DOCUMENT RESUME

ED 464 115	TM 033 796
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TITLE	Privatization in Education: A Growth Curve Analysis of Achievement.
PUB DATE	2002-04-00
NOTE	40p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 1-5, 2002).
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Academic Achievement; Contracts; Elementary Education; *Elementary School Students; Mathematics; *Privatization; Reading; Statistical Analysis
IDENTIFIERS	*Edison Project; Growth Curve Analysis; *Hierarchical Linear Modeling

ABSTRACT

The purpose of this study was to determine whether the students who attended one elementary school in Miami-Dade County, Florida, run by The Edison Project (Edison Schools, Inc.) made greater academic progress than comparable students who attended other district schools. The paper provides a longitudinal examination of the students' academic achievement during the school's first 3 years of operation, 1996-1997 through 1998-1999. The study also extends the range of statistical techniques commonly used in program evaluations. Hierarchical linear modeling (HLM) was used in an individual growth curve analysis to examine the students' achievement in reading and mathematics. Project and control groups' reading and mathematics scores on the Stanford Achievement Test were compared. Two panels of students in the project school were compared. Panel A was comprised of 114 students initially enrolled in grade 2, and Panel B of 159 students initially enrolled in grade 3. Using stratified random sampling, equal numbers of students who attended other district schools were selected as control groups. Analyses were completed in reading and mathematics. Results of the HLM analyses indicate that significant levels of growth were achieved across the 3-year period in both subject areas for all groups of students. In reading, there were no statistically significant differences between project and control groups that could be attributed to group membership, but in mathematics the results were less consistent. In Panel A, no significant source of between-group variation was identified. In Panel B, however, the rate of growth in mathematics over time was greater for project students than for control students. This was the only statistically significant difference attributed to group membership across the analyses. After 3 years of instruction through the Edison model, reading and mathematics performance levels did not differ significantly from those of students in other district schools. (Contains 6 figures, 12 tables, and 30 references.) (SLD)

Privatization in Education:

a Growth Curve Analysis of Achievement

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New Orleans, Louisiana

April, 2002

ABSTRACT

Current initiatives in school reform include contracting educational services to private, for-profit firms. The purpose of this paper is to ascertain whether the students who attended one elementary school in Miami-Dade County, run by The Edison Project (currently Edison Schools Inc.), made greater academic progress than comparable students who attended other district schools. The paper provides a longitudinal examination of the students' academic achievement during the school's first three years of operation, 1996-97 through 1998-99. In addition, it extends the range of statistical techniques typically used in program evaluations. Hierarchical linear modeling (HLM) was employed in an individual growth curve analysis to examine the students' achievement in reading and mathematics.

The project and control groups' reading and mathematics scores on the Stanford Achievement Test were compared. Two panels of students in the project school were followed across the three school years. Panel A was comprised of 114 students initially enrolled in grade 2, and Panel B of 159 students initially enrolled in grade 3. Using stratified random sampling, equal numbers of students who attended other district schools were selected as control groups. During the span of the study, the selected control groups remained comparable to the project groups in terms of demographic characteristics and performance on a pretest, despite attrition.

Analyses were completed in reading and mathematics for both Panels A and B. The results of the HLM analyses indicated that significant levels of growth were achieved across the three-year period in both subject areas for all groups of students. In reading, there were no statistically significant differences between the project and control groups that could be attributed to group membership. However, the results were less consistent in mathematics. In Panel A, no significant source of between-group variation was identified. However, in Panel B, the rate of growth in mathematics over time was greater for the project students than for the control students. This was the only statistically significant difference attributed to group membership across the four analyses. Nonetheless, after the project students had received three years of instruction by means of the Edison model, their final levels of performance in reading and mathematics did not differ significantly from the students' in other district schools.

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INTRODUCTION

Fueled by widespread dissatisfaction with the state of the public school system, experiments in the privatization of education are on the rise. Whether through vouchers, charter schools, or contracts for the provision of services, private firms are having an impact on public education. Amidst promises of increased achievement from potential service providers and resounding denouncements from their opponents, these experiments are rarely subjected to sound, objective examination.

Miami-Dade County Public Schools has been receptive to the idea of privatization. On December 13, 1995, the School Board of Miami-Dade County approved a five-year contract with The Edison Project (currently Edison Schools Inc.) to manage an elementary school in the district. Funding for the project school was comparable to other schools in the district, but adjusted to accommodate the unique aspects of its operation. The Edison Project was permitted to retain any excess funds as profit.

The primary goal of this research was to address the following question:

- Did the students who attended The Edison Project's school for three years make greater academic progress than comparable students who attended other schools in the district?

BACKGROUND INFORMATION

The term "privatize" first appeared in a dictionary in 1983. It was narrowly defined as "to make private, especially to change (as a business or industry) from public to private control or ownership" (Savas, 1987, p.3). Although the term privatization is relatively new, private entities have been contracted to perform public services throughout history.

Recently, under the umbrella of school reform, experiments have been carried out in privatization under various forms. Each form shifts the balance of power between the public and private sectors, and further blurs the public-private boundaries. Murphy (1996) described the five main forms of privatization: (a) franchises, (b) vouchers, (c) grants/subsidies, (d) deregulation, and (f) contracting. In a franchise, the government gives a private entity the authority to provide a service within a specific geographic area. The source of payment distinguishes a franchise: the users pay the provider directly. In the second form of privatization, vouchers authorize consumers to purchase specific goods or services from the private market. The government specifies who is eligible to purchase a service, and who is eligible to provide the service. Vouchers keep the financing in the public sector, while distributing the purchasing power to eligible consumers. As such, vouchers encourage consumption by a specific group.

By awarding grants and subsidies, the third form of privatization, the government provides financial aid or contributions (cash or in-kind) to private organizations or individuals to encourage them to produce a service. Grants and subsidies serve to make the private sector responsive to needs in the public sector and to encourage them to produce a service at a reduced cost to the users. While grants serve to encourage the provision of social services by non-profit organizations, tax programs serve to encourage the donation of materials, equipment, and other goods by private industries. Grants are offered to organizations, colleges and universities, districts, schools, and teachers to institute change in public schools.

The fourth type of privatization is deregulation. Deregulation opens an industry to competitive pressures by removing government regulations. It increases the number of providers of a service by weakening or removing public controls. Charter schools represent a form of school deregulation, designed to provide alternatives to traditional public schools. The Charter School Expansion Act of 1998 authorized states to use federal funds for planning, designing, and initial implementation of public charter schools (S.1380, 1998). By 1999, charter school laws had been enacted in 36 states, Puerto Rico, and the District of Columbia. These laws permit limited numbers of schools to seek contractor status (WestEd and U.S. Department of Education, 2000; Center for Educational Reform, 1999; Hill, Pierce, and Guthrie, 1997). Generally, charter schools function autonomously from the school district, with fewer regulations. Accountability is minimal, as long as the stipulations of the charter are carried out.

Through the final form of privatization, contracting, governments purchase services from the private sector, either from for-profit or not-for-profit organizations. The government retains responsibility for the service, but the private firm performs the service. A whole service or certain elements of the service may be purchased. This form of privatization is the focus of this study.

There have been only four for-profit companies recently engaged in contract-based privatization efforts. These are: Educational Alternatives Inc. (EAI), and Public Strategies Groups Inc., which are based in Minneapolis, Minnesota; Alternate Public Schools (APS), based in Nashville, Tennessee; and The Edison Project (currently Edison Schools Inc.), based in New York (Edison Schools, 2001; Brown and Hunter, 1996; Editorial Projects in Education, 1998; Feir, 1996; Schrag, 1996; Tetreault and Picus, 1996).

As previously noted, the Miami-Dade County Public Schools (MDCPS) has been receptive to the idea of privatization. In fact, EAI's five-year contract to operate an elementary school in Miami-Dade County, signed in June 1991, represents the first time that a public school system entered into a partnership with a private firm to provide the complete educational program. The students' academic performance during the first three years of the program's operation (1991-92 through 1993-94) was evaluated by the district. It was shown that the students' academic performance generally improved in the project school, but not to the degree anticipated. Students in a control group, who did not benefit from the program provided by EAI, performed comparably well (Abella, 1994). Consequently, the district did not renew its contract with EAI.

Currently, only The Edison Project remains as a viable contender in the privatization movement. The Edison Project was founded by Chris Whittle, originator of the highly profitable in-school news program Channel One (Schrag, 1996). A group of nationally recognized professionals from the fields of education, technology, government, communications, and business has worked to develop and guide the implementation of the Edison model. The company's first four schools were opened in 1995, in Mt. Clemens, Michigan; Wichita, Kansas; and Sherman, Texas. That year it also began oversight of the operation of a charter school in Boston, Massachusetts for a non-profit agency. The number of schools operated by Edison has increased yearly, by expansion and acquisition of new contracts. During the 2001-02 school year, The Edison Project is operating 136 public schools in 23 states, including some charter schools (The Edison Project, 1999; Edison Schools, 2001).

In December 1995, the MDCPS signed a five-year contract with The Edison Project. The contract called for The Edison Project to manage an elementary school in the district from August, 1996 through June, 2001. The selected school, which was newly constructed, first opened under management by The Edison Project. The school drew students from an attendance area established by the district. The Edison Project received funding comparable to other schools in the district, but adjusted to accommodate the unique aspects of its operation (e.g., an extended school year). The Edison Project was permitted to retain any excess revenues over expenditures as its compensation for the services provided.

The Edison model is not simply a new instructional method. The implementation of the model calls for global changes in a school's operation. It requires fundamental changes in a school's organization, schedule, curriculum, staffing, technology, as well as instructional method.

The Edison Model

The Edison model is described in the company's book, Partnership School Design. According to this document, the model is founded on ten basic principles, which are known as "fundamentals." While the document contends that the application of any of the fundamentals would result in an improvement, a strategy that encompassed all ten would achieve dramatic results. The fundamentals are:

1. Schools organized for every student's success
2. A better use of time
3. A rich and challenging curriculum
4. Teaching methods that motivate
5. Assessment that provides accountability

6. Educators who are true professionals
7. Technology for an Information Age
8. A partnership with families
9. Schools tailored to the community
10. The advantages of system and scale (The Edison Project, 1994a, p. 10).

The implications of each fundamental on the operation of an Edison project school are detailed in the following sections.

Organization

The organization of an Edison project school is quite distinct from a typical school in Miami-Dade County. The project school is organized into "schools-within-a-school," which are known as "academies." Within each academy, students are organized into "houses." Teachers assigned to a house work as a team in teaching the core subjects of the curriculum. Each house includes 90 to 120 students, and includes an equal number of students from each age/grade level in the academy. This mixture of ages/grades facilitates the forming of ability groups for instruction and related activities. Flexible, ad hoc ability groups are a key element in the instructional strategy of the Edison model. Such grouping is distinct from tracking, which the model shuns. In a project school, every student receives the same curriculum. The teacher-student ratio of a project school is approximately 1:19, but the Edison model's emphasis is not necessarily on small classes. According to Partnership School Design, "the key to effective class organization is not the staffing ratio or the average class size, but matching the class and staffing structure to instructional purpose" (The Edison Project, 1994a, p. 19). To facilitate this, Edison model emphasizes flexible scheduling.

Time

Perhaps the most critical element in an educational program is the "time on task;" this represents the time actually devoted to instruction. Yet, the United States has one of the shortest school years of the industrialized world. To remedy this, the Edison model is based on an extended school year. In a project school, the school year typically begins August 15 and ends July 1. It consists of 210 school days, which is the same as schools in Japan. In contrast, the school year in Miami-Dade County consists of only 180 days.

The school day is also longer in an Edison project school than in the typical Miami-Dade County school. Depending on the grade level, the school day in a project school is from 50 to 90 minutes longer. Such differences may seem minor; but when combined with the extended school year, they produce a remarkable increase in the amount of time a student spends in school during the 13 years between kindergarten and grade 12. A student who remains in project schools for the duration will have a total of 21,210 hours in school. In contrast, a student who attends the typical Miami-Dade County schools will have only 15,570 hours. The difference, when adjusted to a 180-day school year with a seven-hour day, represents almost 4 ½ years of additional schooling (Gomez and Shay, 1998, 1999, 2000). This is a sizable increase in the time on task.

Curriculum

The Edison curriculum is holistic in nature. The curriculum is divided not so much into subjects but domains. There are five major domains: (a) humanities and the arts, (b) mathematics and science, (c) character and ethics, (d) health and physical fitness, and (e) practical arts and skills. The domains serve to integrate the curriculum, so teachers can employ an interdisciplinary approach in the delivery of instruction. Lessons are organized around projects or real life problems, which require the students to delve into different disciplines.

The Edison curriculum is also results-oriented. Each academy has a set of over 100 explicit standards that define the level of educational development that students are expected to achieve (The Edison Project, 1994b, 1994c). The students must demonstrate the attainment of these standards before they can be promoted to the next academy. The standards establish very high academic expectations for the students.

Teaching Methods

The developers of the Edison instructional program recognize the fact that students learn in different ways, so the program employs a variety of teaching methods. They range from traditional lectures to such innovative methods as cooperative learning. However, all the methods, according to The Edison Project, have one thing in common: their effectiveness is well documented.

Assessment

A unique assessment system was developed for the Edison model. It was designed to correspond with the objectives of the educational program. The components of the system are:

the Quarterly Learning Contract, the student portfolio, the embedded assessments, and the Academy Promotion Review. The system is used to monitor the progress of the students in attaining the standards of the educational program. Beyond the assessment measures of the Edison model, students in a project school also take all the standardized tests required by the district and the state. The results of these tests enable the project school to gauge the academic progress of the students against local and national norms.

Educators

The best teachers are often promoted right out of the classroom. To curtail this loss, the Edison model employs a career ladder for teachers. Professional development is an integral part of the ladder. The professional development program is carefully aligned with the model's elements of curriculum, instruction and assessment. Closely associated with professional development is the assessment of job performance. The job performance of the teachers in a project school is assessed by a results-oriented system that includes: (a) the students' academic progress, (b) the quality of the curriculum units developed, (c) the fluency with various instructional methods, and (d) the relationship with colleagues, students, and their families. Evidence of the teacher's accomplishments in these areas is maintained in a portfolio.

Technology

The use of sophisticated technology in the classroom is not a new idea. However, an Edison Project school is unique in the extent to which it uses such technology. A computer is made available to every student's family, every teacher and the principal; all these computers are linked by a network. In this manner, communication among these parties is facilitated.

Partnership

A project school attempts to engage the students' families in the educational process. Communication is maintained through quarterly parent meetings, by telephone and through the computer network. Additionally, if the space is available, a project school maintains a Parent Center, which serves as a base for family members who visit the school. Finally, a Parent Advisory Council is convened by the principal which provides a forum for family members to express their opinions and ideas regarding the school's programs and policies.

Community

An Edison project school is tailored to the community it serves. About one-fourth of the school's curriculum is determined locally. This ensures that the educational program is in accord with the priorities and concerns of the community. Furthermore, the project school is designed to be a hub of activity for the community. The project school enlists the cooperation of community agencies and professionals in the delivery of social services to meet the specific needs of the students in the project school.

System and Scale

Project schools are linked both in their common purpose and literally through the computer network. The network facilitates the exchange of materials and ideas for improving the educational program. In addition, the Central Services of The Edison Project provides support, guidance, and resources to the project schools.

Overall, the ten "fundamentals" which comprise the Edison model make up an eclectic mixture of elements that are not necessarily new or unusual. They are based on established educational practices and sound research. However, the merger of these elements into a cohesive strategy is unique to the Edison model. The basic elements of the model are summarized in Table 1.

Table 1

Basic Elements of the Edison Model

Fundamentals [a]	Elements
1. Organization	▪ "Schools-within-a-school" consisting of academies that combine several ages/grade levels
	▪ Ability grouping, but no tracking
	▪ Teachers organized into teams
	▪ Flexible scheduling (e.g., block scheduling)
2. Time	▪ Extended school year
	▪ Extended school day
3. Curriculum	▪ Interdisciplinary curriculum
	▪ Lessons organized around projects or real life problems
	▪ Results-oriented standards for promotion to the next academy
4. Teaching Methods	▪ Variety of teaching methods
5. Assessment	▪ Unique assessment system for monitoring students' progress toward standards
6. Educators	▪ Career ladder for teachers
	▪ Emphasis on professional development
	▪ Results-oriented system for assessing job performance of teachers
7. Technology	▪ Emphasis on technology (e.g., computer provided for each student's home)
	▪ Home and school are linked by computer network
8. Partnership	▪ Emphasis on parental involvement
9. Community	▪ One-fourth of the curriculum determined locally
	▪ School is conduit for social services
10. System and Scale	▪ School is supported by Central Services of The Edison Project
	▪ School and Central Services are linked by computer network

[a] For the full text of the fundamentals, see pages 5-6.

METHODOLOGY

This study was designed to examine the academic achievement of the students in the Miami-Dade County Public Schools (MDCPS) who attended the elementary school operated by The Edison Project (currently Edison Schools Inc.). To gauge the students' academic performance, a quasi-experiment was conducted. A quasi-experiment is a technically acceptable alternative to a true experiment. Quasi-experiments are often used in "natural social settings" where a true experiment is not feasible (Campbell and Stanley, 1963). The specific quasi-experimental design used in this study was a form of the "nonequivalent control group design." This design essentially involved using repeated test scores to compare the performance of the students who were exposed to an experimental treatment (i.e., the experimental group) to that of a group who were not (i.e., the control group). The two groups were considered "nonequivalent," because the subjects were not randomly distributed between them (as is the case with a true experimental design). This design controlled for most of the primary threats to the internal validity of the findings, including history, maturation, testing, instrumentation, and mortality.

In applying the nonequivalent control group design to the assessment of the project students' academic achievement, the Edison model represented the experimental treatment. As such, the students who attended the project school comprised the experimental group. The students in the control group were drawn from a pool of all 1996-97 MDCPS students who did not attend the project school. The Stanford Achievement Tests (SAT) administered during the students' passage through grade levels of the project school were used to measure their academic performance. The initial test in the series (i.e., the pretest) was administered in the 1995-96 school year. It was the last SAT test administered prior to the students' entry into the project school in year 1 (1996-97).

The analysis was limited to the students who enrolled in the project school in year 1 and attended for three years. These two constraints ensured that the students included in the analyses had the greatest exposure to the Edison model. The analysis focused on two panels of students: those in grade 2, designated Panel A; and those in grade 3, designated Panel B. Each panel represents a single grade-level group that was followed as it progressed through the three years of the study. An overview of the subjects' passage through the grade levels of the project school is presented in Table 2.

Table 2

Grade Level Progression of the Panels through the Project School

	Grade Level		
	Year 1 1996-97	Year 2 1997-98	Year 3 1998-99
Panel A:	2	3	4
Panel B:	3	4	5

Note. While the project spans five school years from 1996-97 through 1999-2000, the research is limited to the first three years.

Sampling Procedures

As stated previously, all students in grades 2 and 3 who were enrolled in the project school during year 1 (1996-97) were part of the experimental treatment group. In that year, a total of 1077 students were enrolled in the project school. This included 181 enrolled in grade 2 and 193 enrolled in grade 3.

The students in the control group were drawn from a pool of 1996-97 MDCPS students. As such, the sampling frame for the control group consisted of all second and third grade students in the district who did not attend the project school. The pool of potential control group members for Panel A contained 27,743 students; and the pool for Panel B contained 27,275 students.

Stratified random sampling was used in the selection of the control group to ensure that it corresponded proportionally with the experimental group on the following variables: grade level, ethnicity (i.e., black, non-Hispanic; Hispanic; white, non-Hispanic; other), eligibility for the free/reduced lunch program (i.e., eligible; not eligible), and performance on the pretest (i.e., reading and mathematics percentile scores, grouped into ten-percentile-point bands). Selection of the sample entailed the following steps. First, a seven character "group code" was assigned to each second and third grade student in the project school. A student's group code corresponded to their characteristic on each of the above variables. As such, 2HY2040 could be the group code for a second grade (2), Hispanic (H) student who is eligible for the free/reduced lunch program (Y), and scored at the 23rd percentile on the reading pretest (20) and at the 46th percentile on the mathematics pretest (40). Each potential control group student was also assigned a group code, along with a randomly generated "pool number." Within group codes, the control group students were then sorted in numerical order, based on their pool numbers. The control group was then selected from the ordered pool, in proportionally equal numbers to the project group, by group code. This procedure provided a stratified random sample, comparable to the project students based on grade level, ethnicity, socioeconomic status, and initial ability level.

As was the case for the students in the project school, the selected sample of control group students was also followed longitudinally across the three school years, 1996-97 through 1998-99. Because the students in the project school were all enrolled in the same school for the duration of the study, students in the control group were removed from the study if they changed schools during the three-year period. This controlled for the potentially confounding effects of discontinuity in educational programs.

Composition of the Sample

Many of the project students lacked pretest scores from the 1995-96 school year, prior to enrollment in the project school. Pretest scores may have been missing for a student for several reasons, for example: absence on the day of testing, recent transfer into the school district, or enrollment in the exceptional student education or the English for Speakers of Other Languages programs. Students without at least one pretest score (i.e., reading or mathematics) were not eligible for inclusion in the quasi-experiment. Thus, of the students originally enrolled in the targeted grades, only 114 of the 181 enrolled Panel A students; and 159 of the 193 enrolled Panel B students were included in the study. Corresponding numbers of students were consequently selected to comprise the control groups.

Table 3 shows the number of students in each group through the three years of the project. The numbers given represent students who were included in at least one statistical procedure completed for this study. Overall, 74.91% of the students identified for inclusion in the study remained through the end of year 3, resulting in an overall attrition rate of 25.09%. Somewhat higher percentages of the project students were lost due to attrition than their counterparts in the control group. This was particularly true in Panel B, where the difference in rate of attrition was more than ten percent.

Table 3

Number of Students in the Project and Control Groups by Year

		Panel Members			**Attrition**
		Year 1	**Year 2**	**Year 3**	**Rate**
Panel A	Project	114	95	83	27.19 %
	Control	114	108	91	20.18 %
Panel B	Project	159	130	108	32.08 %
	Control	159	153	127	20.13 %

Nonetheless, the groups remained similar in terms of demographic characteristics, despite attrition. A delineation of the demographic characteristics of each group may be found in Table 4. As the table shows, the groups were comprised primarily of black students eligible for the free/ reduced lunch program. Few had been enrolled in the English for speakers of other languages (ESOL) program or the exceptional student education (ESE) program.

Initial Comparability of the Groups

The effect of the differential levels of attrition on the comparability of the groups in terms of their initial ability levels was also examined. Simple Analyses of Variance (ANOVAs) were performed at the end of the three-year period, comparing each panel's pretest scores in reading and mathematics. Students were only included in the analyses if they remained in the group over the three years of the study. The SAS GLM procedure was used to accommodate the unequal number of students in the groups (SAS Institute, 1985). The pretest scores were the students' Total Reading and Total Mathematics scores on the Stanford Achievement Test (SAT) administered during the 1995-96 school year, prior to the project students' enrollment in the project school. Table 5 shows the groups' mean pretest scores.

Table 4

Demographic Characteristics of the Project and Control Groups

Characteristic		**Panel A**		**Panel B**	
		Project % (n)	**Control % (n)**	**Project % (n)**	**Control % (n)**
Gender	Female	53.01(44)	52.75(48)	49.07(53)	51.18(65)
	Male	46.99(39)	47.25(43)	50.93(55)	48.82(62)
Ethnicity	Black	90.36(75)	86.81(79)	87.96(95)	81.89(104)
	Hispanic	8.43(7)	12.09(11)	12.04(13)	18.11(23)
	White	1.20(1)	1.10(1)	-- (0)	-- (0)
F/R Lunch	Eligible	90.36(75)	87.91(80)	91.67(99)	86.61(110)
	Not Eligible	9.64(8)	12.09(11)	8.33(9)	13.39(17)
ESOL	Enrolled/Former	21.69(18)	15.38(14)	34.26(37)	30.71(39)
	Not Enrolled	78.31(65)	84.62(77)	65.74(71)	69.29(88)
ESE	ESE	1.20(1)	1.10(1)	2.78(3)	9.45(12)
	Gifted	16.87(14)	8.79(8)	6.48(7)	4.72(6)
	Not Enrolled	81.93(68)	90.11(82)	90.74(98)	85.83(109)

Note. F/R Lunch = Free/Reduced Lunch Program; ESOL = English for Speakers of Other Languages program; ESE = Exceptional Student Education Program

The ANOVAs revealed that there were no significant differences in the pretest scores of the project and control groups. Hence, it may be concluded that the initial ability levels of the groups remained comparable despite attrition. Subsequent differences in reading and mathematics achievement may then be attributed to the intervening instructional experiences.

Table 5

Mean Pretest Scores of the Project and Control Groups

	READING			**MATHEMATICS**		
	Mean	**Standard Deviation**	**n**	**Mean**	**Standard Deviation**	**n**
Panel A						
Project	515.73	38.75	77	531.33	41.71	80
Control	512.33	33.26	84	524.86	39.21	87
Panel B						
Project	545.84	33.40	98	550.84	41.24	104
Control	545.24	31.20	119	549.38	39.38	118

Note. The ANOVA analyses indicated that there were no significant differences in the groups' mean pretest scores at the end of the three-year period.

Instrumentation

The students' performance on the Stanford Achievement Test, Eighth Edition (SAT) was the primary source of data. Scaled scores were used in all analyses because they are articulated across grade levels. As previously noted, the pretest scores, used as a measurement of initial status in the selection of the comparison group, were the Total Reading and Total Mathematics scores. These scores were composite scores of all subtests administered in the appropriate content domain. They were selected because preliminary analyses indicated that they were the best predictors of future achievement. Beginning in the 1997-98 school year, however, the district elected to reduce the number of subtests administered. Only the Reading Comprehension and Mathematics Applications subtests were administered in subsequent years. As a result, the Reading Comprehension and Mathematics Applications subtest scores served as the dependent variables in this study.

Data Analysis Strategies

Hierarchical linear modeling (HLM) was used in a growth curve analysis of the quasi-experiment. Four sets of analyses were completed: Panel A in reading and mathematics, and Panel B in reading and mathematics. The use of HLM in the study of academic growth has been well documented, although it has not typically been used in the evaluation of educational programs (Burchinal, Baily, & Snyder, 1994; Rogosa & Saner, 1995; Willet, Singer, & Martin, 1998; Williamson 1990; Williamson, Applebaum, & Epanchin, 1991; Woodruff & Houston, 1992). The HLM procedure provides an advantage over traditional regression techniques because it partitions variance into embedded hierarchical structures inherent in the nature of the data. In addition, rather than focusing only on mean values at discrete points in time, like traditional methods, HLM takes into account the rate of growth at each structural level. In the case of growth curve analyses, the model explicitly represents individual growth. In addition, it is possible to examine differences in the students' achievement levels and rates of growth within and between groups (e.g., schools, classrooms, or experimental treatment groups).

There are several other advantages to HLM. First, it is more flexible in its requirements for the data. The number of observations available for each subject may vary; thus missing values do not pose a problem. The spacing of observations may also vary, accommodating different ages or testing times across subjects. Complex models can also be specified that include other predictors to account for further systematic variation. Moreover, specification of the covariance structure is flexible. It is possible to conduct hypothesis tests about the determinants of the structure.

HLM does not have the restrictive data requirements and assumptions of traditional multiple regression techniques. However, when the conditions and assumptions of traditional techniques are met, the results of HLM analyses can be formally related to those of traditional multiple regression. Perhaps the most compelling advantage of HLM is that it allows for the examination of embedded relationships in naturally occurring groups. This leads naturally to the study of the relationships between organizational structures and growth.

Bryk, Raudenbush, and Congdon's computer program HLM, Version 4, was used to fit the model separately for each panel and subject area (1996). In a three-level model for time-ordered data, the Level 1 model is comprised of individual growth trajectories. The Level 2 model represents the variation in growth parameters among students in the treatment groups. And, the Level 3 model describes the variation between the two treatments (Bryk & Raudenbush, 1992).

The Level 1 individual growth model assumes that the students' rate of growth is constant between each test period. It examines the rate of growth over time for students across all treatment groups. Empirical Bayes estimates are used to construct growth curves based on estimated true scores for individual students. Empirical Bayes estimates provide the best estimates of true growth. When only three measures are available , the model only predicts linear growth. The Level 1 model may be shown as:

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}(Time)_{tij} + e_{tij}$$

where: Y_{tij} is the outcome at time t for child i in group j;

$(Time)_{tij}$ is the time of testing;

π_{0ij} is the status of child ij, that is the expected outcome for that child at the intercept (i.e., when Time=0);

π_{1ij} is the learning rate for child ij during the period of the study; and,

e_{tij} is the person-specific variance.

The focus of this analysis was on differences in achievement between the project and control groups at the end of the three-year period. As such, the variable 'Time' was coded so that the intercept reflected final status (i.e., level of achievement at the end of year 3). To evaluate final achievement levels, the intercept had to be centered at year 3. Thus, the time variable was coded as -2 for year 1, -1 for year 2, and 0 for year 3.

At Level 2, the model examines variance in the students' achievement within the treatment groups. The model at Level 2 is

$$\pi_{0ij} = \beta_{00j} + r_{0ij}$$
$$\pi_{1ij} = \beta_{10j} + r_{1ij}.$$

And, at Level 3 the model examines variance in the students' achievement that may be attributed to group membership. It may be shown as

$$\beta_{00j} = \gamma_{000} + u_{00j}$$
$$\beta_{10j} = \gamma_{100} + u_{10j}.$$

At Levels 2 and 3, β_{00j} represented the mean status at the end of year 3, within treatment group *j*, while γ_{000} was the overall final mean status. Similarly, β_{10j} represented the mean growth rate within treatment group *j*, while γ_{100} was the overall mean growth rate. Random effects at Level 2 were represented as r_{0ij} and r_{1ij}; while u_{00j} and u_{10j} represented random group effects. This analysis allowed the rates of growth (slopes) over the three-year period of the study to be examined for the individual students, in addition to the rates of growth within and between treatment groups.

RESULTS

The hierarchical linear modeling (HLM) procedure provides an advantage over traditional regression techniques, since it permits the partitioning of variance into embedded hierarchical structures inherent in the nature of the data. In this study, three-level HLM models were used to examine variation of individual students' performance over time; variation among students within the same group; and variation attributable to group membership. In addition, rather than focussing only on mean values at discrete points in time like traditional regression, HLM takes into account the rate of growth, or slope, at each level of the model.

Bryk, Raudenbush, and Congdon's computer program HLM, Version 4 was used to construct the three-level models employed (1996). Four analyses were carried out: Panel A in reading and mathematics, and Panel B in reading and mathematics. Specifically, the HLM analyses were based on the students' scaled scores on the Reading Comprehension and Mathematics Applications subtests of the SAT, administered in the 1996-97, 1997-98, and 1998-99 school years (i.e., years 1, 2, and 3).

Panel A in Reading

A synopsis of the results of the HLM analyses for Panel A in reading is given in Table 6. The table is divided into three sections. The top section notes the fixed effect of the model (i.e., within student variation); and the center section notes the random effects (i.e., within and between group variation). The bottom section lists the percentage of the overall variance that was accounted for by between-groups variance in the status and growth rates. It may be recalled that the time variable was coded so that 'status' represents the final level of achievement at year 3.

Table 6 shows that the mean estimated true status of the Panel A students in reading was 611.80 at the end of the third year. The mean growth rate was 23.89 scaled score points per year. In other words, Panel A students' reading scores increased significantly from the initial level as they progressed from second through fourth grade.

Proceeding to the middle section of the table, it may be seen that there was significant variability among students in the same group (i.e., Level 2) in terms of their status, or level of achievement at year 3 (χ^2=687.67, df=171, p<000), but not in terms of their rate of growth (χ^2=161.27, df=171, p>.500). Thus, while students' achievement levels varied significantly within the groups, their rate of growth did not. Finally, the analysis of the group level parameters (i.e., Level 3) indicated that there was no significant variability that could be attributed to group membership, either in terms of their status at year 3 or in their rate of growth.

Table 6

Three Level HLM Analysis for Panel A in Reading

FIXED EFFECT	*Coefficient*	*Standard Error*	*t –ratio*	*p value*
Mean status at year 3, γ_{000}	611.80	2.85	215.00	.000
Mean growth rate, γ_{100}	23.89	1.10	21.69	.000
RANDOM EFFECT	*Variance Component*	*df*	χ^2	*p value*
Level 1				
Temporal variation, e_{tij}	404.83			
Level 2 (students within groups)				
Individual status at year 3, r_{0ij}	1054.79	171	687.67	.000
Individual growth rate, r_{1ij}	1.44	171	161.27	>.500
Level 3 (between groups)				
Group mean status, u_{00j}	0.01	1	0.69	>.500
Group mean growth, u_{10j}	0.00	1	0.33	>.500
LEVEL 1 COEFFICIENT	*Percentage of variance between groups*			
Status at year 3, π_{0ij}	.000			
Growth rate, π_{1ij}	.000			

The bottom section of the table displays the percentage of overall variance that was attributable to between-groups variance for each parameter at Level 1 of the model. As in Bryk and Raudenbush (1992), this ratio was calculated as: group mean variance / (group mean variance + individual variance). For example, this ratio would be as follows for reading in Panel A: .01 / (1054.79 + .01) = .00001. As shown at the bottom of Table 6, the variance ratios for both status and growth indicate that the percentage of the overall variance due to between-groups variance was negligible (both ratios = .000).

To aid in the interpretation of these results, Figure 1 graphically illustrates the estimated growth curves in reading for 30 randomly selected students in each group of Panel A. The line graph on the left depicts the performance of the students in the project group, while the one on the right depicts that of the students in the control group. It may be recalled that growth curves represent linear growth in models utilizing three observations per students. The growth curves are based on individual student parameters computed by the HLM program using an empirical Bayes (EB) estimation.

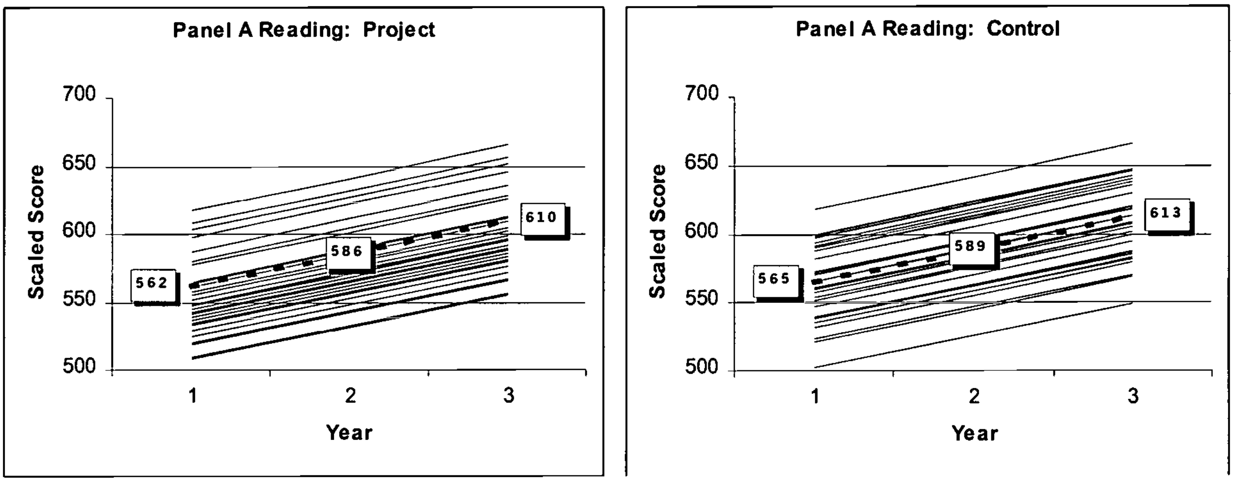

Figure 1. Estimated true reading scaled scores for 30 randomly selected students in the project and control groups of Panel A. The predicted group means are also given, and represented by thick, dashed lines.

A listing of the estimates for Panel A's reading scores is provided in Table 7. While a group's fixed values remain constant, the calculated EB estimates varied for each individual student. The table presents the descriptive statistics for these individual estimates.

Table 7

Values of Panel A's Estimated Parameters in Reading

Group		**Group Fixed Value**		**Individual Empirical Bayes Estimates**			
	n	Intercept	Slope	Intercept		Slope	
				Mean	Standard Deviation	Mean	Standard Deviation
Panel A							
Project	83	611.80	23.88	-1.60	31.44	-.02	.24
Control	91	611.80	23.89	1.47	29.81	.01	.23

Note. The fixed value parameters remain constant within the group.

The students' estimated true scores for each year were calculated from the fixed values of the group's expected parameters and their individual EB parameter estimates. As such, an individual's estimated true scores at years 3, 2, and 1 were calculated as:

Year 3 = fixed value group intercept + EB individual intercept estimate

Year 2 = Year 3 – (fixed value group slope + EB individual slope estimate)

Year 1 = Year 2 – (fixed value group slope + EB individual slope estimate).

Note that the mean estimated growth curves for each group are depicted as thick, dashed lines on the graphs. Estimations of gradual, steady growth in reading were found for the Panel A students. It is evident that while the students' level of achievement (status) differs within the groups, the estimated rate of growth (slope) was uniform. Furthermore, there was little difference apparent in the group means shown in the two illustrations.

Panel B in Reading

A synopsis of the results of the HLM analysis for Panel B students in reading is shown in Table 8. The format of the table is identical to that of Table 6. The Panel B students' mean reading scaled score at the end of year 3 was 616.67. A significant positive rate of growth was identified, at 20.16 scaled score points per year. In other words, the Panel B students' reading achievement increased significantly as they moved from third through fifth grades. Proceeding to the random effects of the model, significant variability among students in the same group was again identified in terms of the students' achievement levels at year 3 (χ^2=1610.72, df=231, p<.000), but not in terms of growth rates (χ^2=247.51, df=231, p=.217). Thus, like their counterparts in Panel A, the Panel B students' levels of achievement varied within the groups, but not their rates of growth. Also in congruence with Panel A, the analysis of Panel B students' reading scores revealed no significant differences between groups, either in terms of status at year 3 or rate of growth. In fact, examinations of variance ratios for both status and growth indicate that the percentage of the overall variance due to between-groups variance was negligible (both ratios = .000). These results are shown in the bottom section of Table 8.

To aid in the interpretation of these results, Figure 2 illustrates the estimated true growth curves of 30 randomly selected students in each group. The growth curves were calculated as described for the Panel A students. See Table 9 for a listing of the estimated parameters. A pattern of gradual, steady growth in reading is apparent for the students in Panel B. In addition, differences in achievement levels are evident, while the rate of growth appears to be relatively consistent within the groups. Finally, a comparison of the mean growth curves for the two groups indicates that the average levels of achievement and growth appear to be similar, as indicated in the HLM analysis.

Table 8

Three Level HLM Analysis for Panel B in Reading

FIXED EFFECT	*Coefficient*	*Standard Error*	*t –ratio*	*p value*
Mean status at year 3, γ_{000}	616.67	2.39	258.41	.000
Mean growth rate, γ_{100}	20.16	0.72	27.87	.000
RANDOM EFFECT	*Variance Component*	*df*	χ^2	*p value*
Level 1				
Temporal variation, e_{tij}	221.08			
Level 2 (students within groups)				
Individual status at year 3, r_{0ij}	1136.59	231	1610.72	.000
Individual growth rate, r_{1ij}	6.54	231	247.51	.217
Level 3 (between groups)				
Group mean status, u_{00j}	0.04	1	0.53	>.500
Group mean growth, u_{10j}	.00	1	0.27	>.500
LEVEL 1 COEFFICIENT	*Percentage of variance between groups*			
Status at year 3, π_{0ij}	.000			
Growth rate, π_{1ij}	.000			

Thus, the HLM analyses of reading scores for Panels A and B were quite consistent. As expected, significant growth was observed as students progressed from grade to grade. And, while individual students' achievement levels varied significantly within their groups, their rates of growth did not. In addition, the analyses failed to reveal any significant differences in reading achievement levels or rates of growth that could be attributed to membership in either the project or control group.

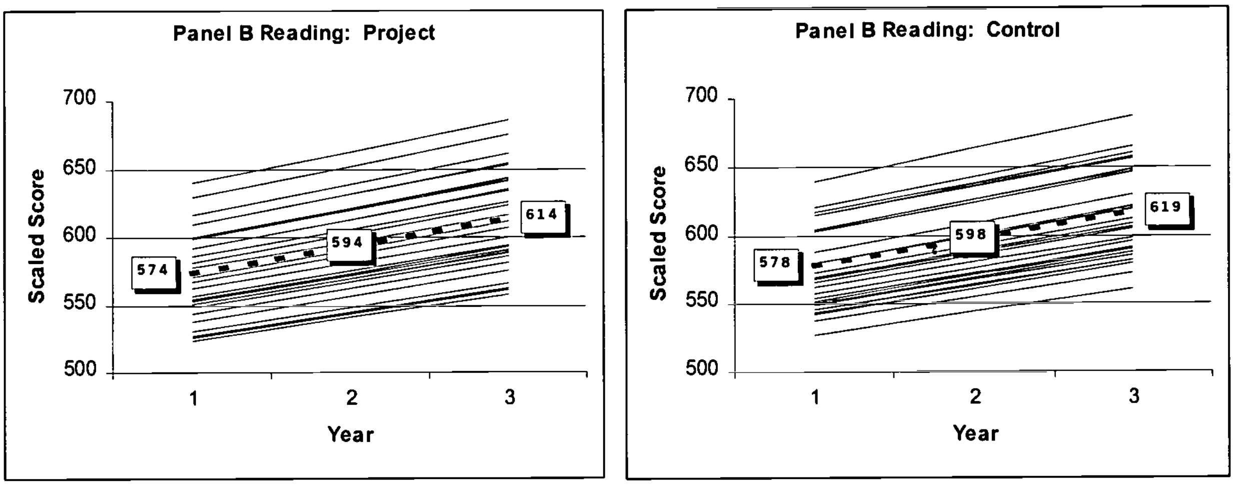

Figure 2. Estimated true reading scaled scores for 30 randomly selected students in the project and control groups of Panel B. The predicted group means are also given, and represented by thick, dashed lines.

Table 9

Values of Panel B's Estimated Parameters in Reading

Group	n	Group Fixed Value Intercept	Group Fixed Value Slope	Individual Empirical Bayes Estimates Intercept Mean	Intercept Standard Deviation	Slope Mean	Slope Standard Deviation
Panel B							
Project	108	616.65	20.16	-2.18	32.51	-.08	1.49
Control	127	616.68	20.15	1.86	32.57	.07	1.54

Note. The fixed value parameters remain constant within the group.

Panel A in Mathematics

Analyses were conducted of the students' mathematics achievement as well. The analysis for Panel A is summarized in Table 10. The format of the table is identical to that of Tables 6 and 8. The mean scaled score for Panel A students was 620.63 at the end of the third year of the project. The average growth rate was found to be significantly positive at 29.34

scaled score points per year, indicating that the students' scores increased as they progressed from second through fourth grades.

Proceeding to the random effects of the model, significant variability was found among the Panel A students within the same group, both in terms of their status at year 3 (χ^2=1241.55, df=171, p<.000) and in terms of their rate of growth (χ^2=291.68, df=171, p<.000). However, no significant source of variability was found between groups, either in terms of status or growth rate. In fact, the examination of variance ratios for both Level 1 parameters indicated that the percentage of the overall variance in mathematics scores due to between-groups variance was again negligible. As shown in the bottom section of Table 10, the ratios for status and growth were both .002.

Table 10

Three Level HLM Analysis for Panel A in Mathematics

FIXED EFFECT	*Coefficient*	*Standard Error*	*t–ratio*	*p value*
Mean status at year 3, γ_{000}	620.63	4.36	142.31	.000
Mean growth rate, γ_{100}	29.34	1.58	18.56	.000
RANDOM EFFECT	*Variance Component*	*df*	χ^2	*p value*
Level 1				
Temporal variation, e_{tij}	460.72			
Level 2 (students within groups)				
Individual status at year 3, r_{0ij}	2470.90	171	1241.55	.000
Individual growth rate, r_{1ij}	166.14	171	291.68	.000
Level 3 (between groups)				
Group mean status, u_{00j}	4.90	1	0.74	>.500
Group mean growth, u_{10j}	0.30	1	0.33	>.500
LEVEL 1 COEFFICIENT	*Percentage of variance between groups*			
Status at year 3, π_{0ij}	.002			
Growth rate, π_{1ij}	.002			

Figure 3 illustrates the results of this analysis. Individual students' estimated true scores in mathematics were calculated in the same way described for the reading scores. See Table 11 for a listing of the estimated parameters for the groups. Again, it may be seen that the estimated growth curves for 30 randomly selected students in each group showed progress over time. However, the differences in the rates of growth for individual students are evident in these line graphs. These differences are represented in the graph by the divergence and convergence of individual students' growth curves. However, once again, the group means and rates of growth were comparable.

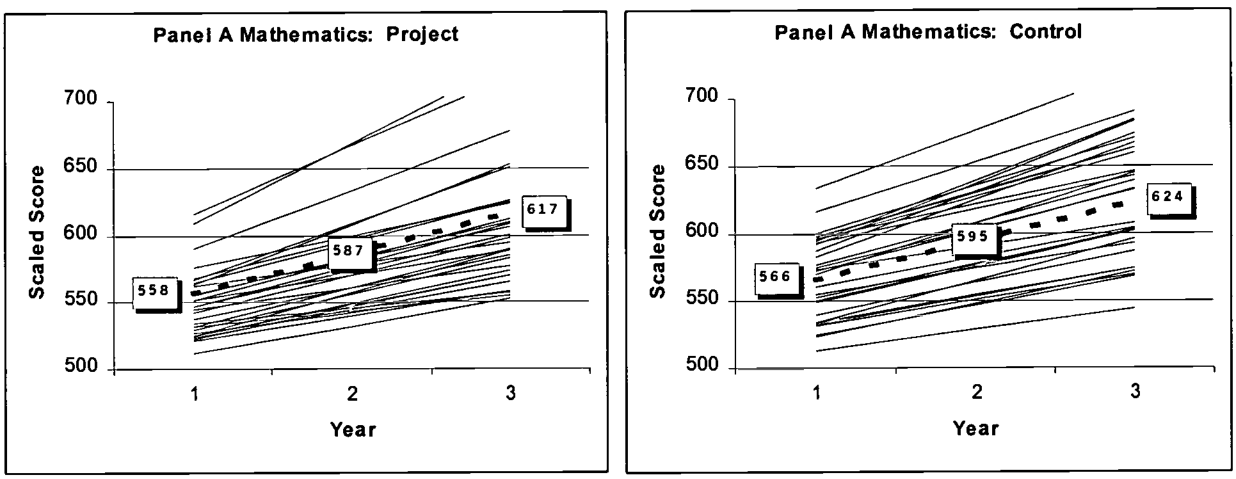

Figure 3. Estimated true mathematics scaled scores for 30 randomly selected students in the project and control groups of Panel A. The predicted group means are also given, and represented by thick, dashed lines.

Table 11

Values of Panel A's Estimated Parameters in Mathematics

Group		**Group Fixed Value**		**Individual Empirical Bayes Estimates**			
	n	Intercept	Slope	Intercept		Slope	
				Mean	Standard Deviation	Mean	Standard Deviation
Panel A							
Project	83	619.27	29.67	-2.66	52.66	-.17	10.89
Control	91	621.99	29.00	2.43	41.09	.16	1.85

Note. The fixed value parameters remain constant within the group.

Panel B in Mathematics

A synopsis of the results of the HLM analysis for Panel B students in mathematics is shown in Table 12. The format of the table is identical to that of Tables 6, 8 and 10. As the table shows, the overall mean scaled score in mathematics was 629.24 in year 3. The average growth rate was significantly positive at 29.87 scaled score points per year. As such, the Panel B students' achievement increased significantly as they progressed from third through fifth grades. An examination of the random effects reveals that there was significant variation among students within the same group with regard to their status at the end of year 3 (χ^2=1172.76, df=231, p<.000), but not with regard to their rate of change (χ^2=230.21, df=231, p>.500). However, at the third level of the model, significant variability was identified between the groups' estimated mean rates of change (χ^2=5.33, df=1, p=.020). Still, the mean differences between groups at year 3 were not statistically significant.

In keeping with these findings, an examination of the variance ratios for status indicated that the percentage of the overall variance due to between-groups variance was negligible (.001). However, this was not the case for the variance ratio for growth rate. As shown at the bottom of Table 12, the ratio for growth rate was .528. In other words, 52.8% of the overall variance in the students' growth rates was attributed to between-groups variance.

Figure 4 provides a graphic illustration of the growth curves for Panel B students in mathematics. Again, the two line graphs show the estimated growth curves for 30 representative students in each group, with estimated true scores calculated as described previously. See Table 13 for a listing of the estimated parameters for the groups. Also shown on each line graph, as a thick dashed line, is the groups' estimated mean growth curve. Once again, gradual steady growth is apparent for Panel B students in mathematics. Within groups, the students' achievement levels varied, while the rates of growth remained consistent. While casual inspection of the estimated mean growth curves of the two groups might suggest that they appear similar, the rates of growth illustrated are significantly different. The average rate of growth for the project group was 31.56 scale score points per year, while that of the control group was 28.19. Of the four sets of HLM analyses, this was the only finding of differences between groups that was statistically significant.

Table 12

Three Level HLM Analysis for Panel B in Mathematics

FIXED EFFECT	*Coefficient*	*Standard Error*	*t –ratio*	*p value*
Mean status at year 3, γ_{000}	629.24	3.02	208.49	.000
Mean growth rate, γ_{100}	29.87	1.72	17.34	.000
RANDOM EFFECT	*Variance Component*	*df*	χ^2	*p value*
Level 1				
Temporal variation, e_{tij}	446.07			
Level 2 (students within groups)				
Individual status at year 3, r_{0ij}	1564.99	231	1172.67	.000
Individual growth rate, r_{1ij}	3.50	231	230.21	>.500
Level 3 (between groups)				
Group mean status, u_{00j}	1.52	1	0.26	>.500
Group mean growth, u_{10j}	3.91	1	5.33	0.020
LEVEL 1 COEFFICIENT	*Percentage of variance between groups*			
Status at year 3, π_{0ij}	.001			
Growth rate, π_{1ij}	.528			

Consequently, the results of the HLM analyses in mathematics were not as consistent as those in reading. Gradual, steady growth curves were generally estimated for all students. However, for Panel A no variation attributable to group membership was identified, while between-group variation was identified for Panel B. In Panel B, the project group's higher rates of growth in mathematics were found to be the significant source of variation. Nonetheless, the levels of mathematics achievement were not significantly different.

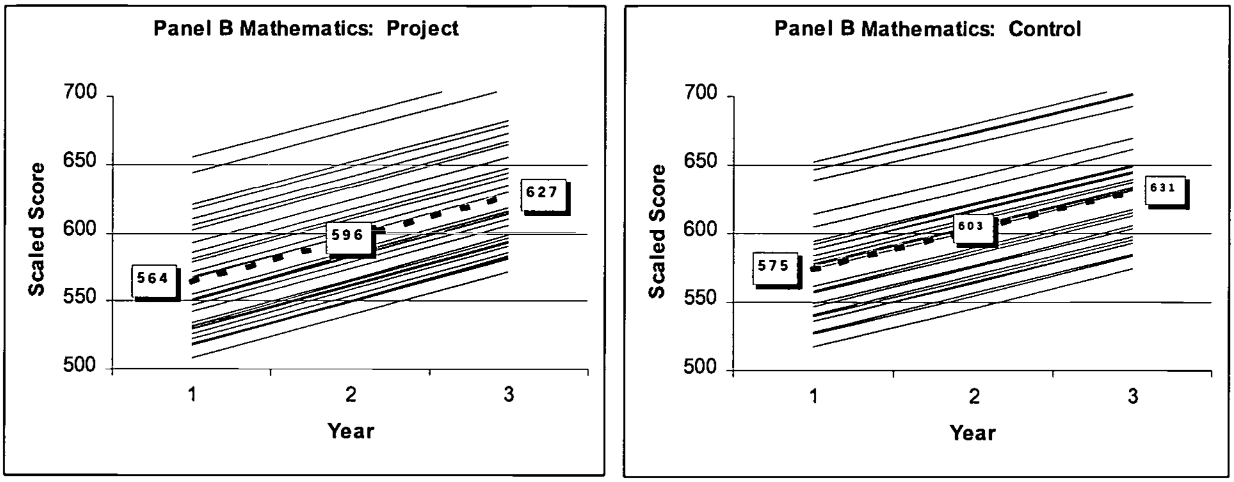

Figure 4. Estimated true mathematics scaled scores for 30 randomly selected students in the project and control groups of Panel B. The predicted group means are also given, and represented by thick, dashed lines.

Table 13

Values of Panel B's Estimated Parameters in Mathematics

Group		Group Fixed Value		Individual Empirical Bayes Estimates			
				Intercept		Slope	
	n	Intercept	Slope	Mean	Standard Deviation	Mean	Standard Deviation
Panel B							
Project	108	628.19	31.56	-1.06	36.49	.02	.31
Control	127	630.28	28.19	.89	38.93	-.01	.34

Note. The fixed value parameters remain constant within the group.

DISCUSSION

Hierarchical linear modeling (HLM) provides a somewhat different view of data than the more traditional alternative, Analysis of Variance (ANOVA). Unlike ANOVA, HLM analysis facilitates the examination of both achievement levels and growth over time. However, the analysis is based on estimated true scores, which precludes the examination of achievement levels at discrete points in time. Figures 5 and 6 provide a comparison of the project students' observed and estimated true scores across the three years of the project, in reading and mathematics, respectively. Note that only the project students' scores are presented for illustrative purposes.

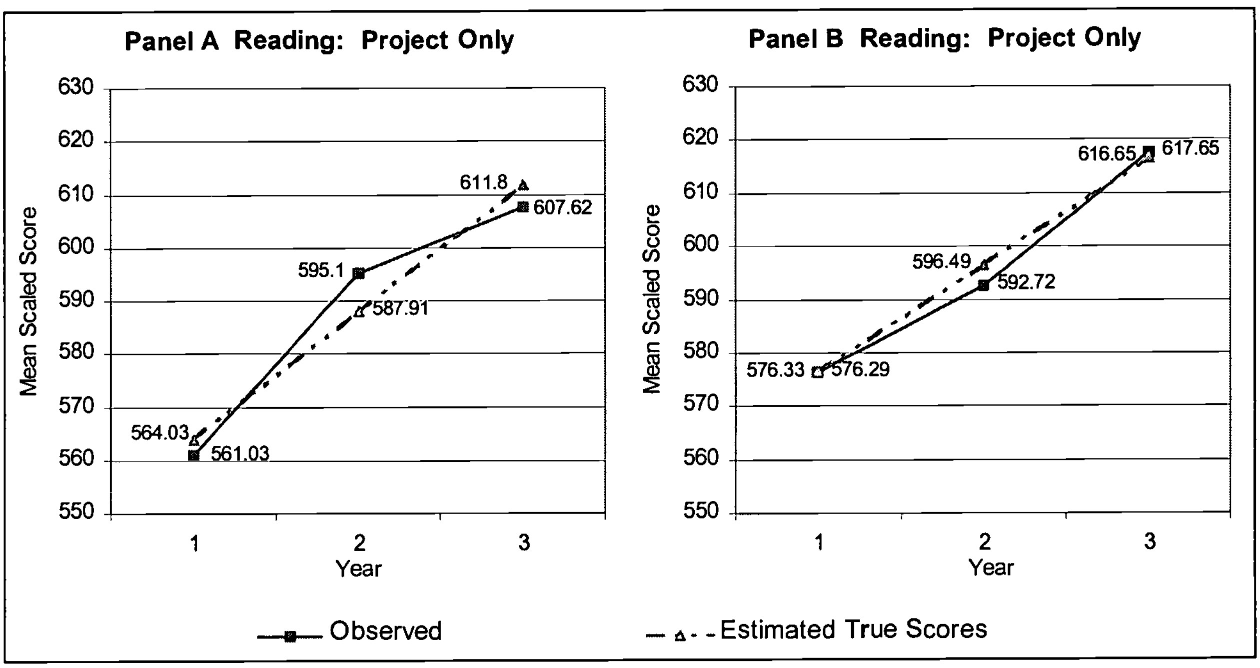

Figure 5. Comparison of the project students' observed and estimated true reading scores across the three years of the project.

The differences between these two sets of scores point out one difference between the ANOVA and HLM procedures. The level of precision available through the interpretation of group results in a traditional ANOVA is obscured in the HLM analysis. Yearly fluctuations in the groups' performance, as indicated by mean observed scores are apparent and traceable in ANOVA. Trends presented in the HLM analysis smooth the effect of such yearly fluctuations. For example, Figure 6 shows that the mathematics scores of students in Panel A showed a marked improvement in year 2, after initial low scores in year 1, but a return to comparatively low scores in year 3. The estimated true scores of this group show consistent, gradual growth.

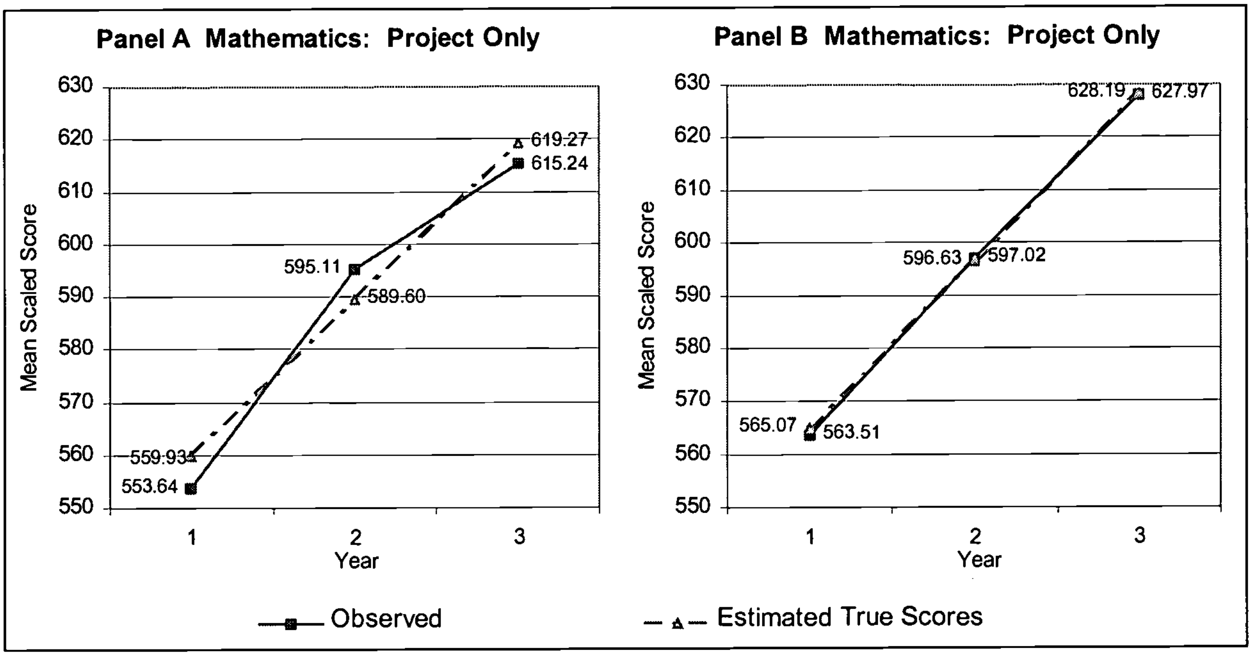

Figure 6. Comparison of the project students' observed and estimated true mathematics scores across the three years of the project.

Despite the loss of precision available in the interpretation of observed scores in the ANOVA procedure, the HLM procedure offers distinct advantages to practitioners in program evaluation. First, although the data were collected at uniform time periods for all subjects in the current research, this is not a requirement of the HLM procedure. Data may be collected at varying time points. As such, the estimated growth curves obtained from HLM analyses are intended to be meaningful along the length of the curve, and to extend beyond current observations. As result, the trajectories may be used to predict levels of achievement into the future.

Secondly, traditional ANOVA techniques do not allow for the examination of growth curves for individual students. Potentially, growth curves can be examined in more detail to discover which students might benefit most from a particular program or intervention. Finally, the ability of the HLM procedure to examine embedded structures in the data renders it more sensitive, and it is thus better able to distinguish the sources of variation in a set of data. This ability would facilitate decision making regarding the adoption and continuation of programs in an educational setting.

The Edison Project Students' Achievement

The primary question that guided this study was: Did the students who attended The Edison Project's (currently Edison Schools Inc.) school make greater academic progress than comparable students who attended other schools in the district? This question can now be addressed. It has been shown that the project students' performance in reading and mathematics prior to enrollment in the project school was comparable to that of the students' in the control group. The results of the analyses conducted after the project students had received instruction by means of the Edison model for three years yielded some surprising results.

The results of the HLM analyses indicated that the students' scores in reading increased over the three years of the study, as would be expected. However, the analyses for both Panels A and B failed to identify any statistically significant differences in reading achievement between the project students and their counterparts in the control group. Thus, the project students' performance in reading was only comparable to that of the control group.

The results of the analyses in mathematics were not as consistent. Again, significant levels of growth across the three year period were found. However, for Panel A no variation attributable to group membership was identified, while the project group's higher rates of growth in mathematics were a significant source of variation in Panel B. Nonetheless, the levels of mathematics achievement at the end of the three-year period were not significantly different in either group.

Thus, at the end of the three-year study, the reading and mathematics achievement of both the Panel A and B students at The Edison Project's school was still only comparable to that of the students attending other schools in Miami-Dade County. The educational program of the Edison model was not superior to the standard program offered at other schools in the district.

Limitations in the Research

One limitation of this study was that only three time-ordered observations were available for inclusion in the HLM analyses. More than three observations would be required to project curvilinear growth models, which are often appropriate when assessing growth in achievement over time. More observations conducted over a longer period of time would provide more reliable estimates of true patterns of growth for the project students. In addition, the student population in this school consists of a relatively homogeneous group of black students from a low socioeconomic neighborhood. A more heterogeneous sample would facilitate the inclusion of other predictive variables in the model, and strengthen the external validity of the findings. Finally, one should not generalize the results on tests of reading and mathematics to other content areas, such as social studies.

Implications for Future Research

This study has been limited to assessing the impact of the Edison model on the academic performance of students attending one public elementary school in Miami-Dade County, Florida. In the future, efforts to replicate the findings of this study should expand the scope by targeting schools at multiple levels (i.e., elementary, middle, senior high) in other areas of the country, with different demographic characteristics.

The application of HLM methodology in this study was useful in examining the impact of an instructional program on student achievement. However, it is only one means of applying the methodology in the evaluation of educational programs. An additional application of the methodology is to test variation within and across embedded structures: teachers, classrooms, schools, and school districts. Given an adequate sample of schools run by The Edison Project, one could determine the sources of variation in student performance, parent satisfaction, teacher effects, and many other outcomes. From a theoretical point of view, it may be possible to determine how variation in school-level variables affects implementation, and how child-level variables relate to individual differences in performance. Thus, HLM methodology appears to be a potentially useful tool in the field of program evaluation.

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