibility of developing a model for both the analysis of the relative contributions of the variables presumed to be important to achievement outcomes in Reading and Mathematics, Grades Two through Six, and the prediction to achievement outcomes in these subjects and grade levels. Derived were certain findings which have relevance for future program development in Compensatory Education as well as for general educational practice.

Presented in this chapter are: (1) a summary of the study; (2) limitations of the study; (3) conclusions relating to the hypotheses; (4) implications of the study; and (5) recommendations for further research.

I. SUMMARY OF THE STUDY

The study is summarized under three major headings: (1) the setting and selection of participants; (2) the procedure; and (3) analysis of the data.

The Setting and Selection of Participants

The setting of the study was in the 19 public elementary schools of the Oakland Unified School District participating in the ESEA Title I Compensatory Education Program of that district for the 1972-1973 school year. Participating schools were similar in: (1) mean income of families served by the schools; (2) racial and ethnic composition; and (3) degree of eligibility for services under ESEA Title I and other related Compensatory Education criteria.

Grade levels involved in the study were Grades Two through Six, inclusive. Grade one was excluded from the study because of unavailability of achievement data in Reading and Mathematics based on the pretest-posttest differential.

The Procedure of the Study

The study was subdivided into four separate analyses of Achievement criteria: Reading Grades 2-3, Reading Grades 4-6, Mathematics Grades 2-3 and Mathematics Grades 4-6. Eighteen schools were involved in each sample because one school (Martin Luther King Elementary) was a K-3 school and one school (Cole Elementary) was a 4-6 school. Investigation of three different possible prediction models resulted in a total of 12 separate regression analyses.

Achievement data were derived by the pretest-posttest methodology, using the Cooperative Primary Tests (Educational Testing Service) for Grades 2-3 in Reading and Mathematics, and the Comprehensive Tests of Basic Skills (California Test Bureau) for Grades 4-6 in Reading and Mathematics.

Analysis of the Data

Twelve separate stepwise multiple regression procedures yielded data which provided, in a majority of the cases, the possibilities of: (1) correlational analyses of selected independent variables and the criterion variable(s); (2) development of prediction procedures with unbiased estimates; and (3) generalizability to population parameters as the population was defined within the present study, also with unbiased estimates.

The .05 level of significance was used to determine whether 12 separate null hypotheses of no correlation of sets of independent variables with criterion or dependent variables were to be retained or rejected. Within the framework of hypothesis testing, prediction, an additional reason for the study, was determined. The prediction capability of regression equations was a function of the statistic "Entry F," for independent variables. Prediction was determined to be possible or not possible according as variables met the .05 Entry F criterion. For variables meeting the criterion, prediction equations

were written, involving those variables and their accompanying Constant terms. Before moving to conclusions relating to the null hypotheses of Chapter III, it is necessary to discuss certain limitations inherent in the study.

II. LIMITATIONS OF THE STUDY

The findings of this study should be viewed with the following limitations in mind:

1) That the fundamental rationale undergirding this investigation was vested in the development of a model, and generalizations from this investigation should be relative to the feasibility of that model.

2. That the findings of this study relate only to schools similar to those described in the sample.

3. That interpretation(s) of multiple correlation coefficients should proceed with awareness of the spuriousness factor cited earlier.

4. That the four variables derived from ratings be evaluated in terms of the intrinsic weaknesses of rating scales, cited earlier.

5. That the 12 variables in the final model of Phase 3 of this investigation were determined by California State Compensatory Education guidelines and are not necessarily the only or most important variables which correlate with achievement in Reading and Mathematics.

III. CONCLUSIONS RELATED TO THE HYPOTHESES

The primary objective of this study was development of a model for analysis of relationships of state-mandated variables presumed to be determinants of achievement in Compensatory Education Reading and Mathematics to achievement criteria in Reading and Mathematics, Grades 2-6. Three models were explored: (1) a model which explored the analytical and predictive abilities of six independent variables based on expenditure percentages, using achievement in Reading and Mathematics as the criterion; (2) a model which investigated the analytic and predictive capabilities of four variables based on ratings of support components, using the same criterion variables as in (1); and (3) a final model which explored the analytic and predictive abilities of the combined independent variables of (1) and (2) above plus two more variables: Program Size and Teaching Approach.

Hypotheses Involving Six Expenditure Variables

Hypotheses 1 through 4, explicitly stated as testing the combined correlation of six independent expenditure variables with, successively, Reading Achievement Grades 2-3, Reading Achievement Grades 4-6, Mathematics Achievement Grades 2-3 and Mathematics Achievement Grades 4-6, are evaluated here in terms of certain plausible conclu-

sions related to them:

1. Hypothesis 1, that of no combined correlation of six expenditure variables to the criterion of Reading Achievement, Grades 2-3, was rejected. The findings resulting from the regression indicate that expenditure variables alone can function as predictors of Reading Achievement Grades 2-3. However, although all six variables were important to accounting for variance in the dependent variable, only one variable (Staff Development Expenditures) was able to predict to Reading Achievement at that grade level. Reading Expenditures correlated .61 with Reading Achievement Grades 2-3, but was not sufficient for prediction. An important conclusion derived from hypothesis testing is that considerable redundancy was displayed by the state-mandated variables, indicating a measure of overlap in function that would suggest that the California State Compensatory Education model should be re-thought in terms of its overall efficiency.

2. Retention of Hypothesis 2, that of no combined correlation of six expenditure variables to the criterion of Reading Achievement Grades 4-6, precluded prediction. Staff Development Expenditures again appeared to be the dominant variable, although it failed to enter the stepwise regression at the required level of significance. An important conclusion derived from Hypothesis 2 is that, in schools similar to those in the present study, it is not likely that the six

expenditure variables predict to Reading Achievement, Grades 4-6, with accuracy commensurate to the 95 percent level of confidence. Thus, unlike its effect related to Reading Achievement, Grades 2-3, it was inadequate.

3. In the test of Hypothesis 3, three of the six variables led to rejection of the null hypothesis. Only one variable, Mathematics Expenditures, met the criterion for use as a predictor to Mathematics Achievement Grades 2-3. The multiple correlation coefficient of .66 and the coefficient of determination of .44 indicate that only 44 percent of the total variance was accounted for by the regression, despite the fact that the null hypothesis was retained.

An important conclusion resulting from the test of Hypothesis 3 was that, although there was statistically significant combined correlation between the independent variables and the criterion of Mathematics Achievement Grades 2-3, the regression left much to be desired as evaluated from the standpoint of the amount of the variance accounted for. Additionally, when the coefficient of correlation is low, the error of prediction is high.

4. A test of Hypothesis 4, that of no combined correlation

between the expenditure variables and the criterion variable, Mathematics Achievement Grades 4-6, revealed that the expenditure variables functioned better both in terms of explained variance and prediction. The multiple R accounted for 70 percent of the variance and resulted in a prediction equation involving two predictors (Auxiliary Services Expenditures and Staff Development Expenditures) and a relatively small Standard Error of Estimate of .1206. This means that the six expenditure variables are better predictors to Mathematics Achievement Grades 4-6 than in the preceding three cases.

General. Investigation of the six expenditure variables from the standpoints of their analytical and predictive abilities reveal that, taken alone, they do not function sufficiently well over all four criterion variables.

This suggests that additional variables are needed if the model aspired to herein is to be functional in actual practice. It is important to bear in mind the fact that magnitude of correlation does not permit or suggest inference, but a plausible conclusion based on the foregoing analyses and applied to the context described herein, is that serious attention should be paid to whether or not there is repitition of fiscal effort in Compensatory Education programs.

An overall conclusion with respect to the model based on six state-mandated variables is that expenditure variables alone do not suffice as predictors to achievement in all levels of Reading and Mathematics in Compensatory Education programs similar to those in the current study.

Hypotheses Involving Four Efficiency of Implementation Ratings As Independent Variables

Four hypothesis-testing procedures, all involving tests of hypotheses of combined correlation of four independent variables based on ratings of efficiency of implementation with the four dependent variables defined as criterion variables in the study, failed to yield significant statistics which would make the chance explanation implausible. Thus, Hypotheses 5 through 8 were retained.

The foregoing led to the conclusion that the four variables based on efficiency of implementation ratings by five independent raters do not act singly or in combination in terms of explanation of sufficient variance or prediction to achievement. However, from a procedural standpoint the rating instrument used appeared to be an effective one, eliciting mean reliability indices of .9331 (Parent Involvement), .8512 (Staff Development), .9004 (Intergroup Activities) and .8989 (Auxiliary Services).

Hypotheses Involving Twelve Independent Variables

The combination of the expenditure variables and the efficiency of implementation variables plus the addition of two variables (Program Size and Teaching Approach) elicited dramatically different results from those of the preceding combinations of variables. Regression procedures resulted in a 12-variable model feasible both in terms of analysis and prediction at all levels of the two criterion variables. Thus, Hypotheses 9 through 12 were rejected. Multiple correlation coefficients of .93, .90, .89 and .90 for Reading Grades 2-3, Reading Grades 4-6, Mathematics Grades 2-3 and Mathematics Grades 4-6 respectively, indicate sufficiently high coefficients of determination. Since error of prediction is inversely related to the magnitude of the coefficient of multiple correlation, that error is relatively small in the event of application of the prediction process.

General. The findings indicate that the 12-variable regression offers practical possibilities for effective analysis and prediction for all four criterion variables. Considering the robustness of multiple regression in general, combined with the possibilities of using the procedure in either decision-oriented or conclusion-

oriented research, the implications for educational practice are evident. Those implications will be considered in the following section.

IV. IMPLICATIONS OF THE STUDY

In view of the limitations previously stated, as well as the demonstrated efficacy of the 12-variable regression model as a tool for the analysis of correlational relationships bearing on achievement in Reading and Mathematics at the elementary level and the prediction power of the model, many implications are imminent. These implications are dual: in terms of the conditions of educational practice as discovered within the present study and educational practice within school districts with similar demography. Additionally, the model appears to be pragmatic for other districts operating Compensatory Education programs based on the California model.

The 12-variable regression model developed herein appears to be capable of functioning in a decision-oriented research context. The sharply-delineated hierarchy gives a practicing administrator an immediate picture of the relative impact(s) of the variables in the regression, forcing attention to those which do not appear contributory to the established criterion variables. Most importantly, the procedure is feasible while the school year is in progress: it is a relatively simple matter to conduct a randomized testing pro-

cedure while the school year is in progress, even in the early months of the school year. The data for the independent variables will be available at any time during the school year also. Regression procedures conducted will show, in progress: (1) variables which do not seem to be eliciting their anticipated impact(s) on outcomes; (2) variables that appear to be operating in inverse relationship to the criterion variables, suggesting re-alignment or replacement; (3) the in-progress impact of certain curricular strategies; and, most importantly, (4) the efficiency of implementation of components by personnel.

The model developed herein suggests the possibility of yet another model. The existence of program budgets within school districts provides immediate arrays of independent variables corresponding to the categorical breakdown(s) within those program budgets, and if a given school district has enough schools, a regression procedure is immediately accomplishable. Such a model would be based on expenditure distributions only, but it would be feasible in terms of the information it would give to administrators on alignment of resources.

With the relatively recent proliferation of myriad commercial approaches sold as instructional adjuncts, it becomes necessary for the conscientious practicing administrator to have at his disposal

a tool for assessment of the relative efficacies of these approaches, particularly in the event of absence of experimental data exhibiting such applicability or efficacy within comparable settings. The 12-variable model herein can provide such a tool, but one caution is in order: action research must be undertaken for the purpose of detailed activity data breakdowns. For example, in a school or set of schools where several approaches are used, it is important to delineate on a teacher-by-teacher basis, just what commercially packaged approaches are used and to account with reasonable accuracy for the degree of implementation (which includes classroom time spent) of such approaches.

The importance of action research as natural accompaniment to the analytical and predictive model surfaced by this study cannot be overemphasized. This writer was considerably limited in the present study because of the absence of action research in the schools during the school year analyzed. It was the original intent of this investigation to include both the Oakland and San Francisco School Districts in the study sample. Unfortunately, the San Francisco data failed to yield information which permitted sufficient delineation of independent or dependent variables as discrete variables.

An ideal situation involving the capabilities of the 12-variable model herein would be application of the action research procedure

described above. For example, within the time-frame of a traditional six or nine week marking period, the model within this study could be used as a monitoring device, affording trend analysis that would be economical in terms of the time spent securing the information. Such trend analysis while the school year is in progress permit administrative adjustments of curricular and instructional activity.

The 12-variable model is equally applicable to conclusion-oriented research, with the capability of transforming the typical simple reportage commonly done in many annual evaluations within school districts to evaluations which point to sharp delineations between schools and their curricular approaches. Such delineations may result in a firmer, broader base for programming in subsequent years.

Implications for the California Compensatory Education Model. The redundancy exhibited by the 12-variable model suggests that certain aspects of the California Compensatory Education model need reinvestigation. While correlations do not imply or infer causality, the correlations in the study herein suggest expenditure overlap and function overlap.

If the components as described in the California State Compensatory Education Guidelines, cited earlier, were intended to have a

concerted impact of all six components on cognition in Reading and Mathematics, the model is wasteful. If the model was designed with the expectations of equal emphasis on cognition and improving the total school life of the child - discounting the economies of effective intercomponent relationships - the California State Compensatory Education model is at least workable.

The literature reveals no evidence that the California State Compensatory Education model was subjected to rigorous statistical analysis in terms of overall efficiency. Mere piloting as was done is not sufficient. While several pilot studies might reveal the compatibility of the model within school districts throughout the state, they fail to reveal duplication of effort as evidenced in the present study.

From the standpoint of the analyses of the relationships between the components in the current California Compensatory Education model and the achievement criteria, several components seem disappointing in terms of the extent of their relationships and certainly in terms of their anticipated effects. Bearing in mind the reality that correlational magnitudes suggest relationship without necessarily being indicators of causality, it is important to examine some of these relationships. Parent Involvement Expenditures and Parent Involvement Activities, thought to be important to the overall goal of cognition in Reading and Mathematics, did not surface as a significant variables

during the development of the final model. This does not mean that the component is irrelevant; rather, it means that the fundamental rationale for its existence should be re-examined in terms of whether it bears meaningfully on student cognition in Reading and Mathematics. Perhaps the rationale for Parent Involvement should be redefined in other than cognitive terms. Auxiliary Services Expenditures exhibited power in predicting to Mathematics Achievement Grades 4-6, but failed to enter the regression(s) in other situations. This suggests that Auxiliary Services needs to be re-assessed in terms of whether it is related to cognition. The ideal involved in the Auxiliary Services component is that of physical and psychological well-being of the child, and is of itself defensible.

The same is true of the Intergroup Relations component. The desired end of self-actualization, of re-impowering the minority child with a sense of contribution, historically, to the development of the nation and the resultant sense of enfranchisement seems minimally related to cognition, per se. Never did the two variables (Intergroup Expenditures and Intergroup Ratings) surface as significant variables in terms of entry or contribution; rather, this component was very low in the overall hierarchy. This suggests that the posit that this variable contributes to cognition (within the present study) be abandoned and replaced with - perhaps - the simple rationale that

the Intergroup Component is good - evaluated alone - in terms of certain desired ends of American Education.

Staff Development, presumably closely related to the hoped-for outcomes of cognition, manifested negative correlations with the criterion in each regression. While negative zero-order correlations of variables with criterion variables have no effect on the predictive power of those variables, there may be several important implications of such negative correlations for districts such as the one described herein using the California Compensatory Education model; implications which might justify alteration of that model in an operational sense. This specific manifestation of negative zero-order correlations may have been due to: (1) the presence of formal staff development activity in the Parent Involvement, Intergroup Relations and Auxiliary Services components, resulting in an effort-duplication effect which obscured the true impact of formal Staff Development activity and expenditures on cognition; and (2) the perceptions of the collective school site staffs relative to formal staff development; that is, the reality that Staff Development activity occurs informally and formally during faculty meetings and other gatherings, combined with the routine staff development activity of Central Office personnel assigned to the schools, may have encouraged sporadic, poorly-focused planning for formal Staff Development as defined by the state guidelines, resulting in expenditure levels that did not accurately reflect the true amount of Staff Development Activity.

V. RECOMMENDATIONS FOR FURTHER STUDY

The findings relative to the statistical power of the 12-variable model herein, coupled with the overall robustness of multiple regression as a statistical tool in general, give credence to the belief that this model could be used with confidence in a variety of analytical and predictive situations in daily school administration. However, much more information is needed, in the form of research tangential to rationale and methodology herein. The following are recommendations for further research, particularly with respect to the further refinement of the general method developed in the present study:

1. As with all non-experimental studies, internal validity is limited, imposing severe restrictions on generalizability. In view of the limitations on the generalizability of the present study, a broader study encompassing several districts of comparable nature with respect to demography should be undertaken. This recommendation is equally applicable to urban, suburban and rural type districts.

2. Districts operating Planning, Programming and Budgeting Systems (PPBS) afford an ideal arena for application of the principles demonstrated in the models herein. With cost categories acting as independent variables and achievement criteria acting as dependent

variables, it is possible to develop new models which could serve as effective decision-making adjuncts in the operationalization of the desired ends of PPBS.

3. Teaching Approach surfaced as a power variable for Reading Grades 4-6 and Mathematics Grades 4-6 in the present study. With a sufficiently large number of cases (schools) and large number of Teaching Approaches identified, a natural consequence of a regression study involving this variable would be the interaction analyses exposed as a result of a multi-dimensional analysis of variance approach involving Teaching Approach and several other plausible variables from a regression. An example which appears plausible is the combination of Teaching Approach, Program Size and Staff Development Expenditures. The interactions surfaced should be evident; more important would be the relevance of the findings for education in general.

4. A natural prerequisite of a study as described in (3) above would be careful, detailed attention to the specifics of classroom methodology. Several instruments have devised which purport to be accurate assessments of the effectiveness of classroom teachers. However, there still does not exist an effective instrument for measuring, in an organized, succinct fashion, the distribution of the energies of the classroom teacher. Such an instrument would be a major breakthrough in terms of enhancing the effectiveness of investigations as described in (3) above.

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APPENDICES

APPENDIX A

SAMPLE SCHOOL SITE BUDGETS

OAKLAND PUBLIC SCHOOLS — July 25, 1972

ESEA TITLE I PROGRAM OF COMPENSATORY EDUCATION

1972 - 1973

CLAWSON ELEMENTARY SCHOOL
3240 Peralta Street (94608)
415 - 658-0163
John Tavors, Principal

TENTATIVE BUDGET ABSTRACT *

DESCRIPTION			ESTIMATED COSTS	
A. Certificated Personnel				
1	Assistant Reading/Mathematics		$11,409	
.50	Math Resource Teacher		6,000	
.30	Pupil Personnel Specialist		4,798	
1	Librarian		14,264	
.50	Nurse		6,418	
	Total Estimated Certificated Costs			$42,889
B. Classified Personnel				
1	Instructional Clerk		5,207	
14	Instructional Assistants	3 hours	26,330	
1	Library Assistant	3 hours	1,800	
1	Community Assistant	6 hours	3,600	
.50	Nurse Assistant		2,603	
	Total Estimated Classified Costs			$39,540
C. Other Costs				
	Other Books		400	
	Instructional Supplies		5,000	
	Admission Fees - Cultural Enrichment		350	
	Office Supplies		50	
	Health Services Supplies		50	
	Excursions and Transportation		600	
	Parent Advisory Supplies		150	
	Parent Involvement Supplies		150	
	Equipment		350	
	Fixed Charges - Certificated		6,433	
	Fixed Charges - Classified		3,438	
	Total Estimated Other Costs			$16,971
	TOTAL ESTIMATED BUDGET COSTS			$99,400

*This is an estimate as not all staff members have been identified and exact salaries could not always be computed. Allocations were based on predicted enrollments also and these figures in some instances may vary. When accurate calculations can be made, revised budgets will be completed.

FIGURE 1
SCHOOL SITE BUDGET

OAKLAND PUBLIC SCHOOLS July 31, 1972

ESEA TITLE I PROGRAM OF COMPENSATORY EDUCATION

1972 - 1973

HIGHLAND ELEMENTARY SCHOOL
8521 A Street (94621)
415 - 562-0755
Dolores Frazier, Principal

TENTATIVE BUDGET ABSTRACT *

DESCRIPTION			ESTIMATED COSTS	
A.	**Certificated Personnel**			
2	Assistants in Reading/Mathematic			
6	Reading/Mathematics Teachers		$107,850	
1	Pupil Personnel Specialist		13,426	
1	Librarian		12,836	
.90	Nurse		11,552	
	Total Estimated Certificated Costs			$145,664
B.	**Classified Personnel**			
1	Instructional Clerk		5,470	
9	Instructional Assistants	3 hours	17,228	
1	Community Assistant	6 "	3,600	
1	Library Assistant	6 "	3,600	
	Total Estimated Classified Costs			$ 29,898
C.	**Other Costs**			
	Instructional Supplies		900	
	Admission Fees - Cultural Enrichment		500	
	Parent Involvement		500	
	PAG		400	
	Fixed Charges - Certificated		22,235	
	Fixed Charges - Classified		8,232	
	Total Estimated Other Costs			$ 32,767
	TOTAL ESTIMATED BUDGET COSTS			$208,329
	Allocation for possible cost of living increase. This sum may be transferred into one of Other Costs category if unused.			6,067
				$214,500

*This is an estimate as not all staff members have been identified and exact salaries could not always be computed. Allocations were based on predicted enrollments also and these figures in some instances may vary. When accurate calculations can be made, revised budgets will be completed.

FIGURE 2
SCHOOL SITE BUDGET

APPENDIX B

EXPENDITURE PERCENTAGES

OF SCHOOLS

TABLE 16

SCHOOL BY SCHOOL EXPENDITURE PERCENTAGES
IN SIX MANDATED CATEGORIES

School	Reading	Mathematics	Parent Involvement	Staff Development	Intergroup Relations	Auxiliary Services
Bunche	.3769	.1668	.0735	.0393	.0244	.3556
Clawson	.2390	.3084	.0426	.0568	.0095	.3434
Cole	.2866	.2866	.0710	.0548	.0028	.2982
Durant	.3891	.3098	.0342	.0700	.0094	.1837
Garfield	.3127	.3127	.0242	.0448	.0158	.2932
Golden Gate	.3389	.3833	.0408	.0533	.0202	.1595
Hawthorne	.4194	.3395	.0257	.0234	.0132	.1601
Highland	.3685	.3685	.0255	.0325	.0023	.2027
Martin Luther King	.3601	.3487	.0292	.0292	.0020	.2267
Lafayette	.3718	.2181	.0792	.0573	.0144	.2568
Lazear	.3487	.3405	.0050	.1077	.0101	.1562
Lockwood	.3334	.3665	.0236	.0412	.0130	.2221
Melrose	.4518	.2799	.0528	.0425	.0301	.1431
Prescott	.4023	.2469	.0278	.0366	.0065	.2817
Willow Manor	.5653	.1843	.1297	.0014	.0134	.1065
Woodland	.3121	.3237	.0406	.0480	.0076	.2473
Kaiser	.4448	.2632	.0018	-----	.0065	.2832
Redwood Heights	.3836	.3653	.0018	-----	.0091	.2381
Sequoia	.4173	.2688	.0023	-----	.0070	.3050

APPENDIX C

INDEPENDENT RATER DATA

QUESTIONNAIRE

The goals below were subsets of Oakland Unified School District Primary Goals for Compensatory Education for the 1972-73 school year. They were determined to be important to the success of the AUXILIARY SERVICES component for that year:

ENSURE THAT STUDENTS' PHYSICAL, MENTAL AND EMOTIONAL HEALTH NEEDS ARE MET.

REDUCE THE INCIDENCE OF TARDINESS AND UNEXCUSED ABSENCES.

ENSURE THE USE OF THE LIBRARY AS A PERSONAL AND INSTRUCTIONAL RESOURCE FOR STUDENTS.

Directions: Opposite each school listed below, please encircle the number which in your opinion best describes the effectiveness of the school in meeting all goals for that school year. Please do not omit a response.

	Not Effective			Poor		Average		Good		Very Effective
Bunche	1	2	3	4	5	6	7	8	9	10
Clawson	1	2	3	4	5	6	7	8	9	10
Cole	1	2	3	4	5	6	7	8	9	10
Durant	1	2	3	4	5	6	7	8	9	10
Garfield	1	2	3	4	5	6	7	8	9	10
Golden Gate	1	2	3	4	5	6	7	8	9	10
Hawthorne	1	2	3	4	5	6	7	8	9	10
Highland	1	2	3	4	5	6	7	8	9	10
M. L. King	1	2	3	4	5	6	7	8	9	10
Lafayette	1	2	3	4	5	6	7	8	9	10
Lazear	1	2	3	4	5	6	7	8	9	10
Lockwood	1	2	3	4	5	6	7	8	9	10
Melrose	1	2	3	4	5	6	7	8	9	10
Prescott	1	2	3	4	5	6	7	8	9	10
Willow Manor	1	2	3	4	5	6	7	8	9	10
Woodland	1	2	3	4	5	6	7	8	9	10
Kaiser	1	2	3	4	5	6	7	8	9	10
Redwood Heights	1	2	3	4	5	6	7	8	9	10
Sequoia	1	2	3	4	5	6	7	8	9	10

FIGURE 3
EFFICIENCY OF IMPLEMENTATION RATING
SCALE - AUXILIARY SERVICES

QUESTIONNAIRE

The goals below were subsets of Oakland Unified School District Primary Goals for Compensatory Education for the 1972-73 school year. They were determined to be important to the success of the PARENT INVOLVEMENT component for that year:

DEVELOP EFFECTIVE COMMUNICATIONS WITH PARENTS AND INCREASE THE PARTICIPATION OF PARENTS IN THE INSTRUCTIONAL PROGRAM

IMPROVE STAFF RELATIONSHIPS AND COMMUNICATIONS WITH PARENTS

Directions: Opposite each school listed below, please encircle the number which in your opinion best describes the effectiveness of the school in meeting all goals for that school year. Please do not omit a response.

	Not Effective		Poor		Average		Good		Very Effective	
Bunche	1	2	3	4	5	6	7	8	9	10
Clawson	1	2	3	4	5	6	7	8	9	10
Cole	1	2	3	4	5	6	7	8	9	10
Durant	1	2	3	4	5	6	7	8	9	10
Garfield	1	2	3	4	5	6	7	8	9	10
Golden Gate	1	2	3	4	5	6	7	8	9	10
Hawthorne	1	2	3	4	5	6	7	8	9	10
Highland	1	2	3	4	5	6	7	8	9	10
M. L. King	1	2	3	4	5	6	7	8	9	10
Lafayette	1	2	3	4	5	6	7	8	9	10
Lazear	1	2	3	4	5	6	7	8	9	10
Lockwood	1	2	3	4	5	6	7	8	9	10
Melrose	1	2	3	4	5	6	7	8	9	10
Prescott	1	2	3	4	5	6	7	8	9	10
Willow Manor	1	2	3	4	5	6	7	8	9	10
Woodland	1	2	3	4	5	6	7	8	9	10
Kaiser	1	2	3	4	5	6	7	8	9	10
Redwood Heights	1	2	3	4	5	6	7	8	9	10
Sequoia	1	2	3	4	5	6	7	8	9	10

FIGURE 4
EFFICIENCY OF IMPLEMENTATION RATING
SCALE - PARENT INVOLVEMENT

QUESTIONNAIRE

The goals below were subsets of Oakland Unified School District Primary Goals for Compensatory Education for the 1972-73 school year. They were determined to be important to the success of the STAFF DEVELOPMENT component for that year:

IMPROVE STAFF RELATIONSHIPS WITH OTHER STAFF MEMBERS AND PARENTS

IMPROVE CLASSROOM SKILLS OF THE INSTRUCTIONAL ASSISTANTS

INCREASE TEACHERS' COMPETENCE WITH READING AND MATH MATERIALS AND EDUCATIONAL AND CLASSROOM MANAGEMENT TECHNIQUES

Directions: Opposite each school listed below, please encircle the number which in your opinion best describes the effectiveness of the school in meeting all goals for that school year. Please do not omit a response.

	Not Effective		Poor		Average		Good		Very Effective	
Bunche	1	2	3	4	5	6	7	8	9	10
Clawson	1	2	3	4	5	6	7	8	9	10
Cole	1	2	3	4	5	6	7	8	9	10
Durant	1	2	3	4	5	6	7	8	9	10
Garfield	1	2	3	4	5	6	7	8	9	10
Golden Gate	1	2	3	4	5	6	7	8	9	10
Hawthorne	1	2	3	4	5	6	7	8	9	10
Highland	1	2	3	4	5	6	7	8	9	10
M. L. King	1	2	3	4	5	6	7	8	9	10
Lafayette	1	2	3	4	5	6	7	8	9	10
Lazear	1	2	3	4	5	6	7	8	9	10
Lockwood	1	2	3	4	5	6	7	8	9	10
Melrose	1	2	3	4	5	6	7	8	9	10
Prescott	1	2	3	4	5	6	7	8	9	10
Willow Manor	1	2	3	4	5	6	7	8	9	10
Woodland	1	2	3	4	5	6	7	8	9	10
Kaiser	1	2	3	4	5	6	7	8	9	10
Redwood Heights	1	2	3	4	5	6	7	8	9	10
Sequoia	1	2	3	4	5	6	7	8	9	10

FIGURE 5
EFFICIENCY OF IMPLEMENTATION RATING
SCALE - STAFF DEVELOPMENT

QUESTIONNAIRE

The goals below were subsets of Oakland Unified School District Primary Goals for Compensatory Education for the 1972-73 school year. They were determined to be important to the success of the INTERGROUP ACTIVITIES component for that year:

PROVIDE EACH STUDENT WITH ENRICHMENT EXPERIENCES DESIGNED TO IMPROVE READING AND MATHEMATICS

PROVIDE ADEQUATE BILINGUAL RESOURCES AND TRAINING TO MEET SPECIAL NEEDS OF CHILDREN FOR WHOM ENGLISH IS A SECOND LANGUAGE

HELP STUDENTS DEVELOP SELF MOTIVATION AND PERSONAL AND ETHNIC IDENTITIES

IMPROVE STUDENT RELATIONSHIPS WITH OTHER STUDENTS AND STAFF MEMBERS

Directions: Opposite each school listed below, please encircle the number which in your opinion best describes the effectiveness of the school in meeting all goals for that school year. Please do not omit a response.

	Not Effective		Poor		Average		Good		Very Effective	
Bunche	1	2	3	4	5	6	7	8	9	10
Clawson	1	2	3	4	5	6	7	8	9	10
Cole	1	2	3	4	5	6	7	8	9	10
Durant	1	2	3	4	5	6	7	8	9	10
Garfield	1	2	3	4	5	6	7	8	9	10
Golden Gate	1	2	3	4	5	6	7	8	9	10
Hawthorne	1	2	3	4	5	6	7	8	9	10
Highland	1	2	3	4	5	6	7	8	9	10
M. L. King	1	2	3	4	5	6	7	8	9	10
Lafayette	1	2	3	4	5	6	7	8	9	10
Lazear	1	2	3	4	5	6	7	8	9	10
Lockwood	1	2	3	4	5	6	7	8	9	10
Melrose	1	2	3	4	5	6	7	8	9	10
Prescott	1	2	3	4	5	6	7	8	9	10
Willow Manor	1	2	3	4	5	6	7	8	9	10
Woodland	1	2	3	4	5	6	7	8	9	10
Kaiser	1	2	3	4	5	6	7	8	9	10
Redwood Heights	1	2	3	4	5	6	7	8	9	10
Sequoia	1	2	3	4	5	6	7	8	9	10

FIGURE 6
EFFICIENCY OF IMPLEMENTATION RATING
SCALE - INTERGROUP ACTIVITIES

TABLE 17

EFFICIENCY OF IMPLEMENTATION OF FOUR SUPPORT COMPONENTS

Mean Rating Scores Taken From Five Independent Raters

School	Parent Involvement	Staff Development	Intergroup Relations	Auxiliary Services
Bunche	6.2	4.0	6.4	6.2
Clawson	6.8	4.6	7.0	7.4
Cole	5.0	4.4	5.8	5.2
Durant	5.6	4.4	6.6	6.0
Garfield	6.6	6.2	5.8	5.4
Golden Gate	5.8	4.8	5.4	5.4
Hawthorne	5.4	5.6	5.4	5.4
Highland	6.2	5.0	5.0	5.0
M. L. King	8.4	8.2	7.8	7.8
Lafayette	7.0	6.6	6.6	6.8
Lazear	4.8	3.8	5.0	4.4
Lockwood	4.4	4.6	5.6	5.2
Melrose	5.8	4.6	5.8	4.8
Prescott	5.0	5.0	5.0	4.8
Willow Manor	6.6	4.8	7.4	4.4
Woodland	4.6	4.2	5.2	6.0
Kaiser	6.2	6.2	5.6	5.6
Redwood Heights	7.0	6.4	5.8	5.6
Sequoia	6.0	6.2	6.0	5.6

TABLE 18

RELIABILITY INDICES OF RATERS (PARENT INVOLVEMENT)
AN EXAMPLE OF COMPUTATION PROCEDURE

Computation Procedure

(1) $\frac{G^2}{n} = \frac{(567)^2}{(18)(5)} = 3509.37$

(2) $\sum(\Sigma x^2) = 3463$

(3) $\frac{\sum T_j^2}{n} = 3432.66$

(4) $\frac{\sum P_i^2}{k} = 3473$

(5) SS_b schools = 36.37
SS_w schools = 10
MS_b schools = 2.0205 (df = 18)
MS_w schools = .1315 (df = 76)

(6) Calculate $\hat{\theta}$

$$\hat{\theta} = \frac{MS_b - MS_w}{k(MS_w)}$$

$$\hat{\theta} = \frac{2.0205 - .1315}{5(.1315)}$$

$$\hat{\theta} = 2.8730$$

(7) Calculate r_1
(reliability - single rater)

$$r_1 = \frac{\hat{\theta}}{1 + \hat{\theta}}$$

$$= \frac{2.8730}{3.8730}$$

$$r_1 = .7418$$

School	1	2	3	4	5	Total
Bunche	7	5	8	6	5	31
Clawson	7	7	8	7	5	34
Cole	8	4	5	3	5	25
Durant	7	4	6	6	5	28
Garfield	6	7	7	6	7	33
Golden Gate	6	3	6	6	8	29
Hawthorne	7	5	6	4	5	27
Highland	7	7	5	7	5	31
M. L. King	10	9	9	6	8	42
Lafayette	9	6	7	7	6	35
Lazear	7	3	6	3	5	24
Lockwood	4	2	4	7	5	22
Melrose	6	7	6	5	5	29
Prescott	8	5	4	3	5	25
Willow Manor	8	8	9	3	5	33
Woodland	7	5	4	3	4	23
Kaiser	8	7	5	6	5	31
Redwood Heights	8	8	6	5	8	35
Sequoia	8	7	5	5	5	30
	138	109	116	98	106	G=567

(8) Calculate r_5 (reliability of mean of 5 raters)

$$\hat{\theta}' = \frac{MS_b - m(MS_w)}{km(MS_w)} \quad \text{where} \quad m = \frac{n(k-1)}{n(k-1)-2}$$

$$\hat{\theta}' = \frac{2.0205 - 1.0270(.1315)}{5(1.0270)(.1315)} = 2.7925$$

$$r_5 = \frac{k\hat{\theta}'}{1 + k\hat{\theta}'} = \frac{5\hat{\theta}'}{1 + 5\hat{\theta}'} = \frac{13.9625}{14.9625} = .9331$$

APPENDIX D

COMPUTER PRINT-OUT DATA

SCHOOL BY SCHOOL PERCENTAGES IN SIX MANDATED CATEGORIES 05/08/76 PAGE 2

FILE GRADES2 (CREATION DATE = 05/08/76) -3

* MULTIPLE REGRESSION *

VARIABLE	MEAN	STANDARD DEV	CASES
X1	.3798	.0693	18
X2	.2997	.0642	18
X3	.0367	.0320	18
X4	.0380	.0277	18
X5	.0112	.0073	18
X6	.2314	.0711	18
Y1	.9694	.4580	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

X2	-.49389					
X3	.39928	-.63858				
X4	-.53552	.20816	-.02774			
X5	.14369	-.30847	.42220	.17011		
X6	-.48877	-.23166	-.23172	-.12674	-.15134	
Y1	.61457	-.42729	-.00880	-.79346	-.12405	.16641
	X1	X2	X3	X4	X5	X6

FIGURE 7
COMPUTER PRINT-OUT DATA

PHASE 1 - PROCEDURE 1
(Page 1 of 2)

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
X4	-14.307374	9.4795361	-1.5092905	-35.171689	6.5569414
X2	-7.3756710	8.0210868	-.91953511	-25.029961	10.278619
X3	-9.3391778	7.4698072	-1.2502569	-25.780110	7.1017545
X6	-3.7374191	7.0588554	-.52946531	-19.273853	11.799015
X5	-3.3668818	9.7237837	-.34625223	-24.768782	18.035019
X1	-2.5134908	7.9081791	-.31783433	-19.919273	14.892291
CONSTANT	5.8259036	7.6393834	.76261503	-10.988258	22.640075

FILE GRADES2 (CREATION DATE = 05/08/76) -3

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. Y1

S U M M A R Y T A B L E

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X4		27.19433	.000	.79346	.62958	.62958	-.79346	27.19433	.000
2	X2		3.60801	.077	.83750	.70140	.07182	-.42729	17.61751	.000
3	X3		4.43298	.054	.87933	.77321	.07181	-.00880	15.91069	.000
4	X6		2.26772	.156	.89828	.80690	.03368	.16641	13.58050	.000
5	X5		.08456	.776	.89907	.80825	.00135	-.12405	10.11626	.001
6	X1		.10102	.757	.90000	.80999	.00174	.61457	7.81550	.002

SCHOOL BY SCHOOL PERCENTAGES IN SIX MANDATED CATEGORIES 05/08/76 PAGE 11

FILE GRADES2 (CREATION DATE = 05/05/76) -3

* MULTIPLE REGRESSION *

VARIABLE	MEAN	STANDARD DEV	CASES
X1	.3757	.0726	18
X2	.2963	.0631	18
X3	.0381	.0323	18
X4	.0403	.0286	18
X5	.0120	.0072	18
X6	.2354	.0728	18
Y2	.7261	.2841	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

X2	-.46084					
X3	.33513	-.63935				
X4	-.58108	.20944	.00342			
X5	.21227	-.23800	.36210	.05458		
X6	-.52263	-.28512	-.19793	-.06324	-.22301	
Y2	.07471	-.20664	-.17906	-.45200	-.05636	.42727
	X1	X2	X3	X4	X5	X6

FIGURE 8
COMPUTER PRINT-OUT DATA

PHASE 1 - PROCEDURE 2
(Page 1 of 2)

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
X4	-5.1761844	10.417418	-.49687787	-28.104763 , 17.752394
X6	.31610841	7.8481995	.40277826E-01	-16.957659 , 17.589876
X3	-3.2004726	8.2777090	-.38663748	-21.419584 , 15.018639
X2	-1.8567775	8.9972101	-.20637258	-21.659500 , 17.945945
X5	3.2034295	10.462274	.30618864	-19.823877 , 26.230736
X1	-1.0622477	8.8259490	-.12030054	-20.496831 , 18.372336
CONSTANT	1.8932852	8.5264001	.22204977	-16.873192 , 20.659762

FILE [redacted] (CREATION DATE = 05/08/76)

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. Y2

S U M M A R Y T A B L E

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X4		4.10816	.060	.45200	.20430	.20430	-.45200	4.10816	.060
2	X6		3.76320	.071	.60323	.36389	.15959	.42727	4.29042	.034
3	X3		.22524	.642	.61152	.37396	.01007	-.17906	2.78762	.079
4	X2		.30762	.589	.62324	.38843	.01447	-.20664	2.05422	.144
5	X5		.12893	.726	.62844	.39493	.00650	-.05636	1.56551	.242
6	X1		.01447	.906	.62907	.39573	.00080	.07471	1.20063	.374

SCHOOL BY SCHOOL PERCENTAGES IN SIX MANDATED CATEGORIES 05/08/76 PAGE 20

FILE GRADES2 (CREATION DATE = 05/08/76) -3

* MULTIPLE REGRESSION *

VARIABLE	MEAN	STANDARD DEV	CASES
X1	.3798	.0693	18
X2	.2997	.0642	18
X3	.0367	.0320	18
X4	.0380	.0277	18
X5	.0119	.0073	18
X6	.2314	.0711	18
Y3	1.2250	.2797	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

X2	-.49585					
X3	.39928	-.63858				
X4	-.53552	.20816	-.02774			
X5	.14369	-.30847	.42220	.17011		
X6	-.48377	-.28166	-.23172	-.12674	-.15134	
Y3	.37880	-.62032	.55594	-.22977	.32111	.06543
	X1	X2	X3	X4	X5	X6

FIGURE 9
COMPUTER PRINT-OUT DATA

PHASE 1 - PROCEDURE 3
(Page 1 of 2)

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
X2	-6.3161366	11.164309	-.56574362	-30.888611 , 18.256338
X3	-.42778310	10.397000	-.41144861E-01	-23.311421 , 22.455855
X4	-7.0504459	13.194281	-.53435622	-36.090857 , 21.969965
X5	5.3464767	13.534241	.39503334	-24.442183 , 35.135137
X1	-4.1330859	11.007156	-.37549081	-28.359669 , 20.093498
X6	-3.5386935	9.8250081	-.36017207	-25.163387 , 18.086000
CONSTANT	5.7263358	10.633027	.53854237	-17.676796 , 29.129468

FILE GRADES2 (CREATION DATE = 05/06/76) -3

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. Y3

SUMMARY TABLE

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X2		10.00743	.006	.62032	.38479	.38479	-.62032	10.00743	.006
2	X3		1.13086	.304	.65416	.42792	.04313	.55594	5.61007	.015
3	X4		.44829	.514	.66759	.44567	.01775	-.22977	3.75191	.036
4	X5		.28176	.604	.67634	.45743	.01176	.32111	2.74001	.075
5	X1		.01780	.896	.67693	.45823	.00080	.37880	2.02995	.146
6	X6		.12972	.726	.68158	.46455	.00631	.06543	1.59057	.239

SCHOOL BY SCHOOL PERCENTAGES IN SIX MANDATED CATEGORIES 05/08/76 PAGE 29

FILE GRADES2 (CREATION DATE = 05/08/76) -3

* M U L T I P L E R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
X1	.3757	.0726	18
X2	.2963	.0631	18
X3	.0381	.0323	18
X4	.0403	.0286	18
X5	.0120	.0072	18
X6	.2354	.0728	18
Y4	.7117	.2014	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

X2	-.46084					
X3	.33513	-.63935				
X4	-.58108	.20944	.00342			
X5	.21227	-.23800	.36210	.05458		
X6	-.52263	-.28512	-.19793	-.06324	-.22301	
Y4	-.14009	-.14416	-.32280	-.44729	-.04395	.67505
	X1	X2	X3	X4	X5	X6

FIGURE 10
COMPUTER PRINT-OUT DATA

PHASE 1 - PROCEDURE 4
(Page 1 of 2)

F-LEVEL OR TOLERANCE-LEVEL INSUFFICIENT FOR FURTHER COMPUTATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
X6	1.7818320	.43543224	4.0920994	.84113789	2.7225261
X4	-2.9393517	1.0718950	-2.7422012	-5.2550399	-.62366348
X3	-1.7122436	1.0260534	-1.6687569	-3.9288871	.50441978
X5	6.2007047	4.6249207	1.3407159	-3.7908284	16.192238
CONSTANT	.40193063	.14011706	2.8685346	.99226144E-01	.70463512

FILE GRADES2 (CREATION DATE = 05/08/76) -3

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. Y4

S U M M A R Y T A B L E

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X6		13.39522	.002	.67505	.45569	.45569	.67505	13.39522	.002
2	X4		6.48865	.022	.78743	.62005	.16436	-.44729	12.23949	.001
3	X3		1.58875	.228	.81165	.65877	.03872	-.32280	9.00951	.001
4	X5		1.79752	.203	.82679	.70022	.04145	-.04395	7.59144	.002

MEAN RATING SCORES
GRADES 2-3--READING/
FILE SCHOOL (CREATION DATE = 05/17/76)

05/17/76 PAGE 2

* M U L T I P L E R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
X3	6.0222	.9938	18
X4	5.3444	1.1454	18
X5	6.0222	.7997	18
X6	5.7111	.9260	18
Y1	.8694	.4580	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

X4	.73697			
X5	.77503	.38418		
X6	.62099	.47866	.59701	
Y1	.18251	.28700	.04533	-.23425
	X3	X4	X5	X6

FIGURE 11
COMPUTER PRINT-OUT DATA

PHASE 2 - PROCEDURE 1
(Page 1 of 2)

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
X4	.16554393	.15537750	1.0654305	-.17012874	, .50121660
X6	-.29875495	.15325074	-1.9494519	-.62983302	, .32323132E-01
X5	.73440443E-01	.24463687	.30020186	-.45506535	, .60194623
X3	.70559064E-01	.25933688	.27207493	-.48970418	, .63082231
CONSTANT	.82372975	.87329787	.94324031	-1.0629155	, 2.7103750

********** MULTIPLE REGRESSION **********

DEPENDENT VARIABLE.. Y1

SUMMARY TABLE

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X4		1.43617	.248	.28700	.08237	.08237	.28700	1.43617	.248
2	X6		3.63892	.076	.51139	.26152	.17915	-.23425	2.65598	.103
3	X5		.56304	.465	.53858	.29007	.02855	.04533	1.90676	.175
4	X3		.07402	.790	.54230	.29409	.00402	.18251	1.35399	.303

MEAN RATING SCORES 05/17/76 PAGE 8
GRADES 4-6--READING
FILE SCHCOL (CREATION DATE = 05/17/76)

* M U L T I P L E R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
X3	5.8333	.8239	18
X4	5.1333	.9152	18
X5	5.9111	.6659	18
X6	5.5667	.7708	18
Y2	.7261	.2841	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

X4	.60223			
X5	.65333	.06692		
X6	.44276	.21680	.41565	
Y2	.38454	.46583	.07890	.41784
	X3	X4	X5	X6

FIGURE 12
COMPUTER PRINT-OUT DATA

PHASE 2 - PROCEDURE 2
(Page 1 of 2)

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
X4	.88121347E-01	.10411323	.84639914	-.13680160 , .31304429
X6	.13265592	.94270382E-01	1.4071855	-.71002849E-01, .33631469
X5	-.93148977E-01	.15320926	-.60798530	-.42413744 , .23783948
X3	.67896795E-01	.15391202	.44114030	-.26460990 , .40040349
CONSTANT	-.31014710	.71631442	-.43297621	-1.8576502 , 1.2373560

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. Y2

SUMMARY TABLE

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X4		4.43415	.051	.46583	.21700	.21700	.46583	4.43415	.051
2	X6		2.33182	.148	.56775	.32234	.10535	.41784	3.56753	.054
3	X5		.18573	.673	.57551	.33121	.00887	.07890	2.31116	.121
4	X3		.19460	.666	.58402	.34108	.00986	.38454	1.68230	.214

MEAN RATING SCORES 05/17/76 PAGE 14
GRADES 2-3 MATH
FILE SCHOOL (CREATION DATE = 05/17/76)

* MULTIPLE REGRESSION *

VARIABLE	MEAN	STANDARD DEV	CASES
X3	6.0222	.9938	18
X4	5.3444	1.1454	18
X5	6.0222	.7997	18
X6	5.7111	.9260	18
Y3	1.2250	.3797	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

X4	.73697			
X5	.77503	.38418		
X6	.62099	.47866	.59701	
Y3	.07638	-.21842	.03293	-.38643
	X3	X4	X5	X6

FIGURE 13
COMPUTER PRINT-OUT DATA

PHASE 2 - PROCEDURE 3
(Page 1 of 2)

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
X6	-.26669740	.11011893	-2.4219034	-.50459487 , -.28799935E-01
X3	.41809539	.18634755	2.2436323	.15516005E-01 , .82067476
X4	-.21372741	.11164712	-1.9143118	-.45492634 , .27471524E-01
X5	-.65085987E-01	.17578479	-.48403497	-.46484592 , .29467395
CONSTANT	1.8849362	.62751165	3.0038266	.52927974 , 3.2405926

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. Y3

SUMMARY TABLE

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X6		2.80869	.113	.38643	.14933	.14933	-.38643	2.80869	.115
2	X3		3.65247	.079	.55876	.31222	.16289	.07638	3.40461	.060
3	X4		3.84010	.070	.67843	.46026	.14805	-.21842	3.97953	.030
4	X5		.23429	.636	.68543	.46982	.00956	.03293	2.87998	.066

MEAN RATING SCORES 05/17/76 PAGE 20
GRADES 4-6--MATH
FILE SCHCOL (CREATION DATE = 05/17/76)

* M U L T I P L E R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
X3	5.8333	.8239	18
X4	5.1333	.9152	18
X5	5.9111	.6659	18
X6	5.5667	.7708	18
Y4	.7117	.2014	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

X4	.60223			
X5	.65333	.06692		
X6	.44276	.21680	.41565	
Y4	.41651	.34655	.02661	.44521
	X3	X4	X5	X6

FIGURE 14
COMPUTER PRINT-OUT DATA

PHASE 2 - PROCEDURE 4
(Page 1 of 2)

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
X6	.10691572	.63089785E-01	1.6946597	-.29381471E-01 , .24321290
X4	-.25949334E-01	.69677040E-01	-.37242303	-.17647742 , .12457875
X5	-.17716960	.10253421	-1.7279972	-.39868128 , .44342081E-01
X3	.16844239	.10300453	1.6352911	-.54085357E-01 , .39097014
CONSTANT	.31439769	.47938835	.65583090	-.72125782 , 1.3500532

MEAN RATING SCORES 05/17/76 PAGE 24
GRADES 4-6--MATH
FILE SCHOOL (CREATION DATE = 05/17/76)

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. Y4

SUMMARY TABLE

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X6		3.95535	.064	.44521	.19821	.19821	.44521	3.95535	.064
2	X4		1.33651	.266	.51362	.26381	.06560	.34655	2.68753	.101
3	X5		.55516	.469	.54026	.29189	.02808	.02661	1.92360	.172
4	X3		2.67418	.126	.64242	.41270	.12081	.41651	2.28377	.116

CONTRIBUTIONS OF 12 VARIABLES TO SCHCOL ACHIEVEMENT 06/04/76 PAGE 3

FILE SCHOOL (CREATION DATE = 06/04/76)

* MULTIPLE REGRESSION *

VARIABLE	MEAN	STANDARD DEV	CASES
X1	.3798	.0693	18
X2	.2997	.0642	18
X3	.0367	.0320	18
X4	.0380	.0277	18
X5	.0119	.0073	18
X6	.2314	.0711	18
X7	6.0222	.9938	18
X8	5.2389	1.1360	18
X9	5.9567	.8353	18
X10	5.6556	.9376	18
X11	464.6111	299.9343	18
X12	.2778	.4609	18
Y1	.8694	.4580	18
Y3	1.2250	.3797	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
X2	-.49989											
X3	.39928	-.63858										
X4	-.53562	.20816	-.02774									
X5	.14369	-.30847	.42220	.17011								
X6	-.48877	-.23166	-.23172	-.12674	-.15134							
X7	.05741	-.13850	.19731	-.34325	-.13450	.19028						
X8	.07510	.09620	-.21432	-.49800	-.37571	.16937	.73384					
X9	.15107	-.36683	.52634	-.17547	-.00747	.07801	.72941	.39016				
X10	-.50076	.01147	.00838	.03070	-.22107	.52195	.60210	.47668	.61543			
X11	-.41695	.52681	-.13878	.36271	-.00692	-.16282	-.32060	-.12057	-.29844	-.08024		
X12	-.13846	.17962	-.37401	-.36856	-.12797	.30938	.21689	.19724	-.00509	.17999	-.42428	
Y1	.61457	-.42729	-.00880	-.79246	-.12405	.16641	.18251	.34246	.11559	-.16705	-.59019	.37699
Y3	.37980	-.62032	.55594	-.22977	.32111	.06543	.07638	-.16910	.10108	-.31970	-.41800	.02521

	Y1
Y3	.35305

FIGURE 15
COMPUTER PRINT-OUT DATA

PHASE 3 - PROCEDURE 1
(Page 1 of 3)

FILE SCHOOL (CREATION DATE = 06/04/76)

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. Y1

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
X4	10.544387	23.411469	.45039409	-49.635794 ,	70.724569
X11	-.78753951E-03	.77271779E-03	-1.0191813	-.27738436E-02,	.11987646E-02
X10	-.18885319	.20303156	-.93016669	-.71075450 ,	.33304811
X6	14.231122	17.570823	.80992916	-30.935430 ,	59.397673
X1	14.364016	17.910023	.80200991	-31.674464 ,	60.402495
X3	15.231691	23.041787	.66104644	-43.998207 ,	74.461589
X12	.14264396	.26013481	.54836554	-.52603869 ,	.81133661
X8	.28083466	.24633881	1.1400342	-.35239978 ,	.91405910
X7	-.33225399	.28806329	-1.1534062	-1.0727330 ,	.40822501
X2	14.412117	21.309765	.67631512	-40.365547 ,	69.189780
X9	.13523613	.20371208	.66386895	-.38841250 ,	.65888875
X5	3.7215913	14.597775	.25494235	-33.802614 ,	41.245797
CONSTANT	-12.098857	18.093123	-.56869923	-58.608004 ,	34.410290

FILE SCHOOL (CREATION DATE = 06/04/76)

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. Y1

SUMMARY TABLE

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X4		27.19433	.000	.79346	.62958	.62958	-.79346	27.19433	.000
2	X11		5.95737	.028	.85725	.73488	.10530	-.59019	20.78874	.000
3	X10		1.83873	.197	.87502	.76566	.03078	-.16705	15.24701	.000
4	X6		1.15290	.302	.88586	.78475	.01909	.16641	11.84938	.000
5	X1		1.45787	.251	.89892	.80806	.02332	.61457	10.10412	.001
6	X3		1.07691	.322	.90839	.82518	.01712	-.00880	8.65355	.001
7	X12		.35165	.566	.91166	.83112	.00594	.37699	7.03038	.003
8	X8		.26257	.621	.91428	.83590	.00479	.34246	5.73077	.009
9	X7		.90480	.369	.92335	.85258	.01667	.18251	5.14066	.015
10	X2		.61747	.458	.92980	.86453	.01195	-.42729	4.46712	.030
11	X9		.48418	.513	.93522	.87464	.01012	.11559	3.80578	.057
12	X5		.06500	.809	.93608	.87625	.00161	-.12405	2.95040	.120

CONTRIBUTIONS OF 12 VARIABLES TO SCHOOL ACHIEVEMENT 06/04/76 PAGE 3

FILE SCHOOL (CREATION DATE = 06/04/76)

* MULTIPLE REGRESSION *

VARIABLE	MEAN	STANDARD DEV	CASES
X1	.3757	.0726	18
X2	.2963	.0631	18
X3	.0381	.0323	18
X4	.0403	.0286	18
X5	.0120	.0072	18
X6 aux.	.2354	.0728	18
X7	5.8333	.8239	18
X8	5.0778	.8895	18
X9	5.9556	.6989	18
X10	5.5111	.7738	18
X11	450.1111	304.1967	18
X12	.2778	.4609	18
Y2	.7261	.2841	18
Y4	.7117	.2014	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

X2	-.46084											
X3	.33613	-.63935										
X4	-.58108	.20944	.00342									
X5	.21227	-.23800	.36210	.05458								
X6	-.52263	-.28512	-.19793	-.06324	-.22301							
X7	.19201	-.20989	.24564	-.41247	.16400	.18133						
X8	.20614	-.02587	-.24902	-.59061	-.14292	.18338	.59020					
X9	.22260	-.57224	.66024	-.15778	.22225	.09729	.58498	.06455				
X10	-.50169	-.11598	.03727	.06219	-.00066	.60718	.40723	.19182	.44041			
X11	-.33803	.52894	-.15597	.30272	.05816	-.19289	-.36169	-.14590	-.36944	-.10117		
X12	-.09627	.21772	-.39966	-.40803	-.13301	.26732	.40793	.40335	.09536	.33723	-.38791	
Y2	.07471	-.20664	-.17906	-.46200	-.05636	.42727	.39454	.52494	.13326	.46871	-.36616	.62862
Y4	-.14009	-.14416	-.32280	-.44729	-.04395	.67505	.41651	.40636	.08873	.50075	-.43677	.71711
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12

Y4	.70165	
	Y2	

FIGURE 16
COMPUTER PRINT-OUT DATA

PHASE 3 - PROCEDURE 2
(Page 1 of 3)

FILE SCHOOL (CREATION DATE = 06/04/76)

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. Y2

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
X12	.37479202	.22483623	1.6669557	-.20315912 ,	.95274316
X2	13.962889	11.594151	1.2043045	-15.840372 ,	43.766150
X8	.18857535	.13249789	1.4232328	-.15201615 ,	.52916684
X10	.28485918	.14041120	2.0287497	-.76073810E-01,	.64579217
X9	-.19734993	.15895502	-1.2415458	-.60595061 ,	.21125074
X1	16.147091	10.704617	1.5084231	-11.369585 ,	43.663767
X7	-.17310097	.14727077	-1.1753926	-.55166679 ,	.20546485
X11	-.19840934E-03	.37297830E-03	-.53195948	-.11571660E-02,	.76034734E-03
X3	15.707704	11.247670	1.3965296	-13.204912 ,	44.620320
X4	18.077997	12.964360	1.3944381	-15.247445 ,	51.403439
X6	13.004360	9.3695810	1.3879340	-11.080549 ,	37.089269
X5	6.7714263	10.700708	.63280169	-20.735202 ,	34.278054
CONSTANT	-14.323018	10.634878	-1.3467967	-41.660426 ,	13.014390

FILE SCHOOL (CREATION DATE = 06/04/76)

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. Y2

S U M M A R Y T A B L E

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X12		10.45360	.005	.62862	.39517	.39517	.62862	10.45360	.005
2	X2		3.86304	.068	.72044	.51903	.12387	-.20664	8.09360	.004
3	X8		2.16580	.163	.76385	.58347	.06444	.52494	6.53702	.003
4	X10		1.30032	.275	.78825	.62135	.03787	.46871	5.33302	.009
5	X9		2.69561	.127	.83114	.59080	.06946	.13326	5.36201	.008
6	X1		1.30719	.277	.85067	.72364	.03284	.07471	4.80060	.012
7	X7		.39141	.546	.85677	.73405	.01041	.38454	3.94306	.025
8	X11		.16960	.690	.85963	.73897	.00492	-.36616	3.18487	.052
9	X3		.04909	.830	.86056	.74056	.00159	-.17906	2.53734	.102
10	X4		.03595	.855	.86133	.74189	.00133	-.45200	2.01201	.183
11	X6		1.71276	.239	.89398	.79921	.05732	.42727	2.17105	.177
12	X5		.40044	.555	.90227	.81410	.01489	-.05636	1.82464	.263

CONTRIBUTIONS OF 12 VARIABLES TO SCHOOL ACHIEVEMENT 06/04/76 PAGE 3

FILE SCHOOL (CREATION DATE = 06/04/76)

* MULTIPLE REGRESSION *

VARIABLE	MEAN	STANDARD DEV	CASES
X1	.3798	.0693	18
X2	.2997	.0642	18
X3	.0367	.0320	18
X4	.0380	.0277	18
X5	.0119	.0073	18
X6	.2314	.0711	18
X7	6.0222	.9938	18
X8	5.2889	1.1360	18
X9	5.9567	.8353	18
X10	5.0556	.9376	18
X11	464.6111	299.9343	18
X12	.2778	.4609	18
Y1	.8694	.4580	18
Y3	1.2250	.3797	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
X2	-.49989											
X3	.39928	-.63858										
X4	-.53552	.20816	-.02774									
X5	.14369	-.30847	.42220	.17011								
X6	-.48977	-.23166	-.23172	-.12674	-.15134							
X7	.05741	-.13850	.19731	-.34325	-.13450	.19028						
X8	.07510	.09620	-.21432	-.48800	-.37571	.16937	.73384					
X9	.15107	-.36683	.52634	-.17547	-.00747	.07801	.72941	.39016				
X10	-.50076	.01147	.00838	.03070	-.22107	.52195	.60210	.47668	.61543			
X11	-.41686	.52681	-.13878	.36271	-.00692	-.16282	-.32060	-.12057	-.29844	-.08024		
X12	-.13846	.17962	-.37401	-.36856	-.12797	.30938	.21689	.19724	-.00509	.17999	-.42428	
Y1	.61457	-.42729	-.00880	-.79246	-.12405	.16641	.18251	.34246	.11559	-.16705	-.59019	.37699
Y3	.37880	-.62032	.55594	-.22977	.32111	.06543	.07638	-.16910	.10108	-.31970	-.41800	.02521

	Y1
Y3	.35305

FIGURE 17
COMPUTER PRINT-OUT DATA

PHASE 3 - PROCEDURE 3
(Page 1 of 3)

FILE SCHOOL (CREATION DATE = 06/04/76)

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. Y3

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
X2	20.439402	20.346737	1.0045543	-31.862754 , 72.741558
X10	-.49974957	.19385618	-2.5727814	-.99706516 , -.43397686E-03
X7	-.22822877	.27504516	-.82978655	-.93524412 , .47878657
X1	13.819031	17.100635	.80810046	-30.138882 , 57.776943
X3	32.781963	22.000485	1.4900564	-23.771223 , 89.335150
X12	.43985411E-01	.24837882	.17709002	-.59448297 , .68245379
X8	.33948549	.23520629	1.4433521	-.26512233 , .94409331
X11	-.11816136E-02	.73779720E-03	-1.6015425	-.30781528E-02 , .71492567E-03
X6	18.970658	16.776764	1.1307698	-24.154731 , 62.096048
X4	21.939780	22.353460	.98149371	-35.520744 , 79.400305
X5	7.9773840	13.938074	.57234479	-27.851031 , 43.805799
X9	.25551157E-01	.19450595	.13136440	-.47443470 , .52553701
CONSTANT	-13.886361	17.275460	-.80382002	-58.293671 , 30.520949

FILE SCHOOL (CREATION DATE = 06/04/76)

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. Y3

SUMMARY TABLE

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X2		10.00743	.006	.62032	.38479	.38479	-.62032	10.00743	.006
2	X10		2.83270	.113	.69463	.48252	.09773	-.31970	6.99321	.007
3	X7		1.56735	.231	.73118	.53462	.05210	.07638	5.36093	.011
4	X1		2.59285	.131	.78231	.61200	.07739	.37880	5.12636	.011
5	X3		1.45450	.251	.80867	.65395	.04194	.55594	4.53537	.015
6	X12		2.42130	.148	.84639	.71638	.06243	.02521	4.63067	.014
7	X8		.88966	.368	.85997	.73955	.02317	-.16910	4.05543	.023
8	X11		1.57072	.242	.88218	.77825	.03870	-.41800	3.94828	.028
9	X6		1.01827	.342	.89626	.80329	.02504	.06543	3.62985	.042
10	X4		.86811	.382	.90829	.82499	.02170	-.22977	3.29982	.063
11	X5		.37657	.562	.91396	.83533	.01034	.32111	2.76690	.111
12	X9		.01726	.901	.91427	.83589	.00057	.10108	2.12234	.209

CONTRIBUTIONS OF 12 VARIABLES TO SCHOOL ACHIEVEMENT 06/04/76 PAGE 3

FILE SCHOOL (CREATION DATE = 06/04/76)

* MULTIPLE REGRESSION *

VARIABLE	MEAN	STANDARD DEV	CASES
X1	.3757	.0726	18
X2	.2963	.0631	18
X3	.0381	.0323	18
X4	.0403	.0286	18
X5	.0120	.0072	18
X6	.3354	.0728	18
X7	5.8333	.8239	18
X8	5.0778	.8895	18
X9	5.8556	.6989	18
X10	5.5111	.7738	18
X11	450.1111	304.1967	18
X12	.2778	.4609	18
Y2	.7261	.2841	18
Y4	.7117	.2014	18

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
X2	-.46084											
X3	.33513	-.63935										
X4	-.58103	.20944	.00342									
X5	.21227	-.23800	.36210	.05458								
X6	-.52263	-.28512	-.19793	-.06324	-.22301							
X7	.19201	-.29989	.24564	-.41247	.16400	.18133						
X8	.20614	-.02587	-.24902	-.59061	-.14292	.18338	.59020					
X9	.22260	-.57224	.66024	-.15778	.22225	.09729	.58498	.06455				
X10	-.50169	-.11598	.03727	.06219	-.00066	.60718	.40723	.19182	.44041			
X11	-.33804	.52894	-.15597	.30272	.05816	-.19289	-.36169	-.14590	-.36944	-.10117		
X12	-.09627	.21772	-.30966	-.40803	-.13301	.26732	.40793	.40335	.09536	.33723	-.38791	
Y2	.07471	-.20664	-.17906	-.45200	-.05636	.42727	.38454	.52494	.13326	.46871	-.36616	.62862
Y4	-.14009	-.14416	-.32280	-.44729	-.04395	.67505	.41651	.40636	.08873	.50075	-.43677	.71711

	Y2
Y4	.70165

FIGURE 18
COMPUTER PRINT-OUT DATA
PHASE 3 - PROCEDURE 4
(Page 1 of 3)

FILE SCHOOL (CREATION DATE = 06/04/76)

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. Y4

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
X12	.14982640	.11421254	1.3118210	-.14376180 , .44341461
X6	7.2008864	4.7595693	1.5129281	-5.0337901 , 19.435563
X1	7.0744017	5.4377423	1.3009814	-6.9035473 , 21.052351
X5	7.8959959	5.4357567	1.4526029	-6.0768492 , 21.868841
X2	7.0950197	5.8896087	1.2029695	-8.0544713 , 22.224511
X11	-.22597319E-03	.18946590E-03	-1.1926853	-.71300339E-03, .26105701E-03
X10	.92802878E-01	.71326224E-01	1.3011046	-.90544231E-01, .27614999
X9	-.82611317E-01	.80746134E-01	-1.0230994	-.29017271 , .12495007
X3	5.9150797	5.7136028	1.0352627	-8.7719806 , 20.602140
X4	6.3919429	6.5456489	.97658665	-10.536749 , 23.320635
X8	.17373479E-01	.67306413E-01	.25812516	-.15564053 , .19038749
X7	-.17026363E-01	.74910758E-01	-.22759244	-.20933062 , .17527789
CONSTANT	-6.2740463	5.4023161	-1.1613623	-20.160931 , 7.6128382

FILE SCHOOL (CREATION DATE = 06/04/76)

* MULTIPLE REGRESSION *

DEPENDENT, VARIABLE.. Y4

SUMMARY TABLE

STEP	VARIABLE ENTERED	VARIABLE REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	X12		16.93820	.001	.71711	.51424	.51424	.71711	16.93820	.001
2	X6		16.11908	.001	.87513	.76585	.25161	.67505	24.53146	.000
3	X1		3.66308	.076	.90245	.81441	.04856	-.14009	20.47885	.000
4	X5		1.25548	.283	.91146	.83076	.01634	-.04395	15.95328	.000
5	X2		1.35555	.267	.92083	.84794	.01718	-.14416	13.38279	.000
6	X11		.94321	.352	.92733	.85994	.01201	-.43677	11.25575	.000
7	X10		.69650	.423	.93224	.86906	.00912	.50075	9.48193	.001
8	X9		.71157	.421	.93737	.87866	.00959	.08873	8.14633	.002
9	X3		.28982	.605	.93963	.88290	.00424	-.32280	6.70199	.007
10	X4		1.46811	.265	.95037	.90320	.02030	-.44729	6.53155	.010
11	X8		.02140	.888	.95055	.90355	.00034	.40636	5.10962	.029
12	X7		.05180	.829	.95107	.90454	.00099	.41651	3.94794	.070