# *Educational Resources and Achievement Gaps in High Poverty Schools:*

## Findings from the Longitudinal Evaluation of School Change and Performance (LESCP) in Title I Schools

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## I. INTRODUCTION

The 1994 Improving America's Schools Act (IASA) adopted several policy reforms designed to improve schools receiving Title I funds. This reauthorization of the Elementary and Secondary Education Act (ESEA) emphasized high standards for all students; a schoolwide focus on school improvement efforts; professional development experiences for teachers; partnerships among schools; parents, and communities; and flexibility to integrate IASA programs with state and local programs.

The Longitudinal Evaluation of School Change and Performance (LESCP) in Title I Schools was initiated to examine the implementation and effectiveness of Title I programs under this new legislation. Interim and final analyses of LESCP data were presented in reports to Congress (Turnbull et al, 1999; 2001). These reports focused on curricular and instructional practices, including standards-based and other reforms that may have resulted from changes in Title I policy, and their effects on student achievement. These analyses also considered aspects of the policy context influencing schools (e.g., policies related to performance standards and the extent to which schools and districts have responded to them) and the extent to which they fostered effective classroom practices.

Prior LESCP analyses completed by Turnbull and colleagues (1991, 2001) found a handful of school and classroom practices associated with reading and math achievement. In both subjects, outreach to parents of low-achieving students and high teacher ratings of professional development were associated with achievement. Other factors associated with achievement included less use of basic-skills oriented instruction, reading teacher awareness and implementation of standards based reform, and teachers who believed they had more to learn in math.

The LESCP data offer rich and detailed information about the operations and outcomes of Title I schools at a time when states, schools, districts, and schools receiving Title I resources were being encouraged to pursue standards-based reform. This paper is designed to complement previous analyses, by investigating additional educational policy issues that have not yet been fully explored using the LESCP data. The primary purpose of these analyses is to examine the relationship between school resources and 1) learning opportunities (i.e., curriculum and instruction); and 2) student achievement; including how school characteristics and the context in which schools operate affect the allocation of resources. Analyses also highlight racial/ethnic gaps in student achievement.

## Conceptual Model

### *The Impact of School Resource Allocation*

Our analysis builds on prior efforts to investigate the relationship between educational resources and student learning, by applying notions of school organizational capacity, social capital, and human capital. A large body of "education production function" research has investigated the relationship between school resource allocation and student learning outcomes. While much of this research has yielded mixed results, consideration of some school characteristics has shown the positive influence on student learning of resource variables such as per pupil expenditure, smaller class size, and characteristics of teachers (Hanushek, 1997; Laine, Greenwald, & Hedges, 1996). A second class of research that has focused on the impact of school resources on student learning is "process-product" research. Studies of this type have considered the distribution of students at different ability levels across classrooms and aspects of

[14] Qualitative data such as that collected in focus groups, classroom observations, and review of documents were not available electronically, and were therefore not included in these analyses. Although much of the principal

curriculum and instruction, such as the difficulty of instructional materials, instructional time, and coverage of instructional topics (e.g., Barr & Dreeben, 1983). Both classes of research continue to be widely used in educational research and have been applied to studies of resource allocation in Title I schools (Wong & Meyer, 2001; Shen, 2002). The analyses in this supplementary study of the LESCP data integrate these two classes of research, conceptualizing school resources according to the following three types:

1. **School organizational capacity**. These resources include several aspects of school organization associated with effective schools (e.g., Rosenholtz, 1985) such as the presence of school goals and the use of standards to assess quality. Organizational capacity also includes the nature and extent of support for teacher professional development, and factors associated with the extent to which the school operates as a learning organization (Cibulka, et al. 2000). Characteristics of the Title I program, such as the allocation of Title I resources and the extent to which Title I services are targeted to particular students are also included in this category. School organizational capacity also includes class size, a factor associated likely to be associated with a school's fiscal capital.

2. **Human capital**. Human capital, as generally defined, refers to the knowledge and skills acquired by an individual that lead to productive work. School resources in this category include characteristics of principals and teachers, such as education, experience, certification, and skills. Other characteristics of teachers were also included in this category of resources, including the extent to which they found the use of standards and assessments appropriate, their participation in professional development activities, and the extent to which professional development affected their work.

3. **Social capital**. Social capital is a resource that has received increasing attention in social science research in recent years. Typical definitions (e.g., Putnam, 1995; Coleman, 1988) describe social capital as networks of social relations, characterized by norms of trust and reciprocity, that serve as a resource for collective action; and community capacity, focusing on physical and social factors that may affect a community's ability to act collectively on its own behalf. Definitions of social capital vary, however, and large-scale studies of social capital have underemphasized the role of schools (Putnam, 2000; Saguaro Seminar, 2001). Studies of social capital related to schools have tended to focus on: 1) traditional family involvement activities, such as family-teacher conference attendance and PTA membership; 2) aspects of the community within schools; and, 3) community services and supports that are available to students. Indicators of school

social capital available in the LESCP data set include efforts to support parent involvement, the extent of parent involvement, characteristics of students' classroom peers, and the provision of instructional support outside of the regular school day.

The conceptual model (Figure I.1) describes hypothesized relationships between four classes of variables: 1) context; 2) educational resources; 3) curriculum and instruction; and 4) student learning. This model reflects the hypothesis that educational resources (boxes 2a-2c) exert both a direct effect on student learning (box 4) and an indirect effect, mediated through their effects on curriculum and instruction (box 3). The model also accounts for characteristics of students aspects of school context (boxes 1a-1b) that are expected to have both direct effects on student learning as well as indirect effects, through their impact on school resources and curriculum and instruction.

### *Racial/Ethnic Achievement Gaps and Classroom-Level Peer Effects*

The gap between racial/ethnic minority and non-minority student achievement has received substantial attention in education research literature (e.g., Jencks & Phillips, 1998), which suggests that substantial achievement gaps persist and lead to long-term economic consequences for low-achieving, minority students. Interest in alleviating this gap has been bolstered by recent research suggesting that improving student learning for low-achieving, minority students can substantially reduce future costs of income transfer and publicly funded social programs (Vernez, et. al. 1999). In our analysis of educational resource allocation and its implications for student learning, we explore its impact relative to the impact of student attributes such as race/ethnicity and poverty. Characteristics of students' classroom peers are also presented in the conceptual model as indicators of social capital. Resource allocation models (e.g., Barr & Dreeben, 1983) suggest that the average ability level in a classroom determines the nature of the curriculum and instruction offered, which in turn affects student

learning outcomes. Our analyses explore the extent to which other peer characteristics are related to student learning outcomes.

## II. DATA SOURCE & VARIABLE CONSTRUCTION

### *Data Source*

The Longitudinal Evaluation of School Change and Progress (LESCP) included data from 71 schools, located in 18 districts, across 7 states. Because of the study's focus on the impact of standards-based reform, states and districts were not selected to be representative to the U.S. population of schools. Rather, states and districts were selected to create a purposive sample of settings where standards-based reform activity had begun, with a focus on high-poverty, Title I schools. Districts and states were selected to reflect variation in the extent to which standards, assessment, and accountability policy and practices had been implemented, and all were pursuing these activities to some extent. Among schools in the sample, all had high concentrations of poor students, with over half of schools having a poverty rate of over 75 percent. All schools received Title I funds. The majority of schools were eligible to operate schoolwide programs and, by the last year of the study, over 80 percent implemented them.

Data collection took place in the spring of 1997, 1998, and 1999, and included three cohorts of students. The first cohort comprised the longitudinal sample of the study. These students were in third grade in 1997 and were followed for two years—through their fourth grade in 1998, and their fifth grade in 1999. Two additional cohorts were selected, including students in fourth grade in 1997 and students in fourth grade in 1999. This data collection strategy resulted in 1) three cross-sectional cohorts of fourth grade students in 1997, 1998, and 1999, allowing comparisons of student experiences in fourth grade classrooms for three consecutive years during which standards-based reforms were emphasized, and 2) a longitudinal cohort of

third grade students, followed for three years, allowing assessment of individual student learning progress over time.

The study included measures of student achievement and other student characteristics; interviews and surveys with district administrators, school principals, teachers, and parents; classroom observations; and document review. These analyses use data from the following sources[4]

- The Stanford Achievement Test, Ninth Edition (SAT-9), measuring reading and math ability;
- Student information, collected using the "Student Information Form;"
- Surveys completed by students' regular reading/language arts and mathematics teacher; and,
- Interviews with school principals.

The analyses in this report focus on the longitudinal cohort of students, considering student learning that occurred between the end of their third and fifth grades and the classroom, school, and other factors that explain differences among students. The LESCP data set provides rich information about the characteristics of schools and classrooms in the sample. Section II presents a detailed description of the variables used in these analyses.

### *Variable Construction & Sample Development*

Analysis variables were developed using data from teacher surveys; principal interviews; a "Student Information Form" completed for each student by his or her regular classroom teacher; and student achievement scores on the Stanford Achievement Test, Ninth Edition. Available interview data included only closed-ended items, which required respondents to select from options presented by the interviewer. Data from these sources were used to create categorical, continuous, and composite variables for analysis. In creating variables for analysis,

response scales for categorical variables were recoded to set lowest values to zero and to reverse scales for negatively worded items. Because the survey and interview protocols were revised as the study progressed, data for some items were not always available for all years of the study.

## Composite Variables

Composite variables were created using several items to yield a more accurate measure than the score from a single item, as well as to create more parsimonious and interpretable analyses. The following general process was used to create composite variables: 1) a set of items was selected which represented a theoretical construct of interest (e.g., parent involvement); 2) items were recoded as necessary to reverse responses to negatively phrased items and to set lowest values to zero; 3) items were converted to standardized z-scores; 4) equally weighted mean z-scores were computed by dividing the sums of non-missing standardized scores by the number of non-missing standardized scores. In other words, if one or more item response was missing, that item did not contribute to the composite score. Composite scores were created only for those cases for which data were available for at least half of the items that comprised the composite. Factor analyses were used to confirm that factor structures were valid. **Table II.1** presents an overview of the variables used in these analyses and the data sources from which they were derived.

## Student Level Variables

Reading and mathematics achievement information was collected using the Stanford Achievement Test, Ninth Edition (SAT-9), administered during each spring of the study. Information about students was taken from the "Student Information Matrix," an instrument completed by students' regular classroom teachers.

**Student Achievement.** Data from the Stanford Achievement Test, Ninth Edition (SAT-9) were used to assess student achievement in reading and mathematics. The SAT-9 measures reading and mathematics content that is aligned with the National Assessment of Educational Progress (NAEP) and National Council of Teachers of Mathematics (NCTM) standards. SAT-9 scores are norm-referenced, based on a sample of 10 million students in the year 2000. The SAT-9 consists of multiple-choice and open-ended items, each of which contribute to "closed-ended" and "open-ended" composite scores. The open-ended scores are based on nine-items designed to reflect instructional objectives that are best measured with performance-based tasks and student constructed responses. While the closed-ended items in reading focus on vocabulary and reading comprehension, the open-ended items focus on reading processes (i.e., initial understanding, interpretation, and critical analysis) and understanding of characters, setting and plot, and underlying meaning of reading passages. The math closed-ended items focus on problem solving and procedures while the open-ended items focus more closely on aspects of process (i.e., use of multiple problem-solving strategies, types of reasoning, and methods of communicating results) and student understanding of number concepts, patterns and relationships, and concepts of shape and space.

The open-ended scores are normed on a smaller sample of students than the closed-ended scores and are based on scorer ratings of student responses, which may compromise objectivity. Because of concerns about their ability to accurately reflect student achievement, prior analyses have focused on closed-ended scores (Turnbull et al., 2001). Analyses in this report also focus on closed-ended reading and math composite scores.

***Gender***. A dummy variable was created based on the Student Information Matrix GENDER variable, with males coded "1."

***Race/ethnicity.*** Separate dummy variables based on the Student Information Matrix ETHNIC variable were created for: African American, Hispanic, and Asian.

***Poverty*.** Dummy variables were created with a value of "1" for students identified as recipients of free or reduced lunch.

***Participation in Title I Programs.*** Dummy variables were created with a value of "1" for students identified as Title I participants.

## Classroom Level Variables

Items from the regular classroom teacher survey were used to create variables describing classrooms, curriculum and instruction, teacher professional development activities, and teacher characteristics.[6]

[6] Survey data were also available from Title I teachers and teachers providing additional instruction in schoolwide programs. However, these data were not used because they were available for only a small proportion of students in the LESCP sample, primarily because the sample consisted of mostly schoolwide program schools, with no

***Classroom Peer Characteristics.*** A variable indicating the proportion of Title I students who came to class ready to learn was available from the teacher survey.

***Classroom Instructional Time.*** Time, in minutes per week, spent on reading/language arts and mathematics instruction.

***Class Size.*** Number of students in reading/language arts and math classrooms, including students who received Title I or other special services and spent part or all of the day in the class.

***Teacher Parent Involvement Efforts.*** Teachers rated their parent involvement efforts according to the frequency with which they used the following parent involvement strategies: 1) home visits with parents or guardians of Title I students; and 2) school-initiated parent-teacher conferences with parents or guardians of Title I students. These items were used to create a composite variable indicating the frequency of parent outreach by teachers. Teachers also indicated the proportion of Title I students for whom they initiated several parent involvement efforts: 1) face-to-face meetings with parents of Title I students; 2) sending materials to parents on ways they can help their child at home; 3) phone calls to parents when their child was not having problems; and 4) phone calls to parents when their child was having problems. These items were used to create a composite variable indicating the scope of parent outreach by teachers.

***Teacher Use of Standards-Based Curriculum.*** Teachers indicated the extent to which they believed their reading/language arts and math curricula reflected: 1) student assessments; 2) content standards; 3) curriculum frameworks; and 4) performance standards. Subject-specific composite variables (reading/language arts and math) were created from these items to indicate the extent to which teacher curriculum was standards-based.

***Teacher Perceptions of Standards and Assessments.*** Items from the teacher survey were used to assess teachers' perceptions of the appropriateness of standards and assessments. Teachers were asked to rate the appropriateness of each of the following for their students: 1) content standards; 2) curriculum frameworks; and 3) performance standards. A composite variable was created to indicate teachers' perceptions of the appropriateness of standards. A second composite variable was created using items measuring teachers' perceptions of the appropriateness of student assessments and the extent to which teacher believed that assessments measured student progress toward performance standards.

***Teacher Instructional Strategies.*** Teachers were asked to indicate the frequency with which they used a variety of instructional strategies for students at different achievement levels, including their use of 1) homogeneous grouping and 2) heterogeneous grouping. A composite variable was created indicating the extent to which teachers differentiated instruction for students at different achievement levels.

***Frequency of formal student assessment***. Teachers were asked how often they used the

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designated Title I teachers. Among all of the teachers who were included in the LESCP sample, less than 10 percent were designated Title I or "Special Instruction" teachers during each of the three years.

following methods to formally assess the progress of their typical students: 1) multiple-choice tests; 2) writing samples; 3) oral, one-on-one reading; 4) portfolios. A composite variable was created to indicate the frequency with which teachers used these formal assessment tools.

***Addressing Student Instructional Needs.*** Teachers were asked to indicate the extent to which they used the following strategies for students having difficulty mastering course content or attaining state-set academic standards: 1) parent-teacher meetings to discuss how parents can help; 2) referrals to community organizations; 3) provision of extra attention from the teacher; 4) provision of extra attention from another school staff member during the regular school day; 5) provision of extra attention from another school staff member outside of the regular school day. A composite variable was created to indicate the extent to which teachers used multiple strategies to address student needs. A second composite variable was created to indicate the extent to which teachers sought support for students outside of the school and regular school day.

***Coordination Among Regular and Specialized Teaching Staff.*** Subject-specific composite variables (reading/language arts and math) were created to indicate the extent to which teachers coordinated activities with Title I staff and/or special service staff, using items from the teacher survey. These items measured the frequency with which reading/language arts and math teachers consulted with Title I staff/special service staff to: 1) develop written lesson plans for Title I students/special service students; 2) discuss coordination of content and activities; and 3) share written records of students' progress.

***Relevance of Professional Development.*** Items on the teacher survey asked teachers to rate the extent to which they believed that professional activities during the prior year were: 1) well matched to the school's or department's plan to change practice; 2) designed to support state or district assessment; 3) designed to support reform efforts underway in the school; 4) designed to support state or district standards or curriculum frameworks. These items were used to create a composite variable indicating the extent to which professional development activities were relevant to local needs.

***Quality of Professional Development.*** Teachers rated the adequacy of professional development in 1) content in math; 2) content in reading; 3) instructional strategies for teaching limited-English proficient students; 4) instructional strategies for teaching low achieving students; 5) instructional strategies for teaching math; 6) instructional strategies for teaching reading; and 7) using assessment results. A composite was created indicating overall teacher perceptions of professional development quality. Two additional composite variables were created indicating teacher perceptions of professional development quality related to reading and mathematics.

***Impact of Teacher Professional Development.*** Teachers were asked to indicate the extent to which professional development activities increased their knowledge or helped them to change practice. Items on the teacher survey asked respondents to indicate the extent to which professional development helped them: 1) adapt teaching to meet state assessment requirements; 2) adapt teaching to meet state standards or curriculum framework requirements; 3) have increased confidence in using new pedagogical approaches in teaching math; 4) have increased confidence in using new pedagogical approaches in teaching reading/language arts; 5) be more motivated to draw from a wide variety of methods when teaching; 6) understand how to help

students engage in collaborative inquiry. Subject-specific composite variables were created to indicate the overall extent to which teachers perceived an impact of professional development activities.

***Teacher Certification.*** A dummy variables was created, indicating whether a teacher was state certified to teach math and or reading/language arts.

***Teacher Experience.*** Total teaching experience, in years, overall and in the current school.

***Teacher Second Language Skills.*** Dummy variable with a value of "1" for teachers who were proficient in a language other than English that his or her students spoke as a first language.

***Teacher Participation in Professional Development Activities.*** The teacher survey asked teachers to report participation in professional development activities according to the amount they received in the following areas: 1) content in reading; 2) content in mathematics; 3) instructional strategies for teaching reading; 4) instructional strategies for teaching math; 5) strategies for using assessment results; 6) instructional strategies for teaching low achieving students; 7) strategies to increase or strengthen parent involvement. A composite variable was created indicating teacher professional development participation across all areas. Two additional composite variables were created indicating teacher participation in professional development related to reading and mathematics.

## School-Level Variables

Data describing schools were taken from the principal and Title I district coordinator interviews. Data from the principal interview includes information about the school, the Title I program, school curriculum and instruction, and professional development activities. The Title I district coordinator interview provided data about district support and policy that characterize the context in which the school operated.

***School Size.*** Total fall student enrollment.

***School Poverty.*** Percent of students who received free or reduced price lunch.

***Targeted Assistance School.*** Dummy variable with value of "1" for schools implementing targeted assistance Title I programs. All other schools were implementing Title I schoolwide programs.

***Use of Title I Funds.*** Principals were asked to describe how Title I resources were used at the school by describing the role of Title I in several school activities, including: 1) providing extra instruction for low achieving students in certain content areas; 2) involving parents as partners in their children's education; 3) expanding professional development opportunities for teachers and

aides. A composite variable was created to measure the extent to which Title I resources were used to support the role of parents and teachers in students' education.

***School Use of Standards-Based Curriculum.*** The principal interview included questions about the extent to which the school used state- or district-developed content standards to guide instruction for reading and math and the extent to which the skills and content taught matched state and district assessments. A single composite variable was created from these items to indicate the extent to which the school used a standards based curriculum.

***School Use of Extended Instructional Time.*** Items from the principal interview were used to assess the extent to which the school used an extended school day and an extended school year to increase instructional time.

***School Implementation of Standards Based Reform.*** Principals were asked to rate the extent to which the school was implementing the following strategies associated with standards-based reform: 1) professional development to enable staff to teach the content students are expected to learn; 2) assessments that measure performance against the content students are expected to learn; and 3) staff participation in professional networks focused on standards-based reforms. These items were used to create a composite indicating the extent to which schools implemented standards-based reform strategies.

***School Goals.*** Principals were asked whether or not specific goals had been established for: 1) improving the partnership between school and family; 2) improving teacher performance, specifically in core academic areas; and 3) improving professional development for teachers. These items were used to create a composite variable indicating the presence of school goals.

***School Support for Teacher Professional Development.*** Items from the principal interview were used to create a composite variable indicating the resources provided by the school for professional development. Four items measured the extent to which the school provided the following resources: 1) inservice days; 2) mini-grants; 3) release days; 4) funds for summer training. Principals were also asked to indicate the extent to which teachers received professional development from a variety of sources, including: 1) district professional development center; 2) other staff employed by the district; 3) professional developers affiliated with reform models (e.g., Success for All); 4) new curriculum frameworks from the state or district; 5) other consultants; 6) other staff who work in the building; 7) regional centers or BOCES. These items were used to create a composite variable indicating the extent to which professional development activities were received from a number of sources.

***Policy Context - Emphasis on Standards-Based Reform.*** Prior analyses of the LESCP (Turnbull et al. 1999; 2001) included variables indicting district and school emphasis on standards-based reform. These variables were constructed using several data sources, focusing primarily on local documents collected onsite in each school district. We included these variables in our analysis because they were the most comprehensive indicator of district emphasis on standards-based policy available.

***Technical Assistance and Support.*** A categorical variable indicating the extent of technical assistance provided to district schools by district staff was taken from the district Title I

coordinator interview. A dummy variable was also created with a value of "1" for schools that received support from the state's system of School Support Teams (principal survey).

***External Factors Affecting Change in Curriculum and Instruction.*** Principals were asked to rate several factors (over which schools may have limited or no control) according to the extent to which they affected changes in curriculum and instruction: 1) district or school testing programs; 2) state testing mandates; 3) public reporting of school or district performance data; 4) changes in the demographics of the student body; 5) new textbooks; 6) new curriculum frameworks from the state or district. Ratings from these six items were combined into a composite variable indicating the extent to which external factors affected changes in curriculum and instruction.

***Parent Involvement.*** A composite variable was created to reflect the extent of parent support provided to students, based upon principal perceptions. Items from the principal interview measured the extent to which parents: 1) helped their children with their schoolwork; 2) made sure their children attended school regularly; and 3) made sure their children attended school on time

***School Support for Parent Involvement.*** Principals were asked to rate the extent to which the school implemented parent involvement activities and to indicate whether or not the school: 1) has written compacts between the school and individual parents on what each will do to help students succeed in school; 2) established specific goals for improving the partnership between school and family.

***Principal Education.*** Highest level of education completed (Associate's, Bachelor's, Master's or professional degree, Doctorate).

***Principal Experience.*** Principal tenure, in years, at the current school.

***Principal Awareness of Standards and Title I Policy.*** An item from the principal interview was used to assess principals' familiarity with state content and/or performance standards in core academic subjects. Principals were also asked to rate the extent to which they felt informed about Title I legislation and whether or not they reviewed the state and district Title I or IASA plans. These items were combined to create a composite variable indicating overall principal awareness of Title I policy and plans.

## Analytic Samples

### *Hierarchical Analyses*

The LESCP data files included imputed values for missing responses on the classroom teacher surveys. These imputed data were limited to variables included in prior analyses,

however (Turnbull et al, 1999; 2001). The HLM achievement growth analyses excluded these imputed values, working with only original responses by teachers.

For longitudinal analyses, the LESCP longitudinal sample was used, which consists of students with test data at three points in time (spring of 1997, 1998, and 1999). Several students, however, did not have test data for all three points in time, due in large part to student mobility during the course of the study (the study did not follow students who moved to schools not included in the LESCP sample). The generalizability of the longitudinal sample was therefore limited in that it represented only students who stayed at the same school for three consecutive years. Prior analyses indicated that this more stable student population had higher average standardized test scores than other students (Turnbull et al., 2001). To increase the generalizability of the longitudinal sample and to increase the overall sample size, test score imputation methods were used.

Test data and student demographic information were used to impute reading and math SAT-9 scores for those students who had test data for two of three points in time. Several prediction models were used, based on data for students who had test scores for all three points in time, to impute a missing third score. The variables used to predict missing student test scores included scores at the other two test points, gender and ethnicity. While there were limited student-level data available for use in the prediction models, these variables explained roughly two-thirds of variation in test scores across the prediction models. The final imputation models were consistent with those used in prior analyses of data from similar student populations (Wong et al., 1995). Despite the availability of a wider range of student-level data, the Wong et al. study also found that best predictors of a test score were the scores at the other two time points and that coefficients associated with the race/ethnicity variables were substantial.

To minimize the impact of missing data at the student, classroom, and school levels, some variables included in the initial conceptual model were dropped. For example, information about the extent to which schools used written standards to assess the quality of teachers and professional development activities was available only for a small group of schools. Despite elimination of variables and imputation procedures, missing data remained a problem To reduce the impact of missing data on sample sizes, classroom- and school-level composite variables were created by averaging scores across the 1997-98 and 1998-99 school years. If data for one of the two years were missing, the available data were used as an estimate of the longitudinal measure. These variables therefore reflected the curriculum and instruction and educational resources experienced by students during the two academic years between the pre- and post-test reading and math achievement measures (spring 1997 and spring 1999). Table II.2 presents the sample sizes of the original LESCP longitudinal sample and the imputed longitudinal sample.

The selection of students who remained in the same schools during the three years of the study reduced the generalizabiltiy of the findings from the achievement growth analyses, by limiting the analysis to non-mobile students. The descriptive analyses that follow, however, present classroom-level data reflecting a larger sample of students.

### *Descriptive Analyses*

Separate samples were created for the descriptive analyses, providing classroom-level data on educational resources allocated to the full LESCP sample. In addition to presenting data for all classrooms serving students in the sample, data are presented for low- and high-achieving classrooms and by grade level. Methods for developing these samples are described below.

*Grouping by Achievement.* To compare responses from high- and low-achieving classrooms, teacher identification numbers were used to match teachers and students in the LESCP sample. Average classroom achievement scores in math and reading were computed

based on individual student test scores. Not all teachers in the LESCP sample had students who also participated in the LESCP study. In addition, some teachers had very few sampled students, while others had more than 20. To increase the validity of average classroom achievement scores, only teachers associated with at least 10 sampled students with valid achievement data were included in these analyses. Although this reduced the sample size considerably, a pool of approximately 200 teachers remained for each of three years.

To determine "high-achieving" and "low-achieving" classrooms, three different indicators of achievement were used: a reading achievement score, a math achievement score, and an average of the two scores. After sorting teachers according to their average classroom achievement level, they were grouped into four categories: top 5 percent, top 20 percent, bottom 20 percent, and bottom 5 percent.

*Grouping by Grade Level.* Comparing teachers by grade level taught was straightforward, with one exception. The LESCP teacher survey instructed teachers to circle all grades they taught, and then to "answer the questions in this section thinking about the topmost grade circled above." Thus, if a teacher taught 1$^{st}$ and 3$^{rd}$ grade, their "top grade" would be 3$^{rd}$ grade, the higher of the two. The "top grade" designation was used to associate teachers with grades in these descriptive analyses.

## III. ANALYSIS METHODS

### Hierarchical Models

Hierarchical linear models (HLMs) were used to model variation in baseline student achievement and achievement growth during the three years of the study. Separate models were developed for reading and math achievement, and were designed to model achievement growth at level-1, student characteristics and instructional experiences at level-2, and school characteristics at level-3. The two-level analyses focused on the effect of student characteristics and classroom-level educational resource indicators on student achievement outcomes. The three-level analyses focused on the impact of school characteristics and school-level educational resource indicators on student achievement outcomes. This approach to modeling achievement outcomes is consistent with prior analyses of LESCP and other Title I data sets (e.g., Turnbull, 2001; Wong et al. 1995). The general form of each type of model (level-1, level-2, and level-3) is described below. Actual analyses used a series of models that explored the full range of variables identified in the prior section.

#### *General Level 1 Model: Individual Student Achievement Growth Trajectories*

Level-1 analyses modeled student growth trajectories over the course of the study (i.e., achievement growth between spring 1997 and spring 1999). Thus, within each student, were three "nested" scores, one for each year of the study. Outcome variables at level-1 were Stanford Achievement Test (SAT-9) closed-ended scores in reading and math. Separate models were specified for mathematics and reading achievement, using the general form:

$$Y_{ijk} = ⑥_{0ij} + ⑥_{1ij} x_k + e_{ijk},$$

where $Y_{ijk}$ is the outcome score for person i, in school j, at time point k; $x_k$ is the time of measurement (i.e., spring 1997, 1998, or 1999), and $e_{ijk}$ is student- and time-specific residual. The growth parameters are the intercept $\pi_{0ij}$ and the linear growth coefficient, $\pi_{1ij}$. The subscripts i and j indicate that these coefficients are person-specific.

### *General Level 2 Model: Impact of Student Attributes and Educational Resources on Individual Achievement Growth*

Each of the $\pi$ coefficients in the level-1 model become outcome variables at level-2. In other words, individual student achievement and achievement growth parameters became level-2 outcome variables that were hypothesized to be affected by a range of level-2 predictors, including student attributes and the allocation of classroom-level educational resources over the course of the study. Several level-2 models were explored, including the following five categories of variables (described in the prior section): individual student attributes, curricular/instructional attributes, and indicators of organizational capacity, human capital, and social capital. These variables are represented in the following general level-2 model:

$$\pi_{sij} = \beta_{s0j} + \beta_{s1j}\text{STATTRIB}_{ij} + \beta_{s2j}\text{CURRINST}_{ij} + \beta_{s3j}\text{ORGCAP}_{ij} + \beta_{s4j}\text{HUMCAP}_{ij} + \beta_{s5j}\text{SOCCAP}_{ij} + r_{sij},$$

where the $\pi_{sij}$ are student-specific achievement growth curve parameters ($\pi_{0ij}$ and $\pi_{1ij}$ with s=0 and s=1, respectively); $\text{STATTRIB}_{ij}$ are individual-level student characteristics such as race/ethnicity or gender; $\text{CURRINST}_{ij}$ are curricular and instructional attributes; $\text{ORGCAP}_{ij}$ are indicators of organizational capacity; $\text{HUMCAP}_{ij}$ are indicators of human capital; $\text{SOCCAP}_{ij}$ are indicators of social capital; and $r_{sij}$ is a residual.

### *General Level 3 Model: Impact of School Resources and Characteristics*

The level-3 model was used to model the attributes of schools and school-level educational resource indicators that explain differences in student achievement outcomes. School level variables were in categories parallel to those at the classroom level, consisting of: school attributes, curricular/instructional attributes, and indicators of organizational capacity, human capital, and social capital. These variables are represented in the following general level-3 model.

$$\beta_{sti} = \gamma_{st0} + \gamma_{st1}\text{SCATTRIB}_j + \gamma_{st2}\text{CURRINST}_j + \gamma_{st3}\text{ORGCAP}_j + \gamma_{st4}\text{HUMCAP}_j + \gamma_{st5}\text{SOCCAP}_j + u_{stj},$$

where the $\gamma_{stj}$ reflect the relationship between school characteristics and school effects. $\text{SCATTRIB}_j$ are school level attributes such as school poverty and policy context; $\text{CURRINST}_j$ are curricular and instructional attributes; $\text{ORGCAP}_j$ are indicators of organizational capacity; $\text{HUMCAP}_j$ are indicators of human capital; $\text{SOCCAP}_j$ are indicators of social capital; and $u_{stj}$ are is a residual.

A separate set of cross-sectional hierarchical models were run that modeled point-in-time student achievement as a function of student characteristics at level-1, classroom characteristics at level-2, and school characteristics at level-3, controlling for pre-test achievement. These analyses focused on point-in-time achievement scores for a cohort of students and compared these scores to explanatory variables linked to their experiences during the prior school year. Results from these analyses were presented in the Interim Report (Wong, Meyer, & Shen, 2002) and yielded few significant findings.

### *Modeling Approach: Two-Level Models of Student Attributes and Classroom-Level Educational Resources*

Several hierarchical models were run for the reading and math achievement analyses. These models include student growth trajectories at level-1 with level-2 student and classroom variables that explain variation in level-1 growth parameters. Unconditional models with no predictor variables were developed first. These models present average initial student achievement scores, average learning growth rates, and tests of the hypotheses that all students have the same initial achievement scores and learning rates. Conditional models were run beginning with student attributes as predictors. Separate conditional models were run, including sets of variables in the following categories:

- Student attributes (gender, race/ethnicity, free lunch receipt, Title I participation);
- Classroom-level curricular/instructional attributes (minutes of reading/math instruction, standards-based curriculum, strategies to address instructional needs, outside support, instructional differentiation, frequency of formal student assessment);
- Classroom-level organizational capacity indicators (relevance of professional development, quality of professional development, coordination among instructional staff, class size);
- Classroom-level human capital indicators (teacher certification, teacher experience, teacher second language ability, teacher perception of standards, teacher perception of assessments, teacher professional development participation, impact of professional development); and,
- Classroom-level social capital indicators (frequency of parent involvement by teacher, scope of parent involvement by teacher, classroom title I student preparedness).

Subject-specific final models were created including only student attribute and classroom-level educational resource variables previously identified as significantly related to either the initial achievement score or learning rate.

### *Modeling Approach: Three-Level Models of School Attributes and School-Level Educational Resources*

The three-level models include student growth trajectories at level-1, within-school variation in growth parameters at level-2, and variation among schools at level-3. School attributes and

school level indicators of educational resources were used to model variation in average school initial achievement and average school learning rates. A parallel strategy was used to develop three-level models for reading and math achievement. Unconditional models with no predictor variables at levels 2 and 3 were developed first**.** These models present average initial student achievement scores, average learning growth rates, and tests of the hypotheses that all students have the same initial achievement scores and learning rates and that average initial achievement scores and learning rates vary significantly across schools. Next, conditional models were run beginning with school attributes as predictors. Separate conditional models were run including sets of variables in the following categories:

- School attributes (school size, school poverty, district focus on assessment and accountability, standards and consequences in school/district plans, support from school district, support from regional technical assistance centers, impact of external factors);
- School-level curricular/instructional attributes (standards-based curriculum, extended instructional time, standards-based reform emphasis);
- School-level organizational capacity indicators (school goals, support for professional development, targeted assistance school, title I to support the role of parents);
- School-level human capital indicators (principal education, principal experience, principal awareness of title I, principal awareness of standards); and,
- School-level social capital indicators (level of parent support, goals for family partnership, written parent compacts).

Subject-specific final models were created including only school attribute and school-level educational resource variables previously identified as significantly related to either the mean initial achievement score or mean learning rate.

## Descriptive Analyses

The descriptive analyses of classroom teacher surveys examine changes over time, differences between high- and low-achieving classrooms, and variation by grade level. In addition to composite resource measurements, responses to individual survey questions which comprise those composite measures are presented. Because the descriptive analyses did not

require that students in the analytic samples have complete longitudinal data they better reflect the full LESCP sample of students.

## IV. RESULTS

This section presents three sets of related analysis. Two-level analyses of student attributes and classroom-level educational resources are presented first, followed by three-level analyses of school attributes and school level educational resources. A summary of the hierarchical analyses presents results from all final models in a comparable and easily-interpreted statistic (months of learning), based on average reading and math achievement growth rates. Highlights from descriptive analyses of teacher surveys are also presented in this section.

### Two-Level Analysis of Student Attributes and Classroom-Level Educational Resources

A series of two-level models were developed following the steps described in the prior section. Tables IV.1 – IV.3 present two-level models for reading achievement and Tables IV.4-IV.6 present two-level models for math achievement. While additional models were run, these tables present the unconditional model, model with student attributes as predictors, and a final model including all classroom-level predictor variables that were significant in prior models.

The unconditional model for reading achievement is presented in Table IV.1. This model indicates that the average initial (spring 1997) reading score was 603.80 and the learning rate was 19.12 (over the two year period between spring 1997 and spring 1999). The large t-ratios indicate that these values are significantly different from zero. The "random effect" section describes the variance attributed to initial reading scores (1158.32) and student learning rates (2.48). The chi-square value for initial reading score indicates that initial scores varied significantly across students, while the chi-square value for learning rate indicates that learning rates did not vary significantly across students. Subsequent models therefore treated the reading

learning rate as a fixed coefficient, because there was not adequate variation among learning rates.

Table IV.2 presents the results of a conditional model, using student attributes as predictors. In addition to the student attribute variables described in the prior section, this model includes dummy variables with a value of "1" for students who had an imputed value for either the 1997, 1998, or 1999 reading test score. Including these variables in the model allows interpretation of coefficients for the other variables, controlling for the possible influence of the imputation process. The intercept for initial achievement, $\beta_{00,}$ in this model represents the average initial score for students who had values of zero on all the predictor variables, i.e., female, white students who were not free/reduced price lunch recipients nor Title I participants and who had no imputed test scores—see Section II for more information about variable coding.

The t-ratios for each variable test the hypothesis that the beta coefficients were significantly different from 0. The table indicates that the initial reading score model coefficients for Male, African-American, Hispanic, Free/ reduced lunch receipt, and Title I participant were significant. Each beta coefficient indicates the difference in initial reading score associated with each student attribute. For example, on average, male students had initial reading scores that were 4.79 lower than female students. Because the models in this section present unstandardized beta coefficients, the coefficients are not comparable across models. A summary at the end of this section presents results for the final model, using a comparable statistic (months of achievement, based on the average learning rate for all students). The proportion of variance explained by the model is presented at the bottom of the table, indicating that 21 percent of the initial reading score variance was explained by these student attributes

Table IV.3 presents results for the final two-level conditional model for reading achievement, using student attributes and all educational resource variables that were found to be significant in prior models. This table indicates that the coefficients for Male, African-American, Hispanic, Free/reduced lunch receipt, Title I participant, Standards-based curriculum, Relevance of professional development, Class size, and Teacher second language ability were significant. For example, on average, free/reduced lunch recipients had initial reading scores that were 12.26 lower than non-recipients. The educational resource variables in the model (except for class size, which is measured in number of students) were standardized with a mean of 0 and standard deviation of 1. The beta coefficients for these variables indicate the relative difference in achievement for a one standard deviation difference in the associated predictor variable. In all two-level HLM models, non-dichotomous variables (including both standardized and unstandardized variables) were "centered," which allows the intercepts and slopes to be interpreted as those for students with average values on these variables. The summary at the end of this section presents results for this and the final model, using a comparable and easily interpreted statistic (months of achievement, based on the average learning rate for all students). The proportion of variance explained by this model is 23 percent, just slightly higher than that explained by the model including only student attribute variables as predictors.

The unconditional model for math achievement is presented in Table IV.4. This model indicates that the average initial (spring 1997) math score was 592.63 and the learning rate was 21.89 (over the two year period between spring 1997 and spring 1999). The large t-ratios indicate that these values are significantly different from zero. The chi-square values indicate that initial math scores and learning rates varied significantly across students

Table IV.5 presents the results of the conditional model for math achievement, using student attributes as predictors. This table indicates that the initial math score model coefficients for Male, African-American, Hispanic, Free/reduced lunch receipt, and Title I participant were significant. The math learning rate model coefficients for African-American, Hispanic, Free/reduced lunch receipt, and Title I participant were also significant. Each beta coefficient indicates the difference in initial math score associated with each student attribute. For example, on average, Title I participants had initial math scores that were 13.96 lower than non-participants. Also, on average, Asian students had math learning rates that were 5.60 higher than white students. A summary at the end of this section presents results for the final model, using a comparable statistic (months of achievement, based on the average learning rate for all students). Thirteen percent of the initial math score variance and 26 percent of the math learning rate variance was explained by these student attributes.

Table IV.6 presents results for the final two-level conditional model for math achievement, using student attributes and all educational resource variables that were found to be significant in prior models. This table indicates that the coefficients for African-American, Hispanic, Free/reduced lunch receipt, Title I participant, Standards-based curriculum, Strategies to address instructional needs, Outside support, Frequency of formal student assessment, Teacher second language ability, and Scope of parent involvement by teacher were significant for the initial math score model. The coefficients for Male, Hispanic, Standards-based curriculum, Quality of professional development, Class size, Teacher certification, Teacher perception of standards, Teacher perception of assessments, and Teacher professional development participation were significant for the math learning rate model.

For example, on average, Title I participants had initial math scores that were 15.96 lower than non-participants and a one standard deviation decrease in the use of a standards-based curriculum was associated with math learning rates that were 1.81 lower. The summary at the end of this section presents results for this and the final model, using a comparable and easily interpreted statistic (months of achievement, based on the average learning rate for all students). The proportion of initial math score variance explained by this model is 17 percent and the proportion of math learning rate variance explained is 55 percent.

## Three-Level Hierarchical Models of School Attributes and School-Level Educational Resources

Three-level models were developed for reading and math achievement, using a strategy similar to that for the two-level models. Tables IV.7 – IV.9 present three-level models for reading achievement and Tables IV.10-IV.12 present three-level models for math achievement. While additional models were run, these tables present the unconditional model, model with school attributes as predictors, and a final model including all school-level predictor variables that were significant in prior models. The unconditional model for reading achievement is presented in Table IV.7. The chi-square values indicate that both average initial reading scores and average learning rates varied significantly across schools. The table also indicates that about 18 percent of the variance in initial reading scores and about 88 percent of the variance in learning rates was across schools.

Table IV.8 presents the results of a conditional model for reading achievement, using school attributes as predictors. As was the case with the classroom-level variables, several school-level composite variables were standardized with a mean of 0 and standard deviation of 1. The coefficients for these variables are interpretable as the difference in average initial reading score and learning rate associated with a one standard deviation increase on the predictor

variable. Some variables, such as School size (expressed as number of students), are unstandardized. Coefficients for these variables are interpretable as the difference in average initial reading score and learning rate associated with a one unit change in the variable, expressed in its original metric.

The table indicates that the average initial reading score model coefficients for School poverty, Standards and consequences in school/district plans, and Support from regional technical assistance centers were significant. No coefficients for the average reading learning rate model were significant. For example, on average, students in high poverty schools had lower average initial reading scores (-0.63 associated with each one percentage increase in the proportion of students receiving free/reduced student lunch). The school attribute variables in the model (except for school size and school poverty) were standardized with a mean of 0 and standard deviation of 1. The beta coefficients for these variables indicate the relative difference in achievement for a one standard deviation difference in the associated predictor variable. In all three-level HLM models, non-dichotomous variables (including both standardized and unstandardized variables) were "centered," which allows the intercepts and slopes to be interpreted as those for schools with average values on these variables. Because the models in this section present unstandardized beta coefficients, the coefficients are not comparable across models. A summary at the end of this section presents results for all models, using a comparable statistic (months of achievement, based on the average learning rate across schools). The proportion of variance explained by the model is presented at the bottom of the table, indicating that 71 percent of the initial reading score variance and 18 percent of the learning rate variance was explained by these school attributes.

Table IV.9 presents results for the final three-level conditional model for reading achievement, using school attributes and all school-level educational resource variables that were found to be significant in prior models. This table indicates that the average initial reading score model coefficients for School poverty, Standards and consequences in school/district plans, and Support from regional technical assistance centers were significant. No school-level variables were significantly associated with average reading learning rates. For example, on average, students in schools with a one standard deviation increase in support from regional technical assistance centers had initial reading scores that were 8.47 higher. The summary at the end of this section presents results for this and all final models, using a comparable and easily interpreted statistic (months of achievement, based on the average learning rate for all students). The proportion of variance explained by this model is 65 percent for average initial reading scores and 6 percent for average learning rates.

The three-level unconditional model for math achievement is presented in Table IV.10. The chi-square values indicate that both average initial math scores and average learning rates varied significantly across schools. The table also indicates that about 21 percent of the variance in initial reading scores and about 90 percent of the variance in learning rates was across schools.

Table IV.11 presents the results of a conditional model for math achievement, using school attributes as predictors. This table indicates that the average initial math score model coefficients for School size, School poverty, Standards and consequences in school/district plans, and Support from school district were significant. The average math learning rate model coefficient for District focus on assessment and accountability was also significant. For example, on average, students in high poverty schools had lower average initial math scores (-0.49 associated with each one percentage increase in the proportion of students receiving

free/reduced student lunch). Because the models in this section present unstandardized beta coefficients, the coefficients are not comparable across models. A summary at the end of this section presents results for the final model, using a comparable statistic (months of achievement, based on the average learning rate across schools). The proportion of variance explained by the model is presented at the bottom of the table, indicating that 52 percent of the initial math score variance and 18 percent of the learning rate variance was explained by these school attributes.

Table IV.12 presents results for the final three-level conditional model for math achievement, using school attributes and all school-level educational resource variables that were found to be significant in prior models. This table indicates that the average initial math score model coefficients for School size, School poverty, Standards and consequences in school/district plans, and Support from school district were significant. Average learning rate model coefficients for District focus on assessment and accountability, Targeted assistance school, and Written parent compacts were also significant.

For example, on average, students in schools with a one standard deviation increase in support from the school district had initial math scores that were 7.95 lower and students in schools with written parent compacts had learning rates that were 4.40 higher. The summary at the end of this section presents results for this and all final models, using a comparable and easily interpreted statistic (months of achievement, based on the average learning rate for all students). The proportion of variance explained by this model is 51 percent for average initial math scores and 33 percent for average learning rates.

### Summary of Findings from Hierarchical Models of Reading and Math Achievement

Results from all models presented in Tables IV.1 through IV.12 are summarized below. To maximize interpretability and comparability across models, results are presented as months of

reading and math achievement, based on average monthly learning rates. Average monthly learning rates were calculated for each of the four final models (two-level and three-level reading and math achievement), based on the learning rate coefficient in the unconditional models.

### *Student and School Attributes*

The HLM analyses documented several achievement gaps in reading and math among students, both in terms of third-grade student achievement and achievement growth over the course of the study. Relative to the average for all third-grade students:

- African American students were about 13 months behind in reading and 12 months behind in math.
- Hispanic students were about 6 months behind in reading and 6 months behind in math and gained at a slightly faster rate in math (about 3 additional months per year).
- Third grade male students were 3.5 months behind in reading and had more gradual achievement gains in math (2.6 fewer months per year).
- In third grade, Title I participants were about 14.5 months behind in both reading and math and gained more slowly in math (about 4 fewer months per year).
- Free/reduced lunch recipients were 9.7 months behind in reading and 8.1 months behind in math.
- Third grade students in high-poverty schools had lower average scores (a one percentage point increase in the proportion of students eligible to receive free/reduced student lunch was associated with students being about 0.5 months behind in both reading and math).

### *Curricular/Instructional Attributes and Educational Resources Associated with Higher than Average Initial Achievement*

The HLM analyses also identified aspects of schools and classrooms (measured during the 1997-98 and 1998-99 school years) that were significantly associated with baseline (spring 1997) student achievement in reading and math. In other words, these results identify differences in fourth and fifth grade resource allocation among students who were higher-achieving at the end of third grade.

*Reading Achievement.* Students in classrooms and schools (in 1997-98 and 1998-99) with the following characteristics had higher than average baseline (spring 1997) reading scores:

- A standards-based curriculum in reading (one standard deviation (SD) was associated with higher baseline reading achievement: 3.4 months)
- Reading teachers who reported professional development activities as relevant (one SD was associated with higher baseline reading achievement: 0.3 months)
- Reading teachers with second language ability (one SD was associated with higher baseline reading achievement: 3.1 months)
- Schools with standards and consequences reflected in school and district plans (one SD was associated with higher baseline reading achievement: 3.4 months)
- Schools that received support from regional technical assistance centers (receipt of support associated with higher baseline reading achievement: 6.8 months)

*Math Achievement.* Students in classrooms and schools (in 1997-98 and 1998-99) with the following characteristics had higher than average baseline (spring 1997) math scores:

- A standards-based curriculum in math (one SD was associated with higher baseline math achievement: 7.3 months)
- Support provided outside of the school and regular school day (one SD was associated with higher baseline math achievement: 10.9 months)
- More frequent formal student assessment by math teacher (one SD was associated with higher baseline math achievement: 2.8 months)
- Standards and consequences reflected in school and district plans (one SD was associated with higher baseline math achievement: 3.4 months)

### *Curricular/Instructional Attributes and Educational Resources Associated with Lower than Average Initial Achievement*

These results identify differences in fourth and fifth grade resource allocation among students who were lower-achieving at the end of third grade.

*Reading Achievement.* Students in classrooms and schools (in 1997-98 and 1998-99) with the following characteristics had lower than average baseline (spring 1997) reading scores:

- Larger class size (each additional student was associated with lower baseline math achievement: -2.6 months)

*Math Achievement.* Students in classrooms and schools (in 1997-98 and 1998-99) with the following characteristics had lower than average baseline (spring 1997) math scores:

- Math teachers who used multiple strategies to address instructional needs (one SD was associated with lower baseline math achievement: -13.2 months)

- Math teachers with second language ability (student placement with these teachers was associated with lower baseline math achievement: -6.0 months)

- Math teachers who used more parent involvement efforts (one SD was associated with lower baseline math achievement: -3.9 months)

- Schools that received support from the district (receipt of support was associated with lower baseline math achievement: -7.4 months)

### *Curricular/Instructional Attributes and Educational Resources Associated with Positive Achievement Gains*

These analyses also identified aspects of schools and classrooms that were significantly positively related to achievement gains over the course of the study. Because there was non-significant variation among achievement slopes in reading, no predictors are presented for reading gains.

*Math Achievement.* Students in math classrooms and schools (in 1997-98 and 1998-99) with the following characteristics had higher than average achievement gains in math:

- Math teachers who reported having had higher quality professional development (one SD associated with 0.9 more months per year)

- Math teachers who were state certified (certification associated with 2.9 more months per year)

- Math teachers who believed assessments were appropriate (one SD associated with 0.7 more months per year)

- Math teachers who participated more in professional development (one SD associated with 2.3 more months per year)

- Schools that used written parent compacts (use of compacts associated with 4.1 more months per year)

- Schools with a targeted-assistance Title I program (targeted-assistance program associated with 4.1 more months per year)

### *Curricular/Instructional Attributes and Educational Resources Associated with Negative Achievement Gains*

These results identify aspects of schools and classrooms that were significantly negatively related to achievement gains over the course of the study.

*Math Achievement.* Students in math classrooms and schools (in 1997-98 and 1998-99) with the following characteristics had lower than average achievement gains in math:

- A standards-based curriculum in math (one SD associated with 1.6 fewer months per year)

- Math teachers who believed standards were appropriate (one SD associated with 1.6 fewer months per year)

- Schools in districts that focused more on assessment and accountability (one SD associated with 0.9 fewer months per year)

## Highlights from Descriptive Analyses

These descriptive analyses are based on a detailed exploration of data from the teacher surveys, providing additional information about educational resource allocation across student sub-populations. Highlights from these analyses are presented below. While findings from these analyses are less robust than those presented earlier in this section because they are not based on tests of statistical significance, they nonetheless provide useful information and may suggest directions for future research.[7]

[7] Due to space considerations, we do not include the descriptive summary tables with this paper. These tables are available upon request from the authors.

- ***Teachers in higher-achieving classrooms were more likely to report that professional development activities were "well matched to [their] school's or department's plan to change practice."*** In both 1998 and 1999, the mean response for teachers in the top 5 percent of classrooms was highest, followed by the response of those in the top 20 percent. From 1998 to 1999, there was also an upward trend in all four of the sub-groups, as teachers judged professional development to be better matched to school or department plans in 1999.

- ***Teachers in higher-achieving classrooms had more teaching experience and more experience in their current school than teachers in lower-achieving classrooms***. This pattern was apparent in each of the three survey years, with greater differences in 1998 and 1999 than in 1997. In 1999, for instance, the top 5 percent of teachers had over 22 years of total teaching experience, the top 20 percent had 16 years, the bottom 20 percent had just over 12 years, and the bottom 5 percent had just over 11 years experience. The same pattern was observed for teaching experience in their current school.

- ***Oral, one-on-one reading assessments were used more often in the lower grades, while multiple-choice tests were more common in upper grades.*** In 1999, 33 percent of first grade and 20 percent of second grade teachers reported that they never used multiple-choice tests. In the third, fourth, and fifth grades, less than 15 percent of teachers reported never using multiple-choice tests. In contrast, more than 77 percent of first grade teachers reported that they used oral, one-on-one reading assessments once or twice weekly, while only 59 percent of fourth and 56 percent of fifth grade teachers reported the same frequency of use. In 1998 this difference was even more pronounced, with first grade teachers at 84 percent and fifth grade teachers just below 60 percent.

- ***Teachers in lower-achieving classrooms used multiple-choice tests more frequently.*** In both 1998 and 1999, teachers in classrooms with the lowest performing students made greater use of multiple-choice tests than teachers in highest performing classrooms. In 1998, 40 percent of teachers in the lowest performing classrooms reported using multiple-choice tests once or twice a week, while only about 20 percent of teachers in the highest performing classrooms reported this level of use. Although the difference was less pronounced in 1997, the 1999 data reflect this trend, indicating a slight increase in the difference between low and high-achieving classrooms (see Table D.29).

- ***Fewer teachers in lower achieving classrooms were state certified than their counterparts in higher-achieving classrooms.*** In 1998 and 1999, over 90 percent of teachers in the highest-achieving 5 percent of classrooms were certified. The higest-achieving 20 percent of classrooms had 87 percent certified in 1998, and 95 percent in 1999. The lowest-achieving 20 percent of classrooms, however, had only 80 percent certified in 1998 and 1999. The bottom 5 percent fared better in 1999, with 80 percent certified, but in 1998 had only a 58 percent certification rate.

- ***Considering teachers in all classrooms, reports indicate that the quantity and quality of professional development decreased over the course of the study***. Comparison of overall teacher means across years indicates decreases in professional development in

strategies for teaching math, strategies for using assessment results, and strategies for teaching low-achieving students. On average, teachers also reported a decrease in the quality of professional development related to strategies for using assessment results.

## V. DISCUSSION

These supplemental analyses of the LESCP data documented substantial achievement gaps for Title I students, free lunch recipients, and racial/ethnic minority students that remained large, even after considering a range of curricular, instructional, and other educational resource variables. While student attributes, such as poverty, gender, and race/ethnicity accounted for the majority of variation in reading and achievement across students and schools, several educational resource indicators were identified that explain achievement variation. Significant relationships were found between achievement and indicators across all categories of educational resources identified in the conceptual framework, including school attributes, curriculum and instruction, organizational capacity, human capital, and social capital.

These findings provide information for administrators and policymakers to consider in the development of state and district school reform efforts—specifically related to the needs of disadvantaged student subpopulations and the effects of resource allocation decisions in high-poverty schools. In particular, findings from these analyses suggest the following:

- Racial/ethnic gaps remained large even after controlling for indicators of poverty and educational disadvantage (i.e., receipt of free/reduced student lunch and Title I participation). This suggests the need to continue to examine causes of these achievement gaps and ways that educational systems can meet the needs of these subpopulations. Further, the size of these achievement gaps was substantial at the end of third grade, highlighting the importance of early intervention programming.

- School poverty had a substantial effect on achievement, independent of individual student poverty. This finding is consistent with recent research suggesting that low-income students perform better in low-poverty schools than those in high-poverty schools (Lefly, 2002). Additional research is needed to better understand these "concentration effects" associated with schools that have a high proportion of disadvantaged students. Qualitative

research may be better suited to a comprehensive understanding of the complex factors that explain these differences.

- Several differences were identified in educational resource allocation for low- and high-achieving students, although few of these differences were significantly associated with differences in achievement gains. Persistent differences in resource allocation may, however, lead to long-term effects and warrant additional investigation. Given continued evidence of funding gaps for low-income and minority students (Orlofsky, 2002), questions about the impact of differing resources must continue to be explored.

- Of the six indicators significantly associated with achievement gains in math, four were indicators of human capital (teacher certification, professional development participation, rating of professional development as high quality, and rating of assessments as appropriate). The descriptive analyses also suggested that certified teachers and those with most experience were in classrooms with the highest-achieving students. These findings suggest the importance of teaching staff in determining student achievement outcomes and the value of qualified and experienced teachers.

- The use of written parent compacts was positively associated with achievement gains in math. While the value of parent compacts for improving reading achievement has been acknowledged by policymakers and practitioners (e.g., Russo et al, 2002), this finding suggests the continued importance of formalizing parent involvement across subject areas.

- Schools with a targeted-assistance Title I program were identified as having higher than average achievement gains in math, relative to those with schoolwide programs. This suggests that targeted-assistance programming may have unique benefits for math instruction. However, because schoolwide program schools represented the majority of the LESCP sample (83 percent), the sample of targeted assistance schools is substantially less representative. Further, schoolwide programs are, by definition, the highest poverty Title I schools (having at least 50 percent of students in poverty), and this difference may be an artifact of the relationship between school poverty and achievement, described above.

- The use of standards-based curriculum, teacher belief in the appropriateness of standards, and school and district focus on assessment and accountability were all negatively associated with math achievement gains. This may reflect schools that were experimenting with new curricula and accountability systems that were more or less finalized at the time of LESCP data collection. It may also be that accountability activities were focused in particular grades or classrooms in response to unmeasured characteristics or practices that negatively influenced student achievement.

While these findings suggest several implications for policy and practice, their limitations should be acknowledged. Although the LESCP sample is large and reflects data collected

throughout the U.S., it is not statistically representative of the entire U.S. student population. The sample was purposively selected to maximize information about high-poverty Title I schools engaged in standards-based reform activity. Further, because participating schools were identified by districts, there may have been a bias toward selecting more effective schools (U.S. General Accounting Office, 2000). Lastly, because the study design did not follow students who changed schools, this analysis is limited to non-mobile students who represent a more stable and typically higher-achieving subgroup. These limitations may help explain the unexpected finding that gains in reading achievement did not vary across sampled students.

Nonetheless, this paper suggests several considerations for allocating resources in high-poverty schools and presents a framework and initial findings for future research that can validate and continue to investigate these relationships. Large, nationally representative studies of schools serving low-income students continue to have strong potential for increasing this knowledge base.

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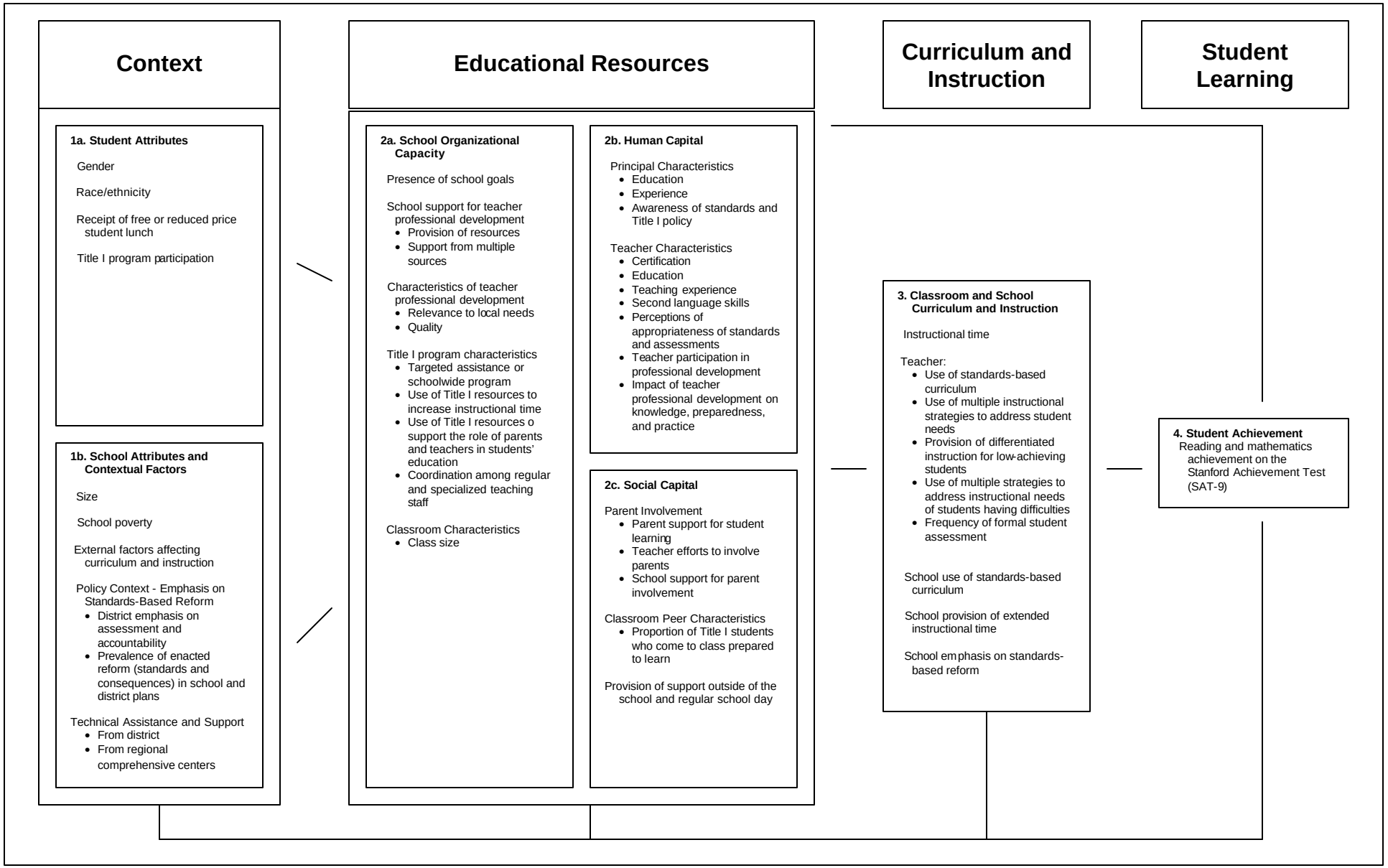
## Figure I.1 Conceptual Model



## Table II.1 Summary of Variables Derived from LESCP Data

| Category | Variables | Survey Instruments<br>Regular classroom teacher | <br>Principal |
|---|---|---|---|
| **CONTEXT** | | | |
| **Student Characteristics** | Gender, Race/ethnicity, Free or Reduced Lunch Receipt, Participation in Title I | Available from student information matrix | |
| **Student learning** | Closed-ended reading (ceread), Open-ended reading (oeread), Closed-ended math (cemath), Open-ended math (oemath), Vocabulary (vocab), Reading comprehension (compr), Math problem solving (prbslv), Math procedures (precdr) | Measured by SAT-9 achievement scores and available from student information matrix | |
| **School Attributes** | School Size | Available from school data set | |
| | Level of school poverty | Variable computed based on aggregate, individual-level data | PTA-47/PSW-41<br>(97: PTA-36a/PSW-32a) |
| | District emphasis on standards-based reform policy | *Identified in data set* | |
| | Extent of technical assistance provided to district schools by district staff | | District Level: TI-4a |
| | Receipt of support from the state's system of School Support Teams | | PTA-72a / PSW-65a<br>(97:PTA-54a / PSW-48a) |
| | Extent to which external factors affected changes in curriculum and instruction | | PTA-35a-f/PSW-29a-f<br>(97: PTA-26a-f/PSW-22a-f) |
| **RESOURCES** | | | |
| **School Organizational Capacity** | Presence of school goals | | PTA-52a / PSW-46a<br>PTA-26a / PSW-20a<br>PTA-61a / PSW-55a |
| | Resources provided by school for professional development | | PTA-70a-d / PSW-63a-d |
| | Extent to which professional development activities were relevant to local needs | SWC/TAC-58a,b,c,d | |
| | Quality of teacher professional development across all areas | SWC/TAC-57a-f,h (quality) | |
| | Quality of prof. dev. quality in reading | SWC/TAC-57a-c | |
| | Quality of prof. dev. quality in mathematics | SWC/TAC-57b-d | |
| | Targeted Assistance School | Available from school data set | |

| Category | Variables | Survey Instruments<br>Regular classroom teacher | <br>Principal |
|---|---|---|---|
| | Use of Title I resources to support role of parents and teachers in students' education | | PTA-3a-c / PSW-7a-c |
| | Teacher coordination with Title I staff and/or special service staff in reading | SWC/TAC-25a-c | |
| | Teacher coordination with Title I staff and/or special service staff in mathematics | SWC/TAC-52a-c | |
| | Class size | SWC/TAC-3 (reading)<br>SWC/TAC-28 (math) | |
| **Human Capital** | Principal Education | | PTA-77 / PSW-70 (97:PTA-58/PSW-52) |
| | Principal Experience | | PTA-75 / PSW-68 (97:PTA-56/PSW-50) |
| | Overall principal awareness of Title I policy and plans | | PTA-20a / PSW-14a (97: PTA-18a)<br>PTA-21a,b / PSW-15a,b (97:PTA-19a,b) |
| | Principal familiarity with content and/or performance standards | | PTA-32 / PSW-26 (97: PTA-21 / PSW-17) |
| | Teacher Certification | 62bb | |
| | Teacher Experience | 62a, 62b | |
| | Teacher Second Language Skills | 63 | |
| | Teacher perception of appropriateness of assessments in reading | SWC/TAC-8c, SWC/TAC-9 | |
| | Teacher perception of appropriateness of standards in reading | SWC/TAC-8a,b,d | |
| | Teacher perception of appropriateness of assessments in math | SWC/TAC-33c, SWC/TAC-34 | |
| | Teacher perception of appropriateness of standards in math | SWC/TAC-33a,b,d | |
| | Teacher participation in prof. development across all areas | SWC/TAC-57aa-af,ah | |
| | Teacher participation in prof. development in reading | SWC/TAC-57aa,ac | |
| | Teacher participation in prof. development in mathematics | SWC/TAC-57ab,ad | |
| | Teacher perception of impact of prof. development | SWC/TAC-58ba-bf | |
| **Social Capital** | Principal perception of level of parental support for students | | PTA-50a,b,c / PSW-44a,b,c (97: PTA-44a,b,c / PSW-39a,b,c) |
| | Frequency of parent outreach by teachers | SWC/TAC-59a-c | |
| | Scope of parent outreach by teachers | SWC/TAC-60a-d | |
| | Written compacts between the school and individual parents | | PTA-49a / PSW-43a (97:PTA-40/PSW-36) |

| Category | Variables | Survey Instruments<br>Regular classroom teacher | <br>Principal |
|---|---|---|---|
| | Establishment of specific goals for improving the partnership between school and family | | PTA-52a / PSW-46a |
| | School Title I Student Preparedness | SWC/TAC-61a | |
| | Average classroom achievement level | Computed from information on student information matrix | |
| **CURRICULUM AND INSTRUCTION** | | | |
| **Classroom and School Curriculum and Instruction** | Teachers' use of standards-based curriculum in reading | SWC/TAC-6a-d | |
| | Teachers' use of standards-based curriculum in mathematics | SWC/TAC-31a-d | |
| | Extent to which teachers differentiate instruction | SWC/TAC-12a,f | |
| | Extent to which teachers use multiple strategies | SWC/TAC-54a-e | |
| | Teachers' search for support outside the school and regular school day | SWC/TAC-54c-e | |
| | Classroom instructional time | SWC/TAC-2 (reading)<br>SWC/TAC-27 (math) | |
| | Frequency of formal student assessment | SWC/TAC-15a-d (reading) | |
| | School use of standards-based curriculum in reading | | PTA-33a/PSW-27a |
| | School use of standards-based curriculum in mathematics | | PTA-33b/PSW-27b |
| | School use of extended instructional time | | PTA-74j / PSW-67j<br>PTA-74k / PSW-67k |
| | Extent to which schools implement standards based reform | | PTA-74b,f,l / PSW-67b,f,l |

**Table II.2**
**Sample Sizes for HLM Achievement Growth Analyses**

| | *SAT-9 Closed-Ended Reading* | *SAT-9 Closed-Ended Math* |
|---|---|---|
| LESCP Longitudinal Sample (students with test data at three points in time) | 1,408 | 1,372 |
| Students with Test Data at Two Points in Time | 1,419 | 1,424 |
| Imputed Longitudinal Sample (students with test data at three points in time, after imputation*) | 2,821 | 2,790 |
| . . .with complete data on key student-level analysis variables | 2,470 | 2,360 |
| . . .and complete data on key school-level analysis variables | 2,436 | 2,325 |

*Note: Scores could not be imputed for some students who had two of three test scores due to missing student demographic information.

**Table IV.1 Two-Level Model for Reading Achievement (Unconditional Model)**

| ***Fixed Effect*** | ***Coefficient*** | ***se*** | ***t ratio*** | |
|---|---|---|---|---|
| Average initial reading score, $\beta_{00}$ | 603.80 | 0.74 | 811.42 | |
| Average learning rate, $\beta_{00}$ | 19.12 | 0.23 | 84.36 | |
| ***Random Effect*** | ***Variance Component*** | ***df*** | ***$X^2$*** | ***p value*** |
| Student initial reading score, $r_{0i}$ | 1158.32 | 2469 | 15816.47 | 0.000 |
| Student learning rate, $r_{1i}$ | 2.48 | 2469 | 2446.36 | >.500 |
| Level-1 error, $e_{ti}$ | 256.31 | | | |
| ***Reliability of Coefficient Estimates*** | | | | |
| Initial reading score, $\theta_{0i}$ | .84 | | | |
| Learning rate, $\theta_{1i}$ | .02 | | | |
| ***Correlation of Initial Score with Learning Rate*** | -0.13 | | | |

## Table IV.2 Two-Level Model for Reading Achievement (Model with Student Attributes as Predictors)

| *Fixed Effect* | *Coefficient* | *se* | *t ratio* | |
|---|---|---|---|---|
| **Model for initial reading score, $\delta_{0i}$** | | | | |
| Intercept, $\beta_{00}$ | 642.52 | 2.18 | 294.50 | *** |
| Male, $\beta_{01}$ | -4.79 | 1.28 | -3.74 | *** |
| African American, $\beta_{02}$ | -16.14 | 1.51 | -10.66 | *** |
| Hispanic, $\beta_{03}$ | -8.76 | 2.29 | -3.82 | *** |
| Asian, $\beta_{04}$ | 0.38 | 5.53 | 0.07 | |
| Free/reduced lunch receipt, $\beta_{05}$ | -13.04 | 1.67 | -7.82 | *** |
| Title I participant, $\beta_{06}$ | -16.63 | 2.34 | -7.12 | *** |
| 1997 imputed score, $\beta_{07}$ | -8.55 | 1.62 | -5.28 | *** |
| 1998 imputed score, $\beta_{08}$ | -16.62 | 2.11 | -7.89 | *** |
| 1999 imputed score, $\beta_{09}$ | -3.64 | 1.85 | -1.97 | * |
| **Model for learning rate, $\delta_{1i}$** | | | | |
| Intercept, $\beta_{10}$ | 19.12 | 0.23 | 84.36 | *** |

| ***Variance Explained by Student-Level Predictors*** | | |
|---|---|---|
| ***Model*** | ***Initial Status Variance ($\delta_{0i}$)*** | ***Learning Rate Variance ($\delta_{1i}$)*** |
| Unconditional | 1158.32 | 2.48 |
| Conditional | 919.50 | N/A |
| Proportion of variance explained | 0.21 | N/A |

Note: ***=p<.001; **=p<.01; *=p<.05

## Table IV.3 Two-Level Model for Reading Achievement (Final Model with All Significant Student Attribute and Resource Variables)

| *Fixed Effect* | *Coefficient* | *se* | *t ratio* | |
|---|---|---|---|---|
| **Model for initial reading score, $\zeta_{0i}$** | | | | |
| Intercept, $\beta_{00}$ | 642.78 | 2.31 | 278.65 | *** |
| Male, $\beta_{01}$ | -4.40 | 1.26 | -3.48 | ** |
| African American, $\beta_{02}$ | -16.41 | 1.58 | -10.42 | *** |
| Hispanic, $\beta_{03}$ | -7.54 | 2.25 | -3.35 | ** |
| Free/reduced lunch receipt, $\beta_{04}$ | -12.26 | 1.66 | -7.39 | *** |
| Title I participant, $\beta_{05}$ | -18.02 | 2.42 | -7.43 | *** |
| 1997 imputed score, $\beta_{06}$ | -7.97 | 1.59 | -5.01 | *** |
| 1998 imputed score, $\beta_{07}$ | -15.35 | 2.07 | -7.41 | *** |
| 1999 imputed score, $\beta_{08}$ | -3.81 | 1.90 | -2.00 | * |
| Standards-based curriculum, $\beta_{09}$ | 4.29 | 1.43 | 3.00 | ** |
| Relevance of professional development, $\beta_{010}$ | 0.42 | 0.09 | 4.42 | *** |
| Class size, $\beta_{011}$ | -2.57 | 1.26 | -2.04 | * |
| Teacher second language ability, $\beta_{012}$ | 3.88 | 1.10 | 3.52 | ** |
| Teacher perception of assessments, $\beta_{013}$ | -1.37 | 1.44 | -0.95 | |
| Impact of professional development, $\beta_{014}$ | 1.24 | 0.93 | 1.34 | |
| Classroom Title I student preparedness, $\beta_{015}$ | 0.42 | 0.99 | 0.43 | |
| **Model for learning rate, $\zeta_{1i}$** | | | | |
| Intercept, $\beta_{10}$ | 19.12 | 0.23 | 84.36 | *** |

| ***Variance Explained by Student-Level Predictors*** | | |
|---|---|---|
| ***Model*** | ***Initial Status Variance ($\zeta_{0i}$)*** | ***Learning Rate Variance ($\zeta_{1i}$)*** |
| Unconditional | 1158.32 | 2.48 |
| Conditional | 890.11 | N/A |
| Proportion of variance explained | 0.23 | N/A |

Note: ***=p<.001; **=p<.01; *=p<.05

## Table IV.4 Two-Level Model for Math Achievement (Unconditional Model)

| ***Fixed Effect*** | ***Coefficient*** | ***se*** | ***T ratio*** | |
|---|---|---|---|---|
| Average initial math score, $\gamma_{00}$ | 592.63 | 0.76 | 782.13 | |
| Average learning rate, $\gamma_{00}$ | 21.89 | 0.27 | 81.87 | |
| ***Random Effect*** | ***Variance Component*** | ***df*** | ***$X^2$*** | ***p value*** |
| Student initial math score, $r_{0i}$ | 1106.62 | 2359 | 12847.90 | 0.000 |
| Student learning rate, $r_{1i}$ | 19.40 | 2359 | 2665.52 | 0.000 |
| Level-1 error, $e_{ti}$ | 298.66 | | | |
| ***Reliability of Coefficient Estimates*** | | | | |
| Initial math score, $\rho_{0i}$ | 0.82 | | | |
| Learning rate, $\rho_{1i}$ | 0.12 | | | |
| ***Correlation of Initial Score with Learning Rate*** | -0.05 | | | |

## Table IV.5 Two-Level Model for Math Achievement (Model with Student Attributes as Predictors)

| *Fixed Effect* | *Coefficient* | *Se* | *t ratio* | |
|---|---|---|---|---|
| **Model for initial math score, $\zeta_{0i}$** | | | | |
| Intercept, $\beta_{00}$ | 620.80 | 2.33 | 266.63 | *** |
| Male, $\beta_{01}$ | 2.46 | 1.43 | 1.72 | |
| African American, $\beta_{02}$ | -13.57 | 1.73 | -7.84 | *** |
| Hispanic, $\beta_{03}$ | -6.36 | 2.56 | -2.49 | * |
| Asian, $\beta_{04}$ | 5.94 | 5.95 | 1.00 | |
| Free/reduced lunch receipt, $\beta_{05}$ | -8.98 | 1.91 | -4.71 | *** |
| Title I participant, $\beta_{06}$ | -13.96 | 2.46 | -5.67 | *** |
| 1997 imputed score, $\beta_{07}$ | -8.29 | 1.71 | -4.83 | *** |
| 1998 imputed score, $\beta_{08}$ | -12.79 | 2.62 | -4.88 | *** |
| 1999 imputed score, $\beta_{09}$ | -4.87 | 1.93 | -2.52 | ** |
| **Model for learning rate, $\zeta_{1i}$** | | | | |
| Intercept, $\beta_{10}$ | 25.81 | 0.86 | 30.13 | *** |
| Male, $\beta_{11}$ | -2.80 | 0.53 | -5.32 | *** |
| African American, $\beta_{12}$ | 1.64 | 0.60 | 2.72 | ** |
| Hispanic, $\beta_{13}$ | 5.00 | 1.08 | 4.62 | *** |
| Asian, $\beta_{14}$ | 5.60 | 1.74 | 3.22 | ** |
| Free/reduced lunch receipt, $\beta_{15}$ | -0.37 | 0.68 | -0.55 | |
| Title I participant, $\beta_{16}$ | -3.96 | 0.87 | -4.56 | *** |
| 1997 imputed score, $\beta_{17}$ | 0.55 | 0.61 | 0.91 | |
| 1998 imputed score, $\beta_{18}$ | -1.68 | 0.96 | -1.74 | |
| 1999 imputed score, $\beta_{19}$ | 0.18 | 0.61 | 0.29 | |

***Variance Explained by Student-Level Predictors***

| *Model* | *Initial Status Variance ($\zeta_{0i}$)* | *Learning Rate Variance ($\zeta_{1i}$)* |
|---|---|---|
| Unconditional | 1106.62 | 19.40 |
| Conditional | 963.83 | 14.30 |
| Proportion of variance explained | 0.13 | 0.26 |

Note: ***=p<.001; **=p<.01; *=p<.05

## Table IV.6 Two-Level Model for Math Achievement (Final Model with All Significant Student Attribute and Resource Variables)

| *Fixed Effect* | *Coefficient* | *Se* | *t ratio* | |
|---|---|---|---|---|
| **Model for initial math score, $\beta_{0i}$** | | | | |
| Intercept, $\gamma_{00}$ | 622.76 | 3.33 | 187.08 | *** |
| Male, $\gamma_{01}$ | 2.40 | 1.41 | 1.70 | |
| African American, $\gamma_{02}$ | -13.29 | 1.96 | -6.77 | *** |
| Hispanic, $\gamma_{03}$ | -6.58 | 2.58 | -2.55 | * |
| Asian, $\gamma_{04}$ | 6.77 | 6.25 | 1.08 | |
| Free/reduced lunch receipt, $\gamma_{05}$ | -8.89 | 1.89 | -4.69 | *** |
| Title I participant, $\gamma_{06}$ | -15.96 | 2.67 | -5.99 | *** |
| 1997 imputed score, $\gamma_{07}$ | -7.44 | 1.70 | -4.39 | *** |
| 1998 imputed score, $\gamma_{08}$ | -12.63 | 2.58 | -4.90 | *** |
| 1999 imputed score, $\gamma_{09}$ | -5.79 | 2.00 | -2.90 | ** |
| Standards-based curriculum, $\gamma_{010}$ | 8.01 | 1.18 | 6.78 | *** |
| Strategies to address instructional needs, $\gamma_{011}$ | -14.47 | 3.75 | -3.86 | *** |
| Outside support, $\gamma_{012}$ | 11.94 | 3.17 | 3.77 | *** |
| Frequency of formal student assessment, $\gamma_{013}$ | 3.11 | 1.52 | 2.05 | * |
| Quality of professional development, $\gamma_{014}$ | -0.06 | 1.05 | -0.06 | |
| Class size, $\gamma_{015}$ | 0.16 | 0.13 | 1.21 | |
| Teacher certification, $\gamma_{016}$ | -0.47 | 2.78 | -0.17 | |
| Teacher second language ability, $\gamma_{017}$ | -6.62 | 1.63 | -4.07 | *** |
| Teacher perception of standards, $\gamma_{018}$ | -2.42 | 1.59 | -1.52 | |
| Teacher perception of assessments, $\gamma_{019}$ | 2.74 | 1.68 | 1.63 | |
| Teacher prof. development participation, $\gamma_{020}$ | -1.38 | 1.66 | -0.83 | |
| Impact of professional development, $\gamma_{021}$ | 1.67 | 1.58 | 1.06 | |
| Scope of parent involvement by teacher, $\gamma_{022}$ | -4.27 | 1.45 | -2.94 | ** |
| | | | | |
| **Model for learning rate, $\beta_{1i}$** | | | | |
| Intercept, $\gamma_{10}$ | 25.32 | 1.20 | 21.03 | *** |
| Male, $\gamma_{11}$ | -2.88 | 0.52 | -5.55 | *** |
| African American, $\gamma_{12}$ | -0.52 | 0.70 | -0.74 | |
| Hispanic, $\gamma_{13}$ | 3.41 | 1.04 | 3.29 | ** |
| Asian, $\gamma_{14}$ | 2.82 | 1.86 | 1.51 | |
| Free/reduced lunch receipt, $\gamma_{15}$ | -0.40 | 0.68 | -0.59 | |
| Title I participant, $\gamma_{16}$ | -4.50 | 0.92 | -4.86 | *** |
| 1997 imputed score, $\gamma_{17}$ | 0.44 | 0.60 | 0.74 | |
| 1998 imputed score, $\gamma_{18}$ | -1.17 | 0.95 | -1.23 | |
| 1999 imputed score, $\gamma_{19}$ | -0.47 | 0.63 | -0.74 | |
| Standards-based curriculum, $\gamma_{110}$ | -1.81 | 0.43 | -4.23 | *** |
| Strategies to address instructional needs, $\gamma_{111}$ | -2.00 | 1.33 | -1.51 | |
| Outside support, $\gamma_{112}$ | 1.44 | 1.11 | 1.29 | |
| Frequency of formal student assessment, $\gamma_{113}$ | -0.51 | 0.54 | -0.94 | |
| Quality of professional development, $\gamma_{114}$ | 0.98 | 0.38 | 2.57 | * |
| Class size, $\gamma_{115}$ | 0.13 | 0.04 | 3.02 | ** |
| Teacher certification, $\gamma_{116}$ | 3.19 | 1.03 | 3.10 | ** |
| Teacher second language ability, $\gamma_{117}$ | 0.52 | 0.59 | 0.89 | |
| Teacher perception of standards, $\gamma_{118}$ | -1.80 | 0.56 | -3.20 | ** |
| Teacher perception of assessments, $\gamma_{119}$ | 1.48 | 0.64 | 2.33 | * |
| Teacher prof. development participation, $\gamma_{120}$ | 2.48 | 0.65 | 3.82 | *** |
| Impact of professional development, $\gamma_{121}$ | 0.10 | 0.56 | 0.18 | |
| Scope of parent involvement by teacher, $\gamma_{122}$ | 0.06 | 0.54 | 0.11 | |

| ***Variance Explained by Student-Level Predictors*** | | |
|---|---|---|
| ***Model*** | ***Initial Status Variance ($\tau_{0i}$)*** | ***Learning Rate Variance ($\tau_{1i}$)*** |
| Unconditional | 1106.62 | 19.40 |
| Conditional | 920.15 | 8.68 |
| Proportion of variance explained | 0.17 | 0.55 |

Note: ***=p<.001; **=p<.01; *=p<.05

## Table IV.7 Three-Level Model for Student Reading Achievement within and between Schools (Unconditional Model)

| *Fixed Effect* | *Coefficient* | *se* | *t ratio* | |
|---|---|---|---|---|
| Average initial reading score, $\gamma_{00}$ | 604.58 | 1.99 | 304.0 | |
| Average learning rate, $\gamma_{00}$ | 19.21 | 0.40 | 47.58 | |
| ***Random Effect*** | ***Variance Component*** | ***df*** | ***$X^2$*** | ***p value*** |
| **Level 1** | | | | |
| Temporal variation, $e_{tij}$ | 252.35 | | | |
| **Level 2 Students within Schools (n=2,436)** | | | | |
| Student initial reading score, $r_{0ii}$ | 971.95 | 2371 | 7769.63 | 0.000 |
| Student learning rate, $r_{1ii}$ | 0.90 | 2371 | 2337.16 | >.500 |
| **Level 3 Between Schools (n=65)** | | | | |
| School mean initial reading score, $u_{00ij}$ | 217.79 | 64.00 | 450.78 | 0.000 |
| School mean learning rate, $u_{01ij}$ | 6.62 | 64.00 | 192.23 | 0.000 |
| ***Level-1 Coefficient*** | ***Percentage of Variance Between Schools*** | | | |
| Initial reading score, $\beta_{0ij}$ | 18.31 | | | |
| Learning rate, $\beta_{1ij}$ | 88.03 | | | |

## Table IV.8 Three-Level Model for Student Reading Achievement within and between Schools (Model with School Attributes as Predictors)

| *Fixed Effect* | *Coefficient* | *Se* | *t ratio* | |
|---|---|---|---|---|
| **Model for initial reading score, $\beta_{0i}$** | | | | |
| Model for mean initial status of average student, $\gamma_{00j}$ | | | | |
| Intercept, $\gamma_{000}$ | 600.76 | 2.05 | 293.67 | *** |
| School size, $\gamma_{001}$ | 0.01 | 0.01 | 0.73 | |
| School poverty, $\gamma_{002}$ | -63.30 | 9.62 | -6.58 | *** |
| District focus on assessment and accountability, $\gamma_{003}$ | -1.05 | 1.02 | -1.02 | |
| Standards and consequences in school/district plans, $\gamma_{004}$ | 4.90 | 1.34 | 3.66 | ** |
| Support from school district, $\gamma_{005}$ | -4.06 | 2.23 | -1.82 | |
| Support from regional TA centers, $\gamma_{006}$ | 9.61 | 3.86 | 2.49 | * |
| Impact of external factors, $\gamma_{007}$ | -1.75 | 3.45 | -0.51 | |
| **Model for learning rate, $\beta_{1i}$** | | | | |
| Model for learning rate of average student, $\gamma_{10j}$ | | | | |
| Intercept, $\gamma_{100}$ | 18.70 | 0.55 | 34.19 | *** |
| School size, $\gamma_{101}$ | 0.00 | 0.00 | -0.48 | |
| School poverty, $\gamma_{102}$ | -1.78 | 2.62 | -0.68 | |
| District focus on assessment and accountability, $\gamma_{103}$ | -0.55 | 0.30 | -1.83 | |
| Standards and consequences in school/district plans, $\gamma_{104}$ | -0.01 | 0.42 | -0.02 | |
| Support from school district, $\gamma_{105}$ | -0.75 | 0.62 | -1.22 | |
| Support from regional TA centers, $\gamma_{106}$ | 1.45 | 1.15 | 1.27 | |
| Impact of external factors, $\gamma_{107}$ | 0.96 | 1.07 | 0.89 | |

***Variance Explained by School-Level Predictors***

| *Model* | *Initial Status Variance ($\beta_{0i}$)* | *Learning Rate Variance ($\beta_{1i}$)* |
|---|---|---|
| Unconditional | 217.79 | 6.62 |
| Conditional | 64.03 | 5.46 |
| Proportion of variance explained | 0.71 | 0.18 |

Note: ***=p<.001; **=p<.01; *=p<.05

**Table IV.9 Three-Level Model for Student Reading Achievement within and between Schools (Final Model with All Significant School Attribute and Resource Variables as Predictors)**

| *Fixed Effect* | *Coefficient* | *Se* | *t ratio* | |
|---|---|---|---|---|
| **Model for initial reading score, $\delta_{0i}$** | | | | |
| Model for mean initial status of average student, $\beta_{00j}$ | | | | |
| Intercept, $\gamma_{000}$ | 601.18 | 1.99 | 302.64 | *** |
| School poverty, $\gamma_{001}$ | -59.30 | 9.00 | -6.59 | *** |
| Standards and consequences in school/district plans, $\gamma_{002}$ | 4.22 | 0.97 | 4.33 | *** |
| Support from regional TA centers, $\gamma_{003}$ | 8.47 | 3.34 | 2.53 | * |
| **Model for learning rate, $\delta_{1i}$** | | | | |
| Model for learning rate of average student, $\beta_{10j}$ | | | | |
| Intercept, $\gamma_{100}$ | 18.94 | 0.54 | 34.76 | *** |
| School poverty, $\gamma_{101}$ | -0.34 | 2.28 | -0.15 | |
| Standards and consequences in school/district plans, $\gamma_{102}$ | -0.50 | 0.33 | -1.49 | |
| Support from regional TA centers, $\gamma_{103}$ | 0.79 | 1.10 | 0.72 | |

| *Variance Explained by School-Level Predictors* | | |
|---|---|---|
| *Model* | *Initial Status Variance ($\delta_{0i}$)* | *Learning Rate Variance ($\delta_{1i}$)* |
| Unconditional | 217.79 | 6.62 |
| Conditional | 75.81 | 6.20 |
| Proportion of variance explained | 0.65 | 0.06 |

Note: ***=p<.001; **=p<.01; *=p<.05.

## Table IV.10 Three-Level Model for Student Math Achievement within and between Schools (Unconditional Model)

| *Fixed Effect* | *Coefficient* | *se* | *t ratio* | |
|---|---|---|---|---|
| Average initial math score, $\gamma_{00}$ | 592.98 | 2.09 | 284.39 | |
| Average learning rate, $\gamma_{00}$ | 22.27 | 0.68 | 32.79 | |
| ***Random Effect*** | ***Variance Component*** | ***df*** | ***$X^2$*** | ***p value*** |
| **Level 1** | | | | |
| Temporal variation, $e_{tij}$ | 300.13 | | | |
| **Level 2 Students within Schools (n=2,325)** | | | | |
| Student initial math score, $r_{0ii}$ | 902.96 | 2261 | 6445.56 | 0.000 |
| Student learning rate, $r_{1ii}$ | 0.03 | 2261 | 2266.91 | 0.461 |
| **Level 3 Between Schools (n=64)** | | | | |
| School mean initial math score, $u_{00ij}$ | 236.56 | 63 | 463.43 | 0.000 |
| School mean learning rate, $u_{01ij}$ | 24.25 | 63 | 399.62 | 0.000 |
| ***Level-1 Coefficient*** | ***Percentage of Variance Between Schools*** | | | |
| Initial math score, $\delta_{0ij}$ | 20.76 | | | |
| Learning rate, $\delta_{1ij}$ | 89.88 | | | |

## Table IV.11 Three-Level Model for Student Math Achievement within and between Schools (Model with School Attributes as Predictors)

| *Fixed Effect* | *Coefficient* | *Se* | *t ratio* | |
|---|---|---|---|---|
| **Model for initial math score, $\pi_{0i}$** | | | | |
| Model for mean initial status of average student, $\beta_{00j}$ | | | | |
| Intercept, $\gamma_{000}$ | 593.83 | 2.64 | 225.30 | *** |
| School size, $\gamma_{001}$ | 0.03 | 0.01 | 2.62 | * |
| School poverty, $\gamma_{002}$ | -48.99 | 11.77 | -4.16 | *** |
| District focus on assessment and accountability, $\gamma_{003}$ | -1.76 | 1.20 | -1.47 | |
| Standards and consequences in school/district plans, $\gamma_{004}$ | 3.57 | 1.48 | 2.41 | ** |
| Support from school district, $\gamma_{005}$ | -8.05 | 3.00 | -2.69 | ** |
| Support from regional TA centers, $\gamma_{006}$ | -1.48 | 5.53 | -0.27 | |
| Impact of external factors, $\gamma_{007}$ | -0.77 | 3.30 | -0.23 | |
| **Model for learning rate, $\pi_{1i}$** | | | | |
| Model for learning rate of average student, $\beta_{10j}$ | | | | |
| Intercept, $\gamma_{100}$ | 20.65 | 0.96 | 21.48 | *** |
| School size, $\gamma_{101}$ | 0.00 | 0.01 | 0.02 | |
| School poverty, $\gamma_{102}$ | -4.82 | 3.70 | -1.30 | |
| District focus on assessment and accountability, $\gamma_{103}$ | -1.14 | 0.41 | -2.80 | ** |
| Standards and consequences in school/district plans, $\gamma_{104}$ | -0.03 | 0.57 | -0.05 | |
| Support from school district, $\gamma_{105}$ | -0.02 | 1.20 | -0.02 | |
| Support from regional TA centers, $\gamma_{106}$ | 4.07 | 2.31 | 1.76 | |
| Impact of external factors, $\gamma_{107}$ | 1.13 | 1.05 | 1.08 | |

***Variance Explained by School-Level Predictors***

| *Model* | *Initial Status Variance ($\tau_{0i}$)* | *Learning Rate Variance ($\tau_{1i}$)* |
|---|---|---|
| Unconditional | 236.56 | 24.25 |
| Conditional | 114.68 | 19.80 |
| Proportion of variance explained | 0.52 | 0.18 |

Note: ***=p<.001; **=p<.01; *=p<.05

## Table IV.12 Three-Level Model for Student Math Achievement within and between Schools (Final Model with All Significant School Attributes and Resource Variables as Predictors)

| *Fixed Effect* | *Coefficient* | *Se* | *t ratio* | |
|---|---|---|---|---|
| **Model for initial math score, $\pi_{0i}$** | | | | |
| Model for mean initial status of average student, $\beta_{00j}$ | | | | |
| Intercept, $\gamma_{000}$ | 595.04 | 4.50 | 132.19 | *** |
| School size, $\gamma_{001}$ | 0.03 | 0.01 | 2.70 | * |
| School poverty, $\gamma_{002}$ | -50.56 | 16.24 | -3.11 | ** |
| District focus on assessment and accountability, $\gamma_{003}$ | -1.88 | 1.16 | -1.62 | |
| Standards and consequences in school/district plans, $\gamma_{004}$ | 3.69 | 1.50 | 2.47 | * |
| Support from school district, $\gamma_{005}$ | -7.95 | 3.10 | -2.57 | * |
| Support from regional TA centers, $\gamma_{006}$ | -1.34 | 5.58 | -0.24 | |
| Targeted assistance school, $\gamma_{007}$ | -0.28 | 5.72 | -0.05 | |
| Written parent compacts, $\gamma_{008}$ | -1.54 | 4.52 | -0.34 | |
| **Model for learning rate, $\pi_{1i}$** | | | | |
| Model for learning rate of average student, $\beta_{10j}$ | | | | |
| Intercept, $\gamma_{100}$ | 16.37 | 1.48 | 11.07 | *** |
| School size, $\gamma_{101}$ | 0.00 | 0.01 | -0.12 | |
| School poverty, $\gamma_{102}$ | 3.91 | 4.12 | 0.95 | |
| District focus on assessment and accountability, $\gamma_{103}$ | -0.94 | 0.38 | -2.49 | * |
| Standards and consequences in school/district plans, $\gamma_{104}$ | -0.12 | 0.49 | -0.24 | |
| Support from school district, $\gamma_{105}$ | -0.19 | 1.05 | -0.18 | |
| Support from regional TA centers, $\gamma_{106}$ | 3.61 | 2.25 | 1.60 | |
| Targeted assistance school, $\gamma_{107}$ | 4.45 | 1.46 | 3.06 | ** |
| Written parent compacts, $\gamma_{108}$ | 4.40 | 1.54 | 2.86 | ** |

| *Variance Explained by School-Level Predictors* | | |
|---|---|---|
| *Model* | *Initial Status Variance ($\pi_{0i}$)* | *Learning Rate Variance ($\pi_{1i}$)* |
| Unconditional | 236.56 | 24.25 |
| Conditional | 115.35 | 16.33 |
| Proportion of variance explained | 0.51 | 0.33 |

Note: ***=p<.001; **=p<.01; *=p<.05.