

The Effects of School Characteristics on Student Academic Performance

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Abstract

This work expanded on previous research on school effectiveness by developing and testing hypotheses about the specific relationships between school characteristics—including aggregated student and classroom characteristics—and student academic performance. The work used data from the “Early Childhood Transitions Project,” a study of intensive social and educational services in a suburban school system, to identify and test the effect of a limited set of school-level characteristics on test score gains made by individual students on the Metropolitan Achievement Test (MAT) between the second and third grade.

The analyses found that there are differences in the size of schools, the percent of low performing students, and the percent of students who are non-English speaking across the schools in the sample. Test score gains are affected by concentrations of these types of students at the schools. Students at schools in this sample with high concentrations of non-English speaking students or high concentrations of Hispanic students achieve lower test score gains than students in other schools. Another “concentration effect” emerged from the analysis of high-performing students in the sample. In particular, female students with high scores on the second grade MAT who are in schools with large concentrations of students who perform poorly on the second grade exam have smaller third grade test score gains than similar students who are in schools without a concentration of low performing students.

These results suggest that more attention be paid to the influence that the characteristics of the student population have on the school’s ability to implement the curriculum. As a first step, researchers may want to simply document the differences in the educational characteristics of students entering schools. This would provide evidence of the segregation that occurs across schools. Researchers may then want to conceptualize students within schools in terms of their homogeneity on demographic measures and their homogeneity on educational characteristics. This “educational minority or majority” concept may bring researchers closer to understanding the school environment, as it is organized by schools and experienced by children.

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Table of Contents

<u>Chapter</u>		<u>Page</u>
	Abstract	
	Acknowledgements.....	iii
1	Statement of the Problem	1
2	Literature Review	3
	Introduction	3
	The Multi-Level Context of School Effects.....	3
	Aggregated Student-Level Variables	3
	Aggregated Classroom-Level Variables.....	4
	School-Level Characteristics	4
	Predominant Methods for Studying School Effectiveness.....	6
	Examining the Specific Relationship between School Characteristics and Student Outcomes.....	7
	Technical Considerations in Examining School Characteristics and Student Outcomes	9
	Test Validity.....	9
	Aggregation Bias.....	9
	Measuring Change within a School Environment	10
3	Methods.....	12
	Subjects	13
	The Design	13
	The Outcome Measure: The Metropolitan Achievement Test (MAT)..	13
	Description and Review.....	14
	Metropolitan Achievement Test (MAT) Reliabilities	14
	Validity of MAT Scores	14
	Development of Predictor Variables.....	15
	Simple Ratios	15
	Summations	15
	Classification Variables.....	15
	Regression Analysis	16

Table of Contents (continued)

<u>Chapter</u>		<u>Page</u>
	The Regression Model for Testing the Influence of Predictor Variables on Student Outcomes	16
	Final Variable Set	17
4	Findings.....	19
	Introduction	19
	The Basic Regression Model	19
	Tests of Additional Variables	23
	Tests of Interactions	24
	Summary of Results.....	25
	Gaining Evidence to Aid in Interpretations	25
	Correlation Analysis.....	26
	Regression Analysis on Sub Groups Other Than the Low Performing Students.....	28
	Final Model.....	29
5	Summary and Implications.....	33
	Introduction	33
	Summary of Findings.....	33
	Relationship with the Literature	34
	Theoretical Considerations and Future Research	35
	Closing Conceptual Statement about the Study of School Effects.....	38
	Bibliography	40
	Resume.....	42

Table of Contents (continued)

List of Tables

<u>Table</u>		<u>Page</u>
3-1	The Model	16
3-2	Mean and Standard Deviation of Data Set Variables Related to the Population of Low-Performing Students (n = 266)	18
4-1	Beta Coefficients Associated with Student-Level, Successive Regressions Using Hierarchical Multiple Regression to Test the Significance of Key Variables on the Performance of Low Achieving Students	20
4-2	Variables That Did Not Have a Significant Effect	24
4-3A	Key Regression Variables from the Analysis of the Low Performing Population and Their Correlation with Other Data Set Variables	26
4-3B	Correlations Related to Predominantly White Schools or Schools with a Mixed Ethnic Environment.....	27
4-4	Selected Statistics, by Predominant Ethnic Environment at the School.....	27
4-5	Beta Coefficients of Statistically Significant Individual, School, and Classroom Variables for the High Performing and ESL Groups in the Transitions Sample.....	28
4-6	Beta Coefficient Associated with Student on the Performance of the Full Transitions Sample	30
4-7	Mean Scores on Second and Third Grade MAT Exam for the Full Transitions Sample, by Selected Variables.....	31
4-8	Mean Scores on Second and Third Grade MAT Exam for the Subgroup of Low Performing Students in the Transitions Sample, by Selected Variables.....	32

Chapter 1

Statement of the Problem

No two schools are alike. Schools, just like the people within them, have different characteristics. This study attempted to uncover school differences and tie them to student outcomes. The types of school differences explored were areas in which a superintendent or principal may have some policy control, and where policy differences may have an effect on test score outcomes. In this research, a set of descriptor variables was developed and tested; namely, how the learning environment in an individual school is structured and organized. Examples of the types of descriptors developed include a school's placement policy for special education students, the degree of classroom homogeneity within the second and third grades at the school, and the language environment of the school and classrooms, among others.

The Transitions Evaluation, a study of intensive social and educational services administered in schools serving low income, ethnically diverse children in a suburban school system is well-suited to identifying differences in school characteristics and studying the effect of those characteristics on outcomes. A database developed for the evaluation has multiple measures of student performance in 15 schools across 2 years. While the present data represent only one school system, it was possible to exploit the unique nature of this database to develop a limited set of school characteristics that differ across the schools and which could be related to the academic performance of the second and third grade children attending these schools.

There is a large literature on the factors that affect school performance. This work relied on previous school effectiveness research, but was primarily concerned with developing and testing new measures of school-level activity and its relationship to school performance. The research goals were threefold:

1. To extract features from the data that distinguish schools,
2. To test whether those features affect school performance, and
3. To interpret the reasons for the effectiveness of those features.

This database is well suited for this work because there is variation across schools in test scores. The research problem was associated with linking choice variables under the control of the school with factors that affect test scores. By exploiting the unique nature of the database, the task was to characterize school policies and to determine how these factors affected variation in

test score outcomes across schools. The following items summarize the conceptualization of this project:

1. Schools can be structured in many different ways and are important containers of significant factors of student achievement (beyond style of the individual teacher, the curriculum, the properties of individual student);
2. These factors form two general categories: those that are intrinsically school level properties such as building, size, demographics of neighborhood, communication patterns, morale, resources, the principal, and the variability of ethnic membership; and those that are indirectly school level: mean student achievement, mean age of teachers, mean number of English as a second language per class, et cetera. These are school level by aggregation.
3. The data base available has a few of the kinds of factors described above. The aggregated factors have not been studied very much as ways to differentiate among schools that differ in aggregated school level achievement.
4. Aggregated school level achievement is very important these days as an accountability indicator.
5. This project looks at the relative power of a few examples of these two kinds of school level factors to predict differences in aggregated school level achievement.

The hypotheses tested addressed the effects of school characteristics on test score gains made between second and third grade on the Metropolitan Achievement Test: Specifically, the hypotheses for this work were

1. Student population characteristics at the school such as the predominant ethnic environment, the language environment, and the presence of concentrations of students with similar abilities have an effect on test score gains of individual students.
2. Explicit school policies such as school size and classroom composition characteristics have an effect on test score outcomes for individual students.
3. School-level characteristics such as special education placement policy, teacher turnover, student attrition have an effect on test score outcomes for individual students.

The literature review that guided the development of this study is discussed in Chapter 2.

Chapter 2

Literature Review

Introduction

Quite a bit of research has been done to identify the influence of student, classroom, and school characteristics on test scores. Student achievement variables aggregated to the school level have been used a great deal to describe school output but variables describing aggregation of properties of classrooms within schools have been studied somewhat less in school analyses. On the other hand direct school-level measures such as the building and physical environment, principal leadership, and the school social and psychological environments have been used often. This chapter describes the ways in which school characteristics have been represented in the literature and the predominant methods and technical considerations associated with studying the effect of school characteristics on test score outcomes.

The Multilevel Context of School Effects

Brookover et al. (1979) introduced a model of a school social system and its influence on achievement and several other outcomes. The Brookover model described schools in terms of: a) student body composition, b) staff inputs, c) school social structure, and d) school social climate. Scheerens and Creemers (1989) noted that the conceptualization of school behavior should be cognizant of the notion that school effects occur in a multilevel context; namely, the individual student level, the classroom level, and the school level. The following sections detail the measures that have been used to describe school behavior at each of the levels described by Scheerens and Creemers.

Aggregated Student Level Variables. Brookover's 1979 model noted the importance of student demographics, and the Brookover model used aggregate, demographic descriptions such as "mean school socioeconomic status" and "percentage White" as school descriptors. Goldhaber and Brewer (1997) described schools in terms of the percent of students from single-parent families and percent of students in a given grade who are White.

Other student-level variables have been used in the analysis of school effects. However, these have been individual, nonaggregated student-level variables such as intellectual capacity and background. These variables have been used to control for the influence of variables that are not under the control of the school, and as a way of interpreting other factors that are under the control of the school (Stringfield, 1994).

Aggregated Classroom Level Variables. The Brookover model used the term “staff inputs” to describe the aggregated school characteristics that are initially measured at the classroom or teacher level. These included teacher descriptors such as “average years teaching experience,” “average tenure in school,” “percentage of teachers with advanced degrees,” and “mean teacher salary,” among others. In general, the most studied teacher- or classroom-level variables have related to classroom instructional strategies such as periodic formative testing, feedback, clarity of presentation, involvement of students in the learning process, and the use of test results to make instructional decisions. Mortimore, Sammons, Ecob, and Stoll (1988) defined a number of classroom instructional characteristics that have an impact on the effectiveness of a school. These included maximum communication between teachers and pupils and the opportunity to learn, defined by the amount of classroom time allocated to learning a subject and the quality of instruction. Teddlie, Kirby, and Stringfield (1989) described classrooms in terms of time spent on task, presentation of new materials, high expectations, positive reinforcement, minimal interruptions, ambience, and appearance of the classroom. The Teddlie, Kirby, and Stringfield work compared the school-level mean scores on several dimensions of effective teaching between effective and ineffective schools. Virgilio, Teddlie, and Oescher (1991) aggregated measures of teacher’s skills and compared mean skill levels of teachers at typical and ineffective schools.

School-Level Characteristics. Direct, nonaggregated measures that have been used to describe school characteristics fall into three categories: building and physical environment, principal leadership, and school social structure.

1. **Building and Physical Environment.** Rutter, Maughan, Mortimore, and Ouston (1979) found that the school environment, which includes good working conditions, responsiveness to pupil needs, and good care and decoration of buildings, is associated with better outcomes for students.
2. **Principal Leadership.** The way in which the principal works with teachers has a demonstrable effect on student outcomes. Mortimore, et al. (1998) included purposeful leadership by the principal and assistant principal and the principal’s role in hiring and firing teachers. The study found that outcomes were more favorable when there was a combination of firm leadership together with a decisionmaking process in which all teachers felt their views were represented. Examples of the

variables used to describe principal leadership include such principal strategies as the type of classroom monitoring and feedback and the type of support for individual teacher improvement. Teddlie and Stringfield (1993) studied other “principal leadership” characteristics such as shared academic leadership versus nonshared academic leadership, relationship to the district or central office, and uniform procedures for discipline.

3. School Social Climate. Brookover’s measure of “school social structure” included teacher satisfaction with school structure, parental involvement, differentiation in student programs, principal’s report of time devoted to instruction, and open versus closed classroom. Brookover’s measure of school social climate used 14 variables derived from student, teacher, and principal reports of the norms, expectations, and feelings about the school. Reynolds (1982) examined student’s attitudes toward school, teachers’ perceptions of students, within-school organizational factors, and school resource levels. His research revealed a number of factors within the school that were associated with more effective regimes. Among the social and psychological variables associated with effective schools were such characteristics as high proportion of pupils in authority positions, positive academic expectations, low levels of coercive punishment, and high levels of student involvement. In research on the parental involvement aspect of school social climate, Hawley and Rosenholtz (1984) identified parent involvement as one of four factors in effective schools that was expected to improve student achievement. Epstein (1987) discussed the various methods a principal could employ in establishing and monitoring effective parent involvement programs.

Sarason (1996) discussed how certain school characteristics, including organizational climate and leadership, influence change within a school. Sarason used the term “street-level implementation” as the way in which implementation at the local level can sometimes be a purposeful or accidental misinterpretation of guidelines promulgated at some system level.

Although both levels of school level factors (direct and aggregated) have been used, there separate effects have not been considered. Further, the school effects found by these studies have been small. Some researchers suggest that school-level variables have not been sufficiently sensitive to certain direct school attributes such as climate, emotional tone, and relationships

among students. Reynolds (1994) suggested that the proportion of variance explained by school-level variables might be improved by tapping school variables such as climate, emotional tone, and relationships. Few studies have used the culture of schooling in terms of attitudes, perceptions, and goals, and the psychosocial relationships among individuals such as students within classrooms, classrooms within schools, and parents within a school community. Though Raudenbush and Willms (1991) were referring to the inadequacy of statistical models at the time their book was written, they prefaced their book on multilevel analysis of schools by saying that:

An irony in the history of quantitative studies of schooling has been the failure of researcher's analytic models to reflect adequately the social organization of life in classrooms and schools. The experiences that children share within school settings and the effects of these experiences on their development might be seen as the basic material of educational research; yet until recently, few studies have explicitly taken account of the effects of particular classrooms and schools in which students and teachers share membership.

The issues emphasized by Reynolds, and by Raudenbush and Willms are critically important to the study of school effects. The research described here exploited the Transition database in an effort to develop as many testable variables as possible. It is important to note that the Transitions database was not constructed to study effective schools or school climate. Consequently, a secondary analysis of the topic is inherently limited. Many critical and direct measures of important school functioning are not available, although attempts were made in this study to develop some surrogate measures.

Predominant Methods for Studying School Effectiveness

Studies of school effectiveness have yielded very useful information about school practices and their differences across effective and ineffective schools; however, there are flaws in the design of these studies. Rather than identifying and testing the influence of a set of inputs (independent variables) on outcome variables such as student achievement (the dependent variable), the dominant methodology to date has involved "preidentifying" a set of ineffective, typical, and effective schools, and then going into those schools and looking at mean and variance differences across schools in terms of their "scores" on specific teaching practices. For example, Virgilio, Teddlie, and Oescher (1991) compared mean skill levels of teachers in

schools that had been labeled effective and ineffective. Notwithstanding a debate on how to define effective, typical, and ineffective schools¹, the flaw in the approach of most of the educational research in this area rests in the direction of the analysis: if the analysis is to yield useful information on the influence of school characteristics on student outcomes, then rather than examining the phenomenon from effect (effective or ineffective school) to cause (certain school practices), the study of school characteristics must proceed from a set of (predictor) variables toward their effect on a (dependent) variable (in this case, student achievement).

School effectiveness research has also been criticized for its inability to account for differences in types of schools. In response to this criticism, researchers have tried to account for differences in types of schools by stratifying their look at effective and ineffective schools along urban and rural lines, and by grade level of school, but many other questions are left unanswered.

In particular, studies designed in this way do not provide information about the impact of specific “inputs” in explaining the variance in student achievement. These types of studies do not allow for the ability to test for relationships (interactions) between levels, specifically between the school organizational and the classroom level, and between contextual conditions and organizational characteristics. Another important question left unanswered is whether schools have the same effect upon all pupils. Aitken & Longford (1986) found evidence of different school effects for children of different ethnic groups. Nuttall (1989) showed large differences for different types of students in the relative effectiveness of schools.

Examining the Specific Relationship between School Characteristics and Student Outcomes

Much of the recent literature that uses a set of school characteristics to test for the magnitude of their influence on student outcomes is available in a book edited by Raudenbush and Wilms entitled Schools, Classrooms, and Pupils: International Studies of Schooling from a Multilevel Perspective (1991). Articles from this book and other studies are provided here as examples of the research design that was used in this work. The research discussed in the Raudenbush and Willms book includes studies in which student outcomes are the dependent variables and school “inputs” are the predictor variables. Studies cited in the book are also

¹ There are differences in the operational definitions in the list of effective school correlates. Some studies use common definitions such as schools with means scores one or two standard deviations away from the standardized residual mean.

included because they represent applications of multilevel statistical models that study the relationship between school characteristics and student outcomes.

Jacobson (1991) studied the relationship between kindergarten screening measures and third grade achievement for two cohorts of pupils enrolled in 30 schools in one district. The analysis used a regression model to estimate the average within-school relationship between kindergarten screening measures and third grade reading and math achievement, and to determine whether the relationship varied across schools. The study provided a means to study the variation between schools in the effects and application of educational interventions. The study did not attempt to explain why the achievement of “at risk” pupils varied significantly across schools; however, the author suggested that inclusion of variables such as the performance on tests during the primary years, heterogeneity of classes, or teacher observations of behaviors, might illustrate how policies and practices differ among schools. Other studies in the book used data from large-scale databases such as the “High School and Beyond Study” from the United States or from similar databases in other countries.

Epstein (1991) used regression analysis to test how certain practices related to parent involvement influence student achievement. Epstein’s model included various aspects of instruction, including teacher’s leadership in parent involvement, teachers’ overall quality of instruction, the students’ need to improve, the quality of the students’ instruction, the parents’ education, homework assignments, and the parents’ improved knowledge about the school parent involvement program. Epstein indicated that her findings did not take into account any prior differences in parent involvement, and would have been better documented by a “full complement of longitudinal measures of (instructional characteristics) and student outcomes over more than one year.”

Economists have applied methods similar to those used in this study to address questions about the contribution of specific inputs to educational outcomes. This “educational productivity” research has been limited, however, by both its focus on the relationship between financial resources and student outcomes, and by data deficiencies (Goldhaber & Brewer, 1997). The data used in the economic analyses has generally not focused on the direct educational environment experienced by students. For example, with respect to the issue of class size, the economic research has used total school enrollment divided by the number of teachers as an average pupil-to-teacher ratio. This research described the most direct measures possible from

the available data to describe the classroom and school environment experienced by students in the sample.

Technical Considerations in Examining School Characteristics and Student Outcomes

The use of the Transitions database to examine the specific relationship between school characteristics and student outcomes required attention to certain technical details including test validity, aggregation bias, and measuring change within a school environment.

Test Validity. The importance of the various kinds of validity (criterion, content, and construct) and the importance of the validity of the interpretation made about test scores were salient points for this work. Cronbach and Meehl (1955) first defined construct validity (as it related to psychological testing) as: "...a network of relations that are tied to observables and hence are empirically testable. The measures are the observables, and the construct is invoked to account for relationships among them." In brief, construct validity is the process of "finding" evidence as it relates to the theory surrounding a particular behavior. Later, Cronbach (1971) indicated that "...one validates, not a test, but an interpretation of data arising from a specified procedure." Messick (1975) noted the importance of construct validity and questioned whether tests should be used for purposes other than that for which they were originally intended. Messick discussed the possible consequences of the misuse of tests:

A proposal to use a test for a particular purpose, then should be appraised in light of the probable future consequences of the testing, not only in terms of what it entails but also in terms of what it makes more likely.

Aggregation Bias. Burstein (1978) conceptualized aggregation bias as "the ecological fallacy due to estimating individual level relations from grouped data." Burstein suggested the need to ensure that aggregating up from the individual data doesn't bias inferences that are made about behavior at the individual level. Burstein identified several statistical approaches for estimating the differences in regression coefficients between grouped data and individual data, and compared a least squares estimator that used deviations of individual observations from their respective grand means versus deviations of group means (e.g., means of each school) from their respective grand means. Burstein introduced a directive that has been woven throughout the literature in subsequent years: (1) measure all variables at their lowest possible level, (2) data from individuals should be matched with data from the groups to which they belong. This research used student-level data to study school effects, and data for classroom and school

variables were assigned to individual students in accordance with their school and classroom assignments in an attempt to be responsive to the threats of aggregation bias described by Burstein.

Firebaugh's (1980) contribution to the literature in this area was to move "multilevel" analysis forward by disentangling contextual effects, the effect of an individual being in a specific group, from the "frog pond" effects, or the effect involving "self-appraisal" or the measure of self-appraisal resulting from one's relative standing in a group. This study examined one aspect related to a student's standing within the classroom, however one of the recommendations for future research involves studying this issue in greater detail.

Measuring Change within a School Environment. The key to studying the effect of classroom factors on individual achievement involves having an adequate measure of change, and to measure it within a school environment. Two review articles shed light on these important issues. Willett (1988) reviewed the literature on measuring change and described the importance of measuring change over time (in the sense of viewing change as a growth process). Willett compared the two ways to measure change and reviewed some of the ways that change can be measured using two data points. He concluded that using more than two time periods of data is a better way to measure educational outputs. Unfortunately, the data available for this study had only two data points to measure change, namely tests taken at the end of the second and third grades.

Raudenbush and Bryk (1988) expanded on Willett's notion of growth patterns, but did so by looking at growth patterns within the school "hierarchy," or the multiple analytical levels within a school environment. Raudenbush and Bryk sought to eliminate the "threats that arise because of the mismatch between the phenomena we seek to study and the analytic tools we have employed to study that reality." They made the case about the "hierarchical, multilevel character of educational decision-making" in which decisions at the various levels affect the teacher inputs at the classroom level. They reviewed the main threats to valid statistical inference in the analysis of multilevel data and described how the threats required statistical methods that addressed the threats.

The main regression models resulting from the analysis of data from the Transitions Evaluation study and presented here did not use the statistical modeling technique proposed by Raudenbush & Bryk. However, two points are relevant. First, to the extent possible with the

available data, variables were developed to describe the conditions within classrooms and within schools. Children within the same classrooms, and students within the same schools were assigned the same data values to describe the particular classroom or school characteristic that was measured. Second, a preliminary analysis using the statistical modeling techniques proposed by Raudenbush and Bryk suggested that the results from an analysis using their methods were similar to those presented here.

To date the literature on school effects does not fully differentiate between direct and aggregated school level predictors of student aggregated achievement levels and gains. Several of both types are available in the present data set to allow for a more detailed examination of this issue. Chapter 3 discusses the methods that were used to develop and test the school-level characteristics, as well as the methods used to recognize and address the threats and biases to these kinds of analyses.

Chapter 3

Methods

The research problem associated with this study is to identify and test the effect of school characteristics on academic performance. The general approach was to use available data to identify school characteristics, look for meaningful variation, and test for the effect of that variation on test score outcomes. The complexity of the problem was in developing measures that were true reflections of the differences across schools and in measuring the outcomes associated with differences in school characteristics. This chapter describes the methods used to carry out this task. It begins by describing the subjects and the design, as well as the outcome and predictor variables. The chapter concludes with a discussion of the modeling technique used in the analysis and presents descriptive data on the variables used in the analysis.

Subjects

The raw data available to study this issue came from an evaluation of an early childhood intervention whose subjects attended 15 elementary schools in the Fairfax County, Virginia public school system. The intervention, known as the Early Childhood Transitions Project, provided intensive social and educational services to a sample of families and their children in the preschool and early elementary years. The sampled subjects in the Transitions evaluation come from two main sampling strata: attendance at Head Start and attendance at a Treatment school. The method used to select the 15 schools in this study is as follows:

Treatment and nontreatment schools were randomly selected from a pool of elementary schools meeting several criteria, including:

1. Fifty percent or more of the kindergarten children were eligible for free or reduced cost meals.
2. Kindergarten classes included five or more Head Start graduates.

All kindergarten classes in each selected school were included in the sample. Children were followed through third grade if they remained in a county school. The core sample, however, was the group of children who remained for 4 years in schools initially assigned to treatment or nontreatment status. The core sample was about one-third the size of the original sample and included about 50 children in each of the four cells of the design (Head Start/Non-Head Start by Treatment/Nontreatment).

The children selected included all Head Start children enrolled in each original kindergarten plus an equal number of matched (by ethnicity and gender) non-Head Start children in each classroom. Fifteen schools were randomly selected from this pool, half of which were randomly assigned to treatment and half assigned to nontreatment status.

The “Head Start/Non-Head Start” and the “Treatment/Control” variables were useful to this work. However, the major relationship of the Transitions Evaluation to this work was that it generated a wealth of data from many different sources and, in many cases, on all students in the study schools during the period 1995 to 1997. As part of the Transitions evaluation, students in that study’s sample were tested in multiple areas over multiple time periods. In order not to single out study children from the rest of the students in a classroom, all students who were in study classrooms were administered the same series of tests. Thus, the data available from the Transitions study were from a variety of tests and scales on a large number of students.

The Design

The design of the Transitions Evaluation is 2 X 2 design (Treatment/Control) by (Head Start/Non-Head Start). It was longitudinal in nature, with repeated measures of school, family, and student attributes. This was a nonexperimental study that tested the relationship between factors and changes in the mastery of a domain of knowledge measured by the Metropolitan Achievement Test. A set of child, classroom, and school factors was developed, using various techniques, to describe the different settings in which subjects experienced the school environment. The unit of analysis started with the child and then moved to the characteristics of the child’s classroom and to the characteristics of the child’s school. The analysis used regression techniques to control for the effects of confounding variables and to predict the change in test scores from Grade 2 to Grade 3 for all students and for specific types of students, given various school characteristics. A database was developed for two cohorts of students in the Transitions Evaluation. Each cohort of students took an achievement test at the end of their second and third grades. This study used one of these cohorts.

The Outcome Measure: The Metropolitan Achievement Test (MAT)

The test scores referred to above came from the Metropolitan Achievement Test (MAT). Review information supports use of the MAT for program evaluation purposes. Information from reviews of the MAT exam in Mental Measurement Yearbook, as well as test reliabilities and validity issues, are presented below.

Description and Review. According to reviews of the MAT, the test is “designed to measure the achievement of students in the major skill and content areas of the school curriculum.” The MAT’s Reading Comprehension Diagnostic Battery focuses on reading skills and generates detailed information about a student’s performance in reading. Reviews in the *Mental Measurements Yearbook* indicate that “the designers of the MAT have made exceptional efforts towards attaining both (a) improving within classroom decisions, such as helping to diagnose each student’s strengths and weaknesses in an area, and (b) improving educational decision making that occurs outside the classroom, such as evaluating programs, curricula, and schools.”

Metropolitan Achievement Test (MAT) Reliabilities. Publisher reliabilities for the MAT report Kuder-Richardson 20 reliability coefficients of most subtests are at least .85 and many are over .90. Local reliabilities, as measured by coefficient alpha reliabilities for raw and standardized scores, were run for the MAT. Using indicators of whether each question was answered correctly or incorrectly as the basis for the local reliability measure, the internal consistency measure (using Cronbach’s alpha) for the Transitions database subjects was high. The Cronbach Coefficient Alpha for raw variables was .93; for standardized variables it was .94. The coefficient alpha was also similar across gender (.92 and .93 for females and .94 and .95 for males) and across ethnic categories (above .90 for White, and between .80 and .90 for African-American and Hispanic students).

Validity of MAT Scores. The validity of the MAT was confounded by the response style of some children. To avoid the kinds of validity issues discussed by Messick (1975), a validity indicator was developed to ensure that only valid test scores would be included in the analysis. The MAT exam is composed of 10 short stories, one story to a page with five comprehension questions for each story listed on each page. A missing page was defined as one on which no response was given to all five questions on that page. Patterns to the distribution of omitted questions and missing pages were examined and a threshold was set to identify students who were simply unable to take the test. A nonvalid indicator was assigned to a MAT score when there were whole missing pages or large numbers of consecutive questions not answered. Only students who had valid test scores on the second grade MAT exam were included in the analyses presented here.

Development of Predictor Variables

The basic analytic plan for this work was to identify a set of school characteristics and test their impact on test score outcomes. This was accomplished in various ways using either simple ratios, summations, dummy classification coding, or regression analysis. The database created for this work contains child-level data on more than 900 students, each with multiple types of tests and each over a 2-year time period. In addition to gender and ethnicity, data were also available on the language capabilities of the student including their primary language and their level of English proficiency. School program data were also available on each child including their status for the Transitions study, their status in the gifted and talented program, their special education status, as well as the school and classroom (or teacher) to which they were assigned. The search for meaningful ways to characterize schools was essentially a data reduction process using the existing data. The following are the ways in which the child-level data was transformed into an analytic file.

Simple Ratios. Many of the variables in the analytic file were created through the use of simple ratios. For example, the ratio of English speakers to all students was calculated for each school as a measure of the school's language environment. Other simple ratio variables included the percentage of students at each school who scored above and below certain levels on the second grade MAT exam (i.e., the percentage of students at a school who are high performing students, or the percentage of students at a school who are low performing students). Teacher turnover at the school was also a simple ratio, and was defined as the percentage of teachers at a school who were new to that grade at the school. Student-level attrition and mobility was defined as the percentage of students at the school.

Summations. Some variables were simple summations of data. Class size was the summation of the number of students in a class. School size was defined as the number of students within the second grade at the school.

Classification Variables. Other analytic variables were simple classification variables. For example, a person whose race/ethnicity is White was coded as a "1" or "yes" on the dummy variable for White. This was done for each race/ethnicity category so that the race/ethnicity variable could be used in the quantitative analysis. Other examples of classification variables were the "presence of gifted students in the classroom." That variable was used if there were students classified as gifted in the classroom. Schools were also classified as having a

predominant ethnic concentration when students of a particular ethnic background were present in large concentrations at the school. Each school in the sample was classified in terms of their predominant ethnicity and were either predominantly Asian schools, predominantly Black, predominantly Hispanic, predominantly White, or of mixed ethnicity.

Regression Analysis. Regression analysis was used to develop a small number of the analytic variables. School-level regressions were run using the “special education status” of a student as the dependent variable. Special education status is a variable that is coded as a “1” if the student is identified as receiving special education services, and a “0” if the student is not in special education. In a regression context, this “0,1” classification can essentially be viewed as the probability of a student being placed in special education. Running school-by-school regressions with special education status as the dependent variable and the second grade MAT score and race/ethnicity as independent variables yielded one measure of a school’s de facto policy for placing certain students in special education. Each school’s (beta) coefficient associated with minority students, and specifically Black students, was essentially the probability that a minority student, or a Black student, would be placed in special education at that school. Two school-level variables were developed using this method: “minority special education placement policy” and “Black special education placement policy.”

The Regression Model for Testing the Influence of Predictor Variables on Student Outcomes

The basic model used for addressing the questions in this study is shown in Table 3-1. The model conceptualizes the third grade MAT score as a function of child, school, and classroom characteristics.

Table 3-1

The Model

Third Grade MAT Score	=	f((Child (Ch), School (S), Classroom))
Ch	=	g(Second Grade MAT test, Race/Ethnicity, Gender, English Proficiency,)
S	=	h(School Predictor Variables)
Cl	=	i.(Classroom Predictor Variables)

In brief, the model tested individual, school, and classroom predictors for their contribution to the variance in the third grade MAT score. A hierarchical regression method was used in order to test the hypotheses about specific predictor variables. The student's second grade MAT score was entered into the regression model in order to account for that score and to have a measure of the gain achieved by the student on the MAT exam between second and third grade. Several other child-level variables were entered into the regression model first, in order to allow the regression model to account for the variance that is outside of the control of the school but is known to have an effect on the outcome variable. Specifically, a student's race/ethnicity, gender, and English language ability were included as control variables or covariates in the analysis.

Using the covariates in the analysis allowed for the effects of other variables to be tested. Each of the variables was entered into the regression equation to test the direction and magnitude of their relationship with the third grade MAT exam. Interaction effects were entered into the regression model to test hypotheses about the effects of school characteristics for specific types of students.

Final Variable Set

The analysis focused on test score gains made by low performing students between second and third grade. Low performing students were identified as those students who correctly answered between 30 and 65 percent on the second grade MAT exam. Analyses of other student populations were also conducted; however, because the success of low performing students is often a focus of school accountability plans, these students were the central focus of the analysis.

It is useful to note that, in the case of the classroom variables, a variable was created to describe the similar phenomena occurring in different years. For example, a student's class size was developed for their second and third grade classrooms. Many school level variables, such as the school's ethnic environment and the ratio of English speaking students to all students, were assumed to be relatively stable over the 2-year period. In these cases, only one variable was created.

It is also important to note that, for the school and classroom characteristic variables, each student within the same school was assigned the same value. For example, in a school in which the ratio of English speaking students was 4 per every 10 students, each student in that particular school was assigned a ".4" value for the variable "ratio of English speaking students to all

students.” The means and standard deviations of the variables used in the analysis of low performing students are presented in Table 3-2.

Table 3-2

Mean and Standard Deviation of Data Set Variables Related to the Population of Low-Performing Students (n = 266)

	<u>Mean</u>	<u>Standard Deviation</u>
<u>Individual Characteristic Variables(n=261)</u>		
Grade 2 MAT test	.50	.09
Grade 3 MAT test	.58	.16
Race/ethnicity		
D-Asian	.16	.40
D-black	.26	.43
D-Hispanic	.39	.48
D-white	.19	.40
<i>School Variables</i>		
Predominant ethnic environment		
D_Asian School	.03	.16
D_Black School	.34	.47
D_Hispanic School	.34	.47
D_mixed School	.17	.37
D_White School	.13	.33
School size (number of students in 2 nd grade)	69.00	25.00
Teacher turnover	57%	23.00
Ratio of English speakers to all students	70%	19.00
Student Attrition/mobility	27%	6.00
Percent of Students who score below .65	29%	10.00
Minority Special Ed Placement Probability	.30	.10
<i>Classroom Variables</i>		
Ratio English to all students second grade	78%	18.00
Ratio English to all students third grade	67%	20.00
Class Size second grade	15.00	2.10
Class Size third grade	19.00	2.40
Special Ed/Gifted Presence: second grade	.01	.01
Special Ed/Gifted Presence: third grade	.02	.03

The next chapter describes the analyses conducted using these data.

Chapter 4

Findings

Introduction

This chapter discusses the results of the analyses that tested the relationship between the school environment and academic performance. The analysis focused on test score gains made by low performing students between second and third grade.² Analyses of other student populations are also presented here; however, because the success of low performing students is often a focus of school accountability plans, low performing students were the central focus of the analysis.

The first part of this chapter describes the development of the basic regression model and the results of the tests of hypotheses related to key school and classroom variables, including tests for interaction effects. The results of numerous additional analyses are presented as evidence to aid in the interpretation of the regression results. A final regression model is presented at the end of the chapter to summarize the key relationships.

The Basic Regression Model. The regression analysis used in this study was intended to identify those student, classroom, and school characteristics that are associated with test score gains. The basic question was: Are the test score gains different at different levels of the individual, school, or classroom variables? The regression model presented here investigated the relationship between the third grade score of low performing students and numerous independent variables developed from the Transitions data set. Because the model statistically controlled for the second grade test score, it essentially tested the hypotheses related to the relationship of the independent variables on the gains made by individual students between second and third grade. The group subject to this regression analysis was the sub-group of low performing students (students who correctly answered between 30 and 65 percent of the questions on the second grade MAT exam).

Table 4-1 describes a reduced set of variables that contribute to the explanatory power of the model represented by the regression equation. These variables included the second grade

² As indicated in the previous chapter, low performing students were identified as those students who correctly answered between 30 and 65 percent on the second grade MAT exam. Extremely low performing students were excluded from the analysis.

score, race/ethnicity, English proficiency, gender, as well as the school ethnic and language environments.

Table 4-1

Beta Coefficients Associated with Student-Level, Successive Regressions Using Hierarchical Multiple Regression to Test the Significance of Key Variables on the Performance of Low Achieving Students

Dependent Variable: Third Grade MAT Score

<u>Variables</u>	<u>Model(1)</u>	<u>Model(2)</u>	<u>Model(3)</u>	<u>Model(4)</u>
Intercept	.23***	.21	-.15	-.09
<u>Individual Characteristic Variables</u>				
Second grade MAT score	.61***	.61***	.58**	.62***
D_English Proficiency	.09***	.09***	.08***	.06**
Race/ethnicity dummies:				
D_Black	-.05**	-.07***	-.07**	-.06**
D_Hispanic	.04	.03	.04	.04
D_Asian	.02	.00	.01	.01
Gender dummy:				
D_Male	-.03*	-.03**	-.03*	-.03*
School Variables				
School type dummies				
D_Hispanic School		-.03**	.09***	.12**
D_Black School		.05*	.05*	.06**
D_Asian School		.16***	.19***	.22***
D_Mixed School		.01	.02	.02
Ratio English: All Students			.07**	.04
Classroom Variables				
Ratio English Presence in second				.16*
R ²	.25	.28	.30	.31
Adjusted R ²	.23	.25	.27	.27

Note: Dependent variable is the third grade MAT score. D_ indicates the variable is a dummy variable with a value of 0 or 1. Omitted race variable is the D_white variable. Omitted predominant ethnic environment variable is D_white school .

***p < .01

** p < .05

* p < .10

Table 4-1 presents the development of the regression analysis with the variables considered to be important to the analysis. The data presented in this table provide the basis for the step-by-step discussion presented on the following pages.

Before describing each of these models individually, it is noted that none of the following variables had a significant effect in this analysis: attrition, school size, teacher turnover, English speaking presence in the student's third grade classrooms, presence of special education in second and third grade classrooms, the placement policy for minority and for Black students, and the child's relative standing within the classroom. In other words, there are no differences in the gains made by students who were in schools at differing levels of each of these variables.

In contrast, the variables discussed on the following pages have an important effect on test score gains. Model 1, presented in the first data column of Table 4-3, is the first step in this process. Model 1 introduced a set of control variables that are a known source of variation in third grade scores. Adding these control variables to the analysis allowed for the eventual testing of variables that are under the control of the school. The variables introduced in Model 1 which were used as control variables are: second grade score, race/ethnicity³, gender, and English proficiency. The Rsq for model 1 is .25. In other words, 25 percent of the variance in the third grade scores of the low performing population can be explained by the control variables.

The following variables are statistically significant in the Model 1 equation:

1. Second grade test scores uniquely account for a significant percentage of third grade gain.
2. Black students gained significantly less than non-black students.
3. Male students gained less than female students.
4. English proficiency uniquely accounts for a significant percentage of the third grade gain score.

During the variable development process, two variables were constructed to distinguish among schools—the predominant ethnic environment and the language environment. Thus model 2 introduced predominant ethnicity of the school into the regression equation, and model 3 introduced language environment. These variables were introduced into the equation as a set of

³ There was some evidence of test item bias in the point biserial correlation analysis done with these data.

dummy variables. If a school could be characterized as having a predominance of one ethnic group, it was coded as such. If not, the school was characterized as “of mixed ethnicity.”

The introduction of the predominant ethnic environment of schools in the Transitions sample increases the explanatory power of the sample (the R-squared increases from .25 to .28) with the introduction of the school ethnic environment variables, and the Hispanic, Black, and Asian school environment, dummy variables were statistically significant. After this stage of the regression, the following effects can be noted:

Model 2 indicates that the predominant ethnic environment of the schools in this sample has an effect on the test score gains of students, and that this effect varies depending on the particular ethnic environment of the school.

Model 3 added the language environment variable to the regression equation. The relationship between the school-level variable “ratio of English speakers to all students” and test score gains is statistically significant and in the positive direction. That is, the higher the ratio of English speakers to all speakers at a school, the higher the third grade gain score will be after holding constant the second grade score, the ethnicity, English proficiency, gender of the students, and the predominant ethnic environment of the school.

The addition of the school-level language environment variable added 2 percent to the proportion of variance accounted for by this model. The main difference in results between model 2 and model 3 is that the direction of the effect of being in a Hispanic school reverses and becomes positive. Adding the school-level language environment, however, indicates that students who are in schools that have high concentrations of English speakers will achieve greater gains than student with low concentrations of English speakers.

There are several possible interpretations of a positive and significant beta coefficient for the school-level language environment variable.

1. Schools in which large portions of students (and their parents) are not native speakers are not able to assert their needs to schools, and thus students at these schools do not have the kind of external input that comes to the school from the surrounding community.

2. Staff at schools in which large portions of students are not native speakers must spend their time “introducing” (or acclimating) the school and its expectations to these students, and thus have less time to focus on the school’s academic program.
3. The language environment variable may be what Cohen and Cohen call a suppressor variable, because it “suppresses irrelevant variance” in the school type variable.
4. Materials in the curriculum and/or the test are not appropriate for the measurement of literacy in non-English speaking children.

Model 4 tests an additional variable that may play a role in test score gains. This variable is similar to the school level measure of English proficiency, but it measures the proportion of the student’s classroom that is English proficient. This variable has a statistically significant effect on test score gains, and the addition of this variable to the model increases the explanatory power of the model by 1 percent. Interpreting this particular classroom language variable is difficult—even after adjusting statistically and controlling for all of the variables previously mentioned, including the student’s second grade test score—the second grade classroom-level language environment has an effect on the third grade gain score. Interestingly, the third grade classroom-level language environment does not have a statistically significant effect on the test score gain.

There are several possible interpretations of the results of model 4:

1. What goes on in second grade is important. There may be an event that does not show up as an effect on the second grade score, but does show up on the third grade score. There may be something that a student gains or does not gain in the second grade—it may not affect the test score in second grade, but has an effect on the third grade test score.
2. Alternatively, the tests could somehow be flawed.

Tests of Additional Variables. Because model 4 included important student and school level characteristics, it served as the base model for subsequent testing of the numerous school-level variables that had been created. These variables were entered into the regression equation one at a time. For example, school-level attrition was entered into the regression equation after the variables in model 4. The variable had the expected negative effect on third grade scores, but it was not statistically significant. High levels of attrition at a school would be expected to have a negative effect on test score outcomes because attrition indicates an unstable school population,

which would in turn indicate an inability of the school to concentrate on their academic program. Also, the way this variable was constructed would indicate that there were a lot of new students coming into the school, thereby disrupting the school's academic program.

The following variables had no effect on the performance of low performing students at a school: schools with a mixed ethnic environment, school size, and the level of student attrition at the school, teacher turnover. Table 4-2 lists the variables that do not have a significant effect on the test score gains of low performing students.

Table 4-2

Variables That Did Not Have a Significant Effect

<u>Variable</u>
School Variables
Percent Low Performing Students
Mixed Ethnic Environment
School Size
Teacher Turnover
Student Attrition
Classroom Variables
Presence of Gifted Students
Presence of Special Ed Students
Ratio English Presence in Third Grade

Tests of Interactions. In order to complete the analysis, two major types of interactions were tested on the low performing population. The interaction variables were not significant in this sample. The first type of test looked for interactions among students who were the minority students relative to the ethnic environment of the school. All possible combinations of race/ethnicity of students and school ethnic environment were tested. For example, the interaction of a Hispanic student in a predominantly White school and the interaction of a Black

student in Black schools were tested. None of these kinds of interaction variables was statistically significant.

The second type of interaction looked for the moderating effect of different types of students in terms of their possible interaction with the variable “percent of low performing kids in the school.” While the school level variable “percent of low performing kids in a school” was not significant, an important question was whether certain types of low performing kids were sensitive to a school environment that was characterized by concentrations of low performing students. For example, the interaction for low performing females in low performing schools, and the interaction between ethnicity and being in a low performing school, were tested. None of these kinds of interaction variables was significant.

Summary of Results

The results of the analyses presented thus far reveal that, for low performing students, there are school effects. These results are summarized below:

1. The predominant ethnic environment makes a difference to low performing students. Relative to low performing students in White schools, low performing students in schools with a predominance of ethnic or minority students such as a predominantly Black school, a predominantly Asian school, and a predominantly Hispanic school have higher predicted third grade gain scores.
2. The school-level language environment, though not significantly significant, plays a role in the gain score of low performing students. The higher the ratio of English speakers to all students in the school, the higher the predicted third grade gain score. Schools with a low ratio of English speakers to all students will have a lower predicted third grade gain score.
3. The ratio of non-English speakers to all students in the second grade classroom has a significant effect on the test score gains made by third grade. This variable works in much the same way as the school level ratio of English speakers to all students.

The remaining sections in this chapter explore the possible interpretations of these results.

Gaining Evidence to Aid in Interpretations. Two techniques were used to aid in the interpretation of the regression results, and to search for alternate hypotheses and corroborating evidence. A correlation analysis looked for relationships between the variables that were statistically significant in the regression analysis, and the other variables in the data set. The

second technique was the application of the regression equations used for the low performing population to other student populations. Both of these techniques added some insight to the interpretation of the results.

Correlation Analysis. Table 4-3 presents the variables that are correlated with the statistically significant variables from the previous section; but which are not significant factors in the regression model. It is clear that the Hispanic school is highly, positively correlated with the school size variable and with the variable ratio of English speakers to all students at the school. The larger schools have the highest concentrations of Non-English speaking children. There is a clear pattern in a cluster of elementary schools in this sample. They are larger than other schools, have a smaller English speaking population, and they have students who perform less well academically. The correlations between the White school and mixed ethnic environment school variable are presented in Table 4-3B. It is revealing to note that predominantly white schools tend to be smaller in size, have a lower teacher turnover rate, and have a smaller number of low performing students enrolled.

The correlation between the White school dummy variable and the minority (Black) placement rate in special education is highly positive. This may be evidence that, compared with Black students in other schools, Black students in predominantly White schools have a higher probability of being placed in special education.

Table 4-3A

Key Regression Variables from the Analysis of the Low Performing Population and Their Correlation with Other Data Set Variables

	<u>Correlated Variable(s) and Coefficient</u>
Predominant Ethnic Environment	
Asian School	School size (-.27), Minority (Black) Placement Rate
Black School	School size (-.46)
Hispanic School	School size (.68), Teacher turnover(.33), Percentage
Predominant Language Environment	
Ratio of English Speakers to all Students	
Ratio of English Speakers to all Students	School Size, (-.47), School Level Student Attrition

Note 1: Only variables with statistically significant correlation coefficients over .20 are shown in the table.

For comparison purposes, see the correlations related to predominantly White schools and schools with a mixed ethnic environment in Table 4-3B.

Table 4-3B

Correlations Related to Predominantly White Schools or Schools with a Mixed Ethnic Environment

<u>Predominant Ethnic Environment</u>	<u>Correlated Variable and Coefficient</u>
White School Mixed Ethnic Environment School	Percentage of Low Performing Students at the School Size (-.28)

Table 4-4

Selected Statistics, by Predominant Ethnic Environment at the School

<u>Predominant Ethnic Environment</u>	<u>Correlations with School's Beta Coefficient on the Probability of Placing Minority (Black) Students in Special Education</u>	<u>Mean Percentage of Low Performing Students</u>	<u>Mean School Size</u>
Asian School	-.33	28	48(0.0)
Black School	-.06	31	62(11.1)
Hispanic School	-.30	35	108(22.3)
Mixed Ethnic Environment	-.00	34	64(12.2)
White School	.68	14	78(27.6)

Note: Most of the beta coefficients resulting from the school-by-school regressions with special education placement policy as the dependent variable and second grade test score and minority status as predictor variables were not statistically significant.

The correlation analyses attempted to find additional evidence to bolster the observations made with respect to the regression results. Mainly, the correlation analysis highlighted the relationship of the key regression variables with other school characteristics such as school size, teacher turnover at the schools, the percentage of students at the schools that are low performing

students. This analysis helped to somewhat refine the interpretation of the regression results, but several additional analyses added to these interpretations.

Regression Analyses on Sub Groups Other Than the Low Performing Students. A second way of searching for corroborating evidence to support or refute any of the possible interpretations was to apply the same regression model on additional groups of students in addition to the set of low performing students. To accomplish this, the regression equation described in column 4 of Table 4-1, was applied to several additional subgroups, including the set of students who score very high on the second grade MAT exam and ESL students. Table 4-5 lists only the statistically significant variables and their beta coefficients in the regression equations run for these subgroups.

Table 4-5

Beta Coefficients of Statistically Significant Individual, School, and Classroom Variables for the High Performing and ESL Groups in the Transitions Sample

<u>Variables</u>	(1) High Performing Group (second grade MAT 90% or higher)	(2) <u>ESL</u> <u>Group</u>
Intercept		
Individual Characteristic Variables		
Second grade MAT score	.90***	.65***
Percent of Low Performing Students		-.32*
Teacher Turnover		-.07**
Classroom Variables		
Ratio English: to All Students in 2 nd grade		-.22***
Interaction Variables		
Female in a Low Performing School	-.19**	
Black Student in a Hispanic School		.29***
Ratio English Proficiency by Low		-.40**

Note 1: Dependent variable is the third grade MAT score. Only the statistically significant variables in the regression model are included in this table. High performing students are defined as students who score 90% or higher on the second grade MAT exam.

***p < .01

** p < .05

* p < .10

Column 1 indicates that the high performing students are not responsible to any of the same school conditions as are the low performing students. The variable that explains much of the variance in the third grade test scores of these children is the second grade test score, a variable which, in this model, is outside of the control of the school system. There is, however, one additional variable that is statistically significant: gain scores of high performing female students are smaller, the larger is the presence of low performing students in the school.

Column 2 shows the regression results for the ESL subgroup of students, probably the most vulnerable population in the sample. This group is responsive to the percentage of students at the school who are low performers—the higher the percentage of low performers at the school, the lower are the third grade gain scores. This group is also responsive to teacher turnover.

Final Model. The models presented thus far can be viewed as fixed effects models in the sense that the estimates apply only to the sample tested. The model was a useful one to identify the areas in which the different groups of students were responsive to the characteristics of the schools in which they were enrolled. The predominant ethnic environment was a useful variable to distinguish schools in the Transitions sample, not only because it highlighted the differential effects on test score gains, but because it brought to light the elements of segregation that are present in the sampled schools with respect to their ethnic and language environments.

The model described below tested the effect of two policy variables that are useful in studying student achievement gains. The first variable tested was the language environment of the schools, the characteristic shown to have some effect in earlier regressions. The second variable tested was the variable “percent of low performing students in the school.” This variable was designed as a way of viewing a school’s population in educational terms, rather than ethnic terms. Several regressions were run using these variables, and Table 4-6 presents the results.

The regressions results presented in the column for Model 1 indicates that the presence of low performing students (a school level characteristic) has a negative effect on the test score gains of students; however, the effect is not statistically significant. Model 2 held constant student characteristics and tested the effects of the school characteristic “percent of students at the school who are not English proficient.” This variable has a negative and statistically significant effect on the test score gains of the full Transitions sample. Including both variables in the equation leaves a significant effect only for the school language environment

characteristic. Including an interaction term for the interaction between being in a school that is both low performing and has a high presence of low performers has a large negative effect.

Table 4-6

Beta Coefficient Associated with Student on the Performance of the Full Transitions Sample

<u>Variable</u>	<u>Model (1)</u>	<u>Model (2)</u>	<u>Model (3)</u>	<u>Model (4)</u>
Second grade MAT Score	.69***	.69***	.70***	.70***
D_English Proficiency	.05***	.04***	.04***	.04***
D_Black	-.04***	-.05***	-.05***	-.05***
D_Hispanic	.00	.00	.00	.00
D_Asian	-.01	-.01	-.01	-.02
D_Male	-.00	.00	.00	.00
Percent of Students at School who Score Below 50% on second Grade MAT	-.04		.02	.19*
Percent of Students at School who are not English Proficient		-.04*	-.04*	.07
Interaction between Low Performing Student Population and Non-English Student Population				-.59*
R sq	.63	.63	.63	.63
Adjusted Rsq	.63	.63	.63	.63

Note: Dependent variable is the third grade MAT score. D_ indicates the variable is a dummy variable with a value of 0 or 1. Omitted race variable is the D_white variable. Omitted predominant ethnic environment variable is D_white school.

***p < .01

** p < .05

* p < .10

Table 4-7 shows the mean second and third grade MAT scores for groups of students at each of the different levels of the key two school characteristics variables. It is recommended that researchers use tables like these to describe the influence of relevant variables to persons who are in key policymaking positions, but who may not have a good understanding of

regression analysis. While Table 4-7 is an oversimplification of the effects of these variables, it can be used to demonstrate the role that the presence of low performing students and non-English speaking students has at schools. There is roughly constant percentage gain across schools with varying levels of low performing students, however it is important to note that the mean third grade score for students in schools with high levels of low performing kids does not approach the mean second grade score for students in high performing schools. These differences are stark. Table 4-7 also shows how students in schools with low levels of English speakers both start out with lower mean scores and achieve lower percentage gains in MAT scores.

Table 4-8 repeats the same tabulations for the low performing set of students in the Transitions sample. A low performing student in a school with a high level of low performing students achieves smaller gains than a low performing student in a school with a low level of low performing students. Low performing students in schools with medium and high levels of English speaking students can be expected to achieve higher gains than the same type of student in a school with a low level of English speaking students.

Table 4-7

Mean Scores on Second and Third Grade MAT Exam for the Full Transitions Sample, by Selected Variables

<u>School Characteristics Variables</u>	<u>Second grade MAT Score</u>	<u>Third Grade MAT Score</u>	<u>Percentage Gained from Second Grade to Third Grade</u>
Presence of Low Performing			
Low	77.4	80.1	3.5
Medium	72.3	75.1	3.8
High	68.0	70.1	3.9
Presence of Non-English			
Low	73.2	76.4	4.3
Medium	73.4	76.4	4.1
High	68.4	70.0	2.1

Note: Presence of low performing students at a school is defined as the percent of students at the school who score below 50% on the second grade MAT exam.

Table 4-8

Mean Scores on Second and Third Grade MAT Exam for the Subgroup of Low Performing Students in the Transitions Sample, by Selected Variables

<u>School Characteristics Variables</u>	<u>Second grade MAT Score</u>	<u>Third Grade MAT Score</u>	<u>Percentage Gained from Second Grade to Third Grade</u>
Presence of Low Performing Students at the School			
Low	52.9	62.9	18.8
Medium	51.1	60.1	19.0
High	48.3	55.0	14.1
Presence of Non-English Speaking Students at the School			
Low	51.5	61.4	19.4
Medium	51.2	60.7	18.5
High	47.1	52.2	10.9

Note: Presence of low performing students at a school is defined as the percent of students at the school who score below 50% on the second grade MAT exam.

It is important to note that the far majority of effects that were detected from these analyses related to the characteristics of the student population enrolled in the schools. These are less individual school “action “or policy variables, and are more school “reaction” variables, in the sense that these are more related to the characteristics of the students coming to the school, (and perhaps the teachers’ leaving the school) than they are of individual school policies with respect to their academic program. With respect to school academic policies, there is evidence that some schools may segregate some students between special education and regular education, but this issue warrants further review before any definitive statements can be made.

Chapter 5

Summary and Implications

Introduction

This study analyzed the influence of the school environment to the extent that was possible within the limitations of the data available from the Transitions database, a database created for program evaluation purposes. The study used simple ratios, summations, dummy coding and regression analyses to create variables describing the school environment, and tested them using regression analysis. Several new ways of looking at the school environment were operationalized and studied. The research uncovered an aspect of the school environment that had not been previously been addressed in the research literature, namely the effect of the language environment on test score gains. The findings from this research may be highly useful to school principals and school systems that are both operating within an accountability system and attempting to meet the needs of “low achieving” student groups.

This chapter summarizes the results of all of the analyses; discusses the relationship of these findings with the literature, and the implications of the findings and observations with respect to future research. The chapter concludes with a conceptual statement about the measurement and study of students especially as it relates to the measurement of test score gains. The statement suggests that researchers focus on the description of children and schools in educational terms (e.g. language capacity of the child and level of concentration levels of low achieving students within a school), rather than on descriptions of children and schools that are based on socioeconomic characteristics such as race and ethnicity, or income.

Summary of Findings

Several different analyses were presented in the previous chapter. The following items summarize the findings:

1. Predominantly Hispanic schools in this sample are larger than other schools, have a smaller English speaking population, and have students who perform less well academically. Predominantly white schools in this sample tend to be smaller in size than the predominantly Hispanic schools, have a lower teacher turnover rate, and have a smaller number of low performing students enrolled.

2. There is some evidence that, compared with black students in other schools, black students in predominantly White school have a higher probability of being placed in special education.
3. A school's language environment (as defined by the portion of students at the school who are English proficient) has a positive affect on the academic performance of low achieving students. That is, schools with higher concentrations of English speakers can be expected to achieve higher test score gains than schools with concentrations of students who do not have English speaking capabilities.
4. With little exception, the academic performance of high-performing students is not highly sensitive to school characteristics. The third grade academic performance of high achieving students is influenced primarily by their second grade test score, and not school, or school population, variables.
5. The academic performance of high-achieving female students, however, is negatively affected by the concentration of low-performing students in the school.
6. The academic performance of ESL students is negatively affected by the concentration of low-performing students at the school and by the school-level teacher turnover rate.

This research finds evidence of segregation in ways in which children are assigned to schools. Some schools in this study have high concentrations of students with the very characteristics that make the prospects for the academic growth of students within them very, very difficult. Other schools have concentrations of students with the characteristics that make prospects for the academic growth of students within these schools very promising.

The documentation here may assist school leadership in providing evidence of the difficulties faced by some schools on a daily basis. Language difficulties make it especially difficult to convey information to non-English speaking students, and schools with high levels of non-English speakers would be expected to have a much more difficult time conveying expectations and information to students and their parents. Similarly, parents and children would have difficulty conveying their educational needs to the schools.

Relationship with the Literature

There are two areas in which these findings are consistent with previous research. First, the findings clearly demonstrate that certain groups of students are differentially responsive to the

characteristics of the school environment. From Coleman (1967) to the research findings here, it is clear that certain types of students are differentially responsive to the characteristics of the school environment. Recently, Wong, Hedges, Borman, and D'Agostino (1996) found that, even though pretest levels of American Indians were comparable to White students in their study, the Native American students grew at a significantly lesser pace than the White students. The authors recommended that further explorations of the potential problems faced by Native American schools be undertaken.

Second, the findings from this research are consistent with the general findings from the research on school effects—generally, it is the characteristics of the students rather than school policies and practices that, in these types of analyses, explain much of the variance in test score outcomes (for, example, Jaeger, 1992, and Goldhaber and Brewer, 1996). The findings from this study are consistent with other school effects studies, including studies that use the more complex method of hierarchical linear modeling. A preliminary analysis of the Transitions data used HLM; early results of the HLM analysis indicate that the aggregated school population variable, Hispanic school, explains much of the variance in academic performance. Individual student characteristics, rather than the characteristics of the school, explain the largest portion of the variance in test scores. In other words, in regression or regression-like analyses, it is normally the case that student-level characteristics (including family characteristics) explain much of the variance in test-core outcomes; while the effects of school practices explain a much smaller portion of the variance in test score outcomes. The largest and most recent study to look at school effects, the Prospects Re-Analysis (Wong, et al 1996), used hierarchical linear modeling method (HLM) and found some school effects for certain school practices (such as school level decisionmaking authority) but generally did not consistently find that school attributes explained achievement differences across cohorts and subjects.

Theoretical Considerations and Future Research

There are several technical and substantive reasons for the difficulty that researchers face in finding school effects using methods similar to those used in this study. One of the reasons is that most studies test only a portion of the ways in which schools can differ. With little exception, the variables in this analysis that are statistically significant are student and family variables that have been aggregated to the school level. In other words, they describe the characteristics of the student population at the school, rather than school policies and practices.

These variables are extremely important dimensions of what happens in schools, and it is important to fully describe them. It is clear that student and family-driven factors have largely been ignored in the research on school effects.

A closely-related set of important school differences relate to the curriculum and curricular differences. It is a myth that a common curriculum is the same across schools within the same system; this is a function of both differences in teaching style and in local decisions about how a given curriculum can be presented to students of different backgrounds. It seems that the first step in looking for school effects is to develop better measures of how schools differ. Developing a school-level measure of curriculum coverage would be an excellent way to begin to isolate the true differences across schools and to begin to test for school effects. Students within a school are the driving force behind what happens within the school; they drive both the definition of the curriculum and the way in which the school teaches it. Thus it is not surprising that student population characteristics explain much of the variance in test score outcomes.

It is difficult to find research on school effects that includes variables related to curriculum differences. A book on international perspectives on school effects cited a study from Europe (Tizard et al, London, 1988) which found a substantial association between test score gains and their coverage in the curriculum. This, however, focused on the overlap of content between curriculum and test. The construction of a measure of curriculum coverage is described in Farquhar et al. (1987); teachers in the studies completed checklists and scored students based on what was experienced by the student. Clearly a count of points of overlap is a very narrow means of capturing the nature of students' experience of a curriculum in the classroom. It is, however, an important step in an important direction.

There are also some suggestions from this research to indicate that students who are in the educational minority of a school are the most affected by school characteristics. For example, the test score gains of high performing female students in schools with large concentrations of low performing students are negatively affected by the presence of low performing students. English as a second language students, who could be considered the most needy among a set of students with great educational needs, were the most responsive subgroup of students to school characteristics. There is also evidence that schools may segregate some of the school's racial minority students. As stated previously, it appears that black students were more likely to be placed in special education classes when they were in predominantly White schools, than when

they were in other schools. It is important, however, to be cautious with respect to this statement, and to investigate whether this phenomena is indeed occurring.

The findings from this research suggest that the real key to studying school effects is to do a better job of describing how schools differ in the first place. Only after schools have been adequately described can we begin to have hope for testing the full model of educational practices. In addition to studying curricular differences across the schools, there are several implications for future research that follow from this study:

1. The segregation that results from the assignment of children to particular schools needs to be better documented. The segregation that appears to occur through differential special education placement rates for black students needs to be fully investigated.
2. Researchers who study school effects may want to investigate further the notion about the effects of the presence of concentrations of students within a school can have on the outcomes of individual students. This research showed the negative effect of having large concentrations of students who are non-English speakers. However, there may be other cases where concentrations of certain types of students may actually be advantageous for a school, in that they can efficiently meet the educational needs of their students.
3. Researchers may want to conceptualize students within schools in terms of whether the students who are part of the educational majority at the school or educational minority at the school. The findings about the effect on high-performing female students in a school with a concentration of low performing students are suggestive, that students who are in the educational minority at a school face difficult problems.

Qualitative research can help to more appropriately describe schools and school differences. One of the first aspects to understand would be how an individual school identifies its educationally minority population; and whether and how it provides appropriate educational services to that group. The description of the way in which a school addresses the needs of its educational minority group would be a useful qualitative indicator of school differences.

Closing Conceptual Statement about the Study of School Effects

One can best view this research, and studies like it, within the context of the current accountability era in public education. This era in which schools are held accountable for the

gains that students make may be a great opportunity for schools to demonstrate that students who come to different schools within the same system indeed have different needs, and that these needs drive the curriculum. Only after accounting for those differences, and describing these differences in educational terms, can one actually be able to truly begin to study the effect of school differences. This work could be accomplished by the development of better measures to describe schools and the students within them. The first measure would be a measure of the school's curriculum coverage, and subsequent measures would focus on educationally-relevant descriptors.

It may actually make sense to characterize school differences on the basis of the educational characteristics of the students, rather than the race/ethnicity characteristics. One wonders whether educators would better serve themselves if they had good, direct measures of the educational characteristics of students when they come to school, rather than the socioeconomic characteristics of the students. The educational characteristics, for example such obvious things as ability of the child to speak English, would better help educators describe their opportunities and challenges in carrying out their educational mission. In this era of accountability by test score, it would be safe to assume that schools are making a good faith effort to cover the curriculum, and are only constrained by the limits of their student population.

Besides the school curriculum coverage measure, one could seek to develop a measure of "sources of education" for each student. Just as we conceptualize income into "sources of income," such as wage, interest, and social security income, we may want to view students in terms of their "sources of education." Such sources of education would be from parents, from preschools, from schools, and from community organizations. Actually characterizing new students to an elementary school in these terms would give researchers more meaningful ways to describe the school's student population. Changes in the ways in which we measure and report on school differences may be a real help to schools and schools systems.

Perhaps this is an overly optimistic statement, but maybe someday all that will be needed to gather momentum for needed resources is the demonstration that certain types of schools (e.g., schools with low levels of English speakers relative to all students at the school) and, in some cases, certain types of vulnerable students will start off with low scores and pretty much stay that way unless some appropriate intervention is applied. Further study of the specific ways in which

concentrations of students affect student academic performance will help in the design and testing of such interventions.

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REGINA YUDD

SUMMARY

Regina Yudd is a senior research analyst whose work has focused on informing the policy debates in the employment and training area. Her primary interest and experience is in workforce development. She has worked on studies related to skill standards, the reinvention of the *Dictionary of Occupational Titles*, and the use of technology to best match job applicants to job vacancies. Her skills span the range of research activities, from developing large-scale databases to evaluate training and education program and process analyses of public programs.

EDUCATION

Ph.D. Candidate, Educational Research and Evaluation, Virginia Polytechnic Institute and State University

M.A., Economics, George Mason University, 1986

B.A., Economics, University of Maryland, 1980

RELEVANT PROJECT EXPERIENCE**Westat (1992 to Present)****Job Matching Research Project**

Client: Center for Employment Security Education and Research (CESER)

Project Overview: Westat conducted this 12-month, two-part project to provide CESER with a comprehensive inventory of the job matching procedures used in each state. The project involved (1) collecting and analyzing best practices in job matching procedures and (2) explored the use of job matching data as labor market information. During part 1 of the project, Westat's activities included a mail survey of state employment security agencies, site visits to several locations, analyses of other Federal data sources, and the preparation of a final report. Specific tasks for part 2 included a literature review, telephone interviews with state officials, and report preparation.

Responsibilities: Senior research analyst for part 1. Ms. Yudd is developing the mail survey, focus group, and site visit protocols. She will direct telephone followup for the mail survey and conduct site visits. Ms. Yudd is Westat's primary part 1 contact and is responsible for interacting with the main client and the project's technical steering group.

Development of Prototype New Occupational Information/Classification System to Replace the Current Dictionary of Occupational Titles

Client: Utah Department of Employment Security

Project Overview: Westat is one of several organizations participating in a project to develop a prototype for a new occupational classification system to replace the Dictionary of

Occupational Titles (DOT). Westat is experimenting with alternative technologies for data collection, developing and pretesting questionnaires for collecting information about occupational skills and responsibilities from employers and workers, developing a sample design, selecting the sample occupations for the surveys, and negotiating with establishments to participate in the surveys. Westat is also responsible for conducting a pilot test and performing the main data collection, which will most likely involve telephone interviews with employers and the distribution of self-administered questionnaires to employees.

Responsibilities: Ms. Yudd compiled potential labor market context descriptors for the DOT and noted some of their uses, described the data sources, discussed the possibility of linking state labor market information databases to the new DOT, and recommended descriptors and databases. She coauthored a report of these findings.

Job Training Partnership Act (JTPA) Rapid Response Mechanism: 1994-1997

Client: Employment and Training Administration, U.S. Department of Labor

Project Overview: The JTPA Rapid Response Mechanism has been operated by Westat since 1986 and is in its third cycle. The purpose of the project is to generate information and analyses, on a rapid-turnaround basis, concerning any aspect of JTPA program operations and related activities that may be of current interest to policymakers. The system provides timely information and analyses on various programmatic, management, and organizational issues, typically within 90 days of the identification of an issue. Telephone surveys and on-site visits or case studies are conducted to provide data for the analyses.

Responsibilities: Based on her experience in the employment and training area and her knowledge of qualitative research, Ms. Yudd contributes to the design of studies, including the development of study protocols and data analysis strategies. Because she speaks Spanish, Ms. Yudd has conducted focus groups at sites where Spanish is the dominant language of program participants. Ms. Yudd also participated in the following studies under the Rapid Response contract.

Coordination of Housing and Job Training Services - Ms. Yudd reviewed site reports, conducted followup interviews, contributed to the synthesis of data, and edited the final report.

Evaluation of the 1992 Amendments to the Emergency Unemployment Compensation (EUC) Act - This study examined how states implemented the 1992 EUC amendments that permitted unemployment insurance (UI) claimants to receive federally funded EUC benefits without exhausting their regular benefits. Study states were chosen on the basis of their EUC payments relative to UI exhaustion rates, and state and local staff were interviewed about their policies and procedures with respect to EUC eligibility.

National Evaluation of the JTPA Summer Youth Employment and Training Program (SYETP) - The SYETP provides summer jobs and academic enrichment to more than 600,000 14- to 21-year-olds each summer. The central objectives of this study were to describe program operations and practices, identify effective practices, and recommend program improvements. Data collection included a mail survey of all 631 service delivery areas operating the program; 50 on-site case studies; and brief exit surveys of program participants, teachers, and worksite supervisors. Ms. Yudd contributed to the

design of this study, including the development of study protocols and data analysis strategies. Because she speaks Spanish, Ms. Yudd conducted focus groups at sites where Spanish is the dominant language of program participants.

Data Processing and Special Technical Analyses for the Planning and Evaluation Service

Client: Office of the Under Secretary, U.S. Department of Education

Project Overview: For more than 15 years, Westat has provided the Department with a wide variety of analytical and support services under successive task order contracts. Tasks generally fall into one of three categories: (1) recurring data processing and reporting on education data submitted by state education agencies (e.g., the Title I/Chapter 1 Program, the General Education Provisions Act); (2) program evaluations (e.g., the Chapter 2 Inexpensive Book Distribution Program, the Allen J. Ellender Fellowship Program); and (3) quick-turnaround policy research and data analyses for Planning and Evaluation Service operations (e.g., graphics development, library searches, planning support, simulations and modeling).

Responsibilities: Ms. Yudd had the following responsibilities.

Evaluation of the Chapter 2 Inexpensive Book Distribution Program (IBDP) for the Office of Policy Research and Planning - Ms. Yudd evaluated the effectiveness of the IBDP, a book distribution program to motivate children to read. She conducted interviews with key staff, analyzed program data, and reported on the national administration and local operations of the IBDP. In addition, she prepared recommendations on developing the self-sufficiency of local IBDP projects and modifying reporting requirements so that planning information would be available from local projects.

Eisenhower Math and Science State Grant Program - Ms. Yudd participated in the development of a program database, developed and initiated data checks, and prepared tabulations based on the data. She also contributed to the definition of issues related to data items on the three data collection forms, including the feasibility of collecting such data as well as how the data would be used.

Special Issues Analysis Center for the Office of Bilingual Education and Minority Languages Affairs (OBEMLA)

Client: U.S. Department of Education

Project Overview: Activities conducted under this task order contract provided administrative, research, and policy support to OBEMLA. Working under a subcontract, Westat was responsible for data processing and reporting on more than 2,000 annual grant applications as well as surveys of services to limited-English-proficient children and families submitted annually by state education agencies. Westat also carried out policy research utilizing data collected by other Federal agencies and had significant involvement in designing a management information system for OBEMLA.

Responsibilities: Ms. Yudd is developing a database of funded and nonfunded applications submitted to OBEMLA. She also produces summary and analysis reports on federally funded bilingual education activities.

National Assessment of Vocational Education Data Collection and Analysis Project

Client: U.S. Department of Education

Project Overview: During this 27-month project, Westat and several subcontractors and consultants designed, conducted, and reported on eight information collection efforts. The purpose of this research was to assess the implementation of Federal requirements for vocational education programs, as stipulated in the 1990 amendments to the Perkins Act, and to evaluate the effects of Federal funding on vocational education programs. The components of this project were (1) seven omnibus surveys of state and local vocational education administrators; (2) community case studies with local personnel, parents, students, and others; (3) a study of materials from vocational education programs; (4) case studies involving tribal institutions; (5) development of a questionnaire and a sampling frame for a study of vocational education in juvenile correctional facilities; (6) a survey of 6,000 employers; (7) case studies of the effects of changes in Federal vocational education funding on public secondary school districts; and (8) a followup survey of 1,000 targeted omnibus survey respondents. Westat designed most of the components; developed survey instruments and interview protocols; trained data collectors; conducted telephone, mail, and field operations and site visits; processed and analyzed data; and wrote numerous reports and case studies.

Responsibilities: Ms. Yudd was the senior researcher on two community-level site visits. Training for and conducting these site visits, as well as the two case studies written for the project, enhanced Ms. Yudd's substantive knowledge in vocational training research and her substantial experience in field interviewing.

Development of Prototype New Occupational Information/Classification System to Replace the Current Dictionary of Occupational Titles

Client: Utah Department of Employment Security

Project Overview: Westat is one of several organizations participating in a project to develop a prototype for a new occupational classification system to replace the Dictionary of Occupational Titles. Westat is experimenting with alternative technologies for data collection, developing and pretesting questionnaires for collecting information about occupational skills and responsibilities from employers and workers, developing a sample design, selecting the sample occupations for the surveys, and negotiating with establishments to participate in the surveys. Westat is also responsible for conducting a pilot test and performing the main data collection, which will most likely involve telephone interviews with employers and the distribution of self-administered questionnaires to employees.

Responsibilities: Ms. Yudd developed the labor market information descriptors that will provide summary information about current and future employment opportunities in specific occupations.

Urban Institute, Washington, DC (1986 to 1991)

Evaluation of the Washington State Family Independence Program (FIP) - As a research associate, Ms. Yudd contributed to two components of this evaluation: the process analysis and the development of administrative cost estimates for the Food Stamp Cash-Out Study. She played a key role in the employment and training component of the process evaluation. This component centered on the identification of key staff and agencies responsible for

coordinating and providing educational services for FIP clients. The process analysis identified the primary education, employment, and training activities in which FIP clients were enrolled (i.e., vocational, postsecondary, and remedial education). Using program data, information from interviews with key staff, and data on individual clients, the study reported on the level and extent of participation in comprehensive education and training services and the extent to which program sites emphasized basic skills and remedial education. Ms. Yudd also developed estimates of the administrative costs of delivering food stamp benefits via cash or Food Stamp Coupons to participants at research sites in the FIP evaluation. Administrative cost estimates were based on a detailed review of the processes for cash and coupon delivery in client service offices in Washington State.

Basic Skills Training for Adult Workers - Ms. Yudd designed a study to determine the capacity of public and private educational service providers to meet the expected increase in demand for adult basic educational services.

Basic Skills Training for Training Program Participants Studies - Ms. Yudd produced a series of studies for the Employment and Training Administration. She provided background information for a study on the potential use of volunteers in the Job Training Partnership Act (JTPA) and was responsible for two other quick-response studies. One study identified the availability of information for defining and assessing basic skills requirements for specific occupations. The second focused on ways of assessing and serving learning-disabled participants in JTPA.

Program for Research on Immigration Policy - For the implementation analysis, Ms. Yudd identified and interviewed all relevant parties in New York City for a Ford Foundation study on the implementation of the Immigration Reform and Control Act of 1986. Parties included Immigration and Naturalization Service officials, community-based organizations, and education providers. Ms. Yudd had lead responsibility for an analysis of the use of the Systematic Alien Verification for Entitlements database verifying the alien status of noncitizen applicants for Aid to Families with Dependent Children, Unemployment Insurance, and other assistance benefits.

Food Stamp Program Operations Study - The report identified the extent of computer matching in the Food Stamp Program, including the timing of matches and the methods used in accessing external data files. Computer matching is the automated comparison of information provided to welfare agencies by applicants to Aid to Families with Dependent Children, Food Stamp, and other benefit programs. Reports described four typologies, including mode and range of databases accessed, the intensity of state matching policies, and the maturity of matching operations. Reports on state and local computer matching practices required intensive on-site interviews and observation of state computer matching systems.

Evaluation of the Prepared Meals Provisions for the Homeless - Ms. Yudd conducted on-site interviews with food and shelter providers to homeless individuals and families. She also reported on shelter suggestions for improvement.

Mathematica Policy Research, Washington, DC (1986)

Ms. Yudd participated in the Food Stamp Program Operations Study. She served as an executive interviewer on the claims and computer matching areas of this study.

OTHER PROFESSIONAL EXPERIENCE

Inter-American Institute for Agricultural Cooperation, Quito, Ecuador (1985) - As an economist, Ms. Yudd advised the Ecuadorian Minister of Agriculture on the possibilities for privatizing certain state-owned enterprises, including the sugar, tea, and banana companies. The analysis was based on the financial status of the companies, including the level of state support received by each and the market conditions for the products.

Inter-American Development Bank, Washington, DC (1980 to 1986) - As a human resources assistant, Ms. Yudd conducted background research for the implementation of a bank-wide performance evaluation system and assisted in synthesizing information on such bank personnel policies as staff rotation and employee benefits. She also provided administrative support in the bank's payroll office.

Department of Economics, University of Maryland, College Park, MD (1979 to 1980) - As a research assistant, Ms. Yudd conducted time-series analyses with data from a study conducted for the Small Business Administration.

TECHNICAL REPORTS

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