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PAPER

Getting Inside the Black Box

Examining How the Operation of Charter Schools Affect Performance

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Abstract

In recent years, a series of papers have examined the performance of charter schools with mixed results. Some of this research has shown that charter school performance varies by charter type or the age of the school (Buddin and Zimmer, 2005; Sass, 2005; Bifulco and Ladd, 2005; Hanushek et al., 2002). However, this research has not examined the school attributes that lead to high- or low-achieving charter schools. In this paper, we use student-level achievement and survey data of charter schools and a matched-set of traditional public schools from California to take an initial step into examining correlations between school operational features and student achievement. While we did not find characteristics that consistently lead to improved student achievement, we did identify some features that are more important at different grade levels or in charter schools versus in traditional public schools. We also examined the relationship between greater autonomy within schools, which is a major tenet of the charter movement, and student achievement and found very little evidence that greater autonomy leads to improved student achievement.

INTRODUCTION

In education, few topics have created as much debate as charter schools, which are publicly supported schools given greater autonomy of operation in exchange for public accountability. Since charter schools' inception in 1991, the charter school movement has seen tremendous growth as 40 states plus the District of Columbia have passed charter school laws. Currently, more than 3,500 charter schools enroll nearly 1 million students nationwide. As the charter school movement has grown, rhetoric from advocates and opponents has dominated the debate about their effectiveness. Only recently have researchers been able to provide any quantifiable results, which are mostly mixed. However, this research has generally treated charter schools as a monolithic group, which might not be the case.

Part of the impetus for charter schools is to create autonomous schools, which would become incubators of creative and innovative ideas (Kolderie, 2004; Finn et al., 2000; Nathan 1996; 1998). As with any innovation, successes and failures will occur, but part of the point is to learn from them. Therefore, it is imperative that researchers begin prying open the black box of charter schools and look for the correlates of success and failures. In this paper, we take a first step toward this goal by using both student achievement and school survey data to examine how the organizational structure and operation of charter and traditional public schools affect performance. In the next section, we first outline the findings from the previous research. Then we describe the data and research approach for our analysis and finally, provide results and conclusions.

LITERATURE REVIEW

As the charter movement has grown, so has the research of the performance of these schools. Most of this research has examined charter schools in individual states, including Arizona (Solmon et al., 2001), California (Zimmer et al., 2003; Buddin and Zimmer, 2005), Florida (Sass, 2005), Michigan (Eberts and Hollenbeck, 2002; Bettinger, 2005), North Carolina (Bifulco and Ladd, 2005), Texas (Gronberg and Jansen, 2001; Booker et al., 2004; Hanushek et al., 2002), and Pennsylvania (Miron, et al., 2002).[1] In addition, a few recent studies have examined student achievement in charter schools nationally, but these have primarily relied on point-in-time school-level data, which cannot account for the effects charter schools have on the growth of student achievement (AFT, 2004; Hoxby, 2004; Carnoy et al., 2005).

Overall, the research on charter schools has revealed mixed results ranging from slightly positive, to no effect, to negative impacts. Zimmer et al. (2003) and Buddin and Zimmer (2005) argue that measuring the effect of charter schools is complex and it is difficult to paint a single picture of the performance because charter schools vary from school to school. The authors illustrate this point by showing that the performance of charter schools varies by schools started from scratch (startup schools), schools that convert from public schools (conversion schools), and schools that offer a significant portion of instruction outside of traditional classrooms (nonclassroom-based schools). These results suggest that charter school performance could vary by the operation and

[1] Hoxby and Rockoff (2004) also examined four charter schools in Chicago, which provided some evidence that charter students outperform noncharter students. Their analysis capitalized on the fact that these schools are oversubscribed and used a lottery mechanism to admit students. Presumably the lottery winners and losers are similar in every way except admission into these schools. Tracking performance of both sets of students then creates an unbiased perspective of performance. However, Hoxby and Rockoff's study has a major drawback in that it may have limited implications for those schools that do not have waiting lists. In fact, you would expect schools with waiting lists to be the best schools, and it would be surprising if they had the same results as other charter schools.

organizational structure of schools and underscores the need to examine these aspects of charter schools in greater detail when evaluating their performance.

However, part of the challenge of addressing this need is that researchers have generally treated charter schools as a black box, and have failed to examine the actual organization or operation of these schools. Most of the research has focused on teachers. For instance, Bomotti, Ginsberg, and Cobb (1999) and Burian-Fitzgerald, Luekens, and Strizek (2004) examined teacher experience and turnover rates and found that charter schools tend to have less-experienced teachers and more turnover than traditional public schools. In another study, Burian-Fitzgerald (2004), utilizing a national sample of charter and traditional public from the nationwide Schools and Staffing Survey, found that charter schools can create slightly higher levels of collaboration among teachers. Other studies have examined the operation of charter schools more broadly; such studies include Miron and Nelson (2002), which used a survey of all of Pennsylvania charter schools. Zimmer et al. (2003) surveyed both charter and traditional public schools in California. This analysis suggested that charter schools provide more instructional hours in non-core subjects, such as fine arts and foreign languages, but are less likely to offer some types of programs, including gifted programs. Also, startup charter schools are more likely to mainstream students for special education. In addition, charter-school principals reported having less- experienced and less-credentialed teachers.

While the above research has been informative, the authors have not taken the next step and examined how these variations may affect student achievement. Ted Kolderie (2004), who was instrumental in passing the first charter law in Minnesota, argues that charter laws are intended to create schools with a wide variety of educational

and operational approaches and that learning from their experiences requires understanding differences in how different charter schools operate. By having a better understanding of how charter schools operate, we can begin to understand what leads to improved performance. Such understanding is a critical step toward realizing the hope that charter schools could be laboratories and incubators for promising educational practices that might be used in all schools.

DATA

Our analysis uses data from a survey of charter and traditional public schools as well as test score data from schools included in the survey sample. Below, we describe these two data sets.

Surveys

To examine the operation of charter and traditional public schools, we surveyed principals of charter schools and a matched sample of traditional schools in spring 2002. These surveys used consistent questions as much as possible to allow comparisons. To identify the universe of California charter schools, we created a list by merging the California charter school office's publicly available data with the charter schools listed in the 2000–2001 California Basic Educational Data System (CBEDS). Schools were eligible if they opened before September 15, 2001, and had a status of "operating" as of February 2002. In total, 357 schools met these requirements. We then contacted the individual schools and their respective chartering authorizers to verify the data in our initial list. We made changes in our database to reflect updated information obtained during these interviews, including adding schools that were not in our original list. Twenty schools were added to our sample this way, while 25 were eliminated. Thus, the

final sample included 352 charter schools. One limitation to this method is the small possibility that a charter school was not included in our sample because it was not entered in either the California charter office data or the CBEDS data.

The creation of a match sample of noncharter comparison schools was crucial to our analysis. In the past, researchers have generally found that charter schools disproportionally serve low-income and high-minority students (Gill et al., 2001; Zimmer et al., 2003; Finnigan et al., 2004), which may influence the schools' cost and governance structures. To avoid confounding differences associated with school type with differences related to students served, we matched charter and noncharter schools by an estimated *propensity* score (Rosenbaum and Rubin, 1983). The propensity score is the probability that a school with a given set of characteristics is a charter school as opposed to a traditional public school. These propensity scores can then be used to match charter schools to noncharter schools by finding those with similar propensity scores.

To carry out the propensity match, we used a four-step process. First, we stratified charter schools into eight categories (elementary schools, middle schools, high schools, county schools, continuation schools, juvenile hall schools, special education schools, and alternative education schools) used by the California Department of Education (CDE) to designate all public school types.[2] Roughly 60 charter schools were new in the 2001–2002 school year and were not included in the 2000–2001 CBEDS data, and thus,

[2] Some charter schools had grade ranges that intersected multiple strata (e.g., kindergarten through grade 12 school intersects the elementary, middle, and high school strata). In these cases, the charter schools were included in each category and matched to a traditional public school for each category. Because of the small sample of county, continuation, juvenile hall, special education, and alternative education schools, a propensity match was not used in these cases. Instead, if demographic data were available for these schools, the schools were matched based on the criteria of getting schools within 10 percent or racial characteristics of the charter schools. In many cases, demographic characteristics were not available for these schools and schools were matched to a traditional public school of the same school type within the district or the closest district.

could not be matched to public schools. Second, within grade range strata, we fit a logistic regression model to predict designation (1 = charter; 0 = traditional public) as a function of aggregate school characteristics, including percentage ethnicity (percentage White, Black, Asian, and Hispanic), pupil socioeconomic status (percentage free and reduced-price lunch),[3] and percentage English language learners. Using these characteristics, predicted values for charter school *i* and traditional public school *j* were created (p_i and p_j). Then, the distance between these schools (d_{ij}) is estimated as the absolute value of the difference between their propensity scores, $d_{ij} = | p_i - p_j |$. We calculated the distance between each charter school and every traditional public school. Fourth, we matched to each charter school a traditional school that minimizes d_{ij} over all California traditional public schools *j*.

As part of the matching process, we allowed a traditional public school to be matched to multiple charter schools because of budget and time constraints. While the propensity scores do not create perfect matches, they do create a sample of traditional public schools with characteristics that closely resemble those of charter schools. Table 1 displays the characteristics of the matched elementary, middle, and high schools for charter and traditional public schools.

[3] It was later discovered that many charter schools do not participate in free and reduced-price lunch programs. Because the original propensity match included percentage free and reduced-price lunch, the final sample had to be weighted to account for this bias.

Table 1: Ethnic/Racial and Low-English Proficient Breakdown[4]

School Type	Schools	Percentage White	Percentage Black	Percentage Hispanic	Percentage Asians	Percentage Others	Percentage LEP
Elementary Schools	Charter Schools	48.5	14.9	27.8	2.7	6.1	15.6
	Match Public Schools	51.5	13.3	27.7	2.9	4.6	17.1
Middle Schools	Charter Schools	51.8	11.7	23.8	2.3	10.4	9.4
	Match Public Schools	54.3	13.8	22.5	4.0	5.4	10.6
High Schools	Charter Schools	52.9	9.6	26.4	4.0	7.1	10.0
	Match Public Schools	53.2	5.3	28.8	6.8	5.9	10.2

Source: 2001–2002 CBEDS data.

However, not all of the charter or matched traditional public schools responded to our survey. Table 2 highlights the number surveyed, the number of respondents, and the percentage response rate for each sample. The response rates were nearly 75 percent for both charter and traditional public schools.

Table 2: School Survey Response Rate

Survey	Sample	Respondents	Percentage Response Rate
Charter School Survey	352	257	73%
Conventional Public School Survey	245	184	75%

[4] We only matched conventional public schools to charter schools for those schools about which we had demographic information.

To adjust for differential response rates among and across charter and traditional schools, which may create bias in our results if types of charter schools are underrepresented, we weighted the data so that the sample of charter schools reflected the population of charter schools in the state. Traditional public school results were weighted to ensure comparability with the full sample of traditional public schools created through the propensity match. To weight the data for nonresponse, we used a logistic regression that predicts whether a school responds or not based on its demographic characteristics, including percentage racial/ethnic breakdowns, percentage free and reduced-price lunch (including a dummy variable for whether the school participated in the free and reduced-price lunch program), and percentage language proficient (Little and Rubin, 1987). In this approach, the universe of charter and traditional public schools are included in a single data set. Using the coefficient estimates from the regression, we enter each school's characteristics to gain a predicted probability (p) of responding. This analysis weight for each charter and traditional public school that responded is the odds of responding p/(1-p) as described by Hirano, Imbens, and Ridder (2000). Table 3 displays the characteristics of the sample after weighting.

Table 3: Student Characteristics of Weighted Sample

School Type	Percentage White	Percentage Black	Percentage Hispanic	Percentage Asians	Percentage Others	Percentage LEP
Charter Schools	50.1	13.5	26.8	2.8	6.8	14.8
Conventional Public Schools	47.4	11.6	30.7	3.9	6.4	17.7

Source: 2001–2002 CBEDS data.

Before proceeding, we should mention some possible drawbacks of our survey data. First and foremost, we relied on self-reported information through a survey of

school principals, which may contain some errors. In addition, although we had a high response rate and weighted the sample for nonresponse, we did not have a 100 percent response rate. This may have created small errors in our percentages and averages. Finally, the survey data we collected are from a single point in time, while our student achievement data (described below), are longitudinal. Our analysis combined these data to examine how operational and structural characteristics of schools affect performance. This analysis rests on the assumption that these school characteristics are consistent over time. In many, but not all cases, this appears to be a safe assumption.

Student-Level Data

The CDE provided individual records for all California students who took the Stanford 9 from 1998 through 2002.[5] The test is administered in the spring of each year at elementary and secondary schools. Test scores are reported in terms of the percentile normal curve equivalent based on the Stanford 9 norming sample. If, for example, a student is in the 45th percentile for math in the third grade and in the 50th percentile in the fourth grade, the student's achievement level is increasing relative to his/her grade cohort. The analysis divided students into two groups: elementary- (grades two through five) and secondary-level (grades six through eleven). The main limitation of the data is that it does not provide a student-level identifier to track year-to-year changes in a student's test scores. Individual identifiers are important for this type of analysis because they would allow the analysis to isolate a baseline achievement level for individual students. Baseline achievement would allow the analysis to better adjust for the student's

[5]Starting in 2002–2003, CDE switched from the Stanford 9 to the California Achievement Tests, Sixth Edition (CAT/6) in 2003–2004. Therefore, our data sets include the full range of test scores for the Stanford 9.

unmeasured background, which has an ongoing effect on his or her achievement. Nevertheless, it does represent one of the most comprehensive data sets of charter schools ever compiled.

For our analysis, these test score data were restricted to the sample of charter and traditional public schools included in our survey data, which includes 131, 117, and 77 charter elementary, middle, and high schools and 87, 42, and 55 traditional public elementary, middle, and high schools, respectively. The data include characteristics of charter and traditional public school students, including information on English learner status, race/ethnicity, parent's education,[6] school lunch eligibility, and student mobility (i.e., whether the student is in the first year at his or her current school). Later in the analysis, these variables are used to adjust test scores for the effect of student background. The data file also identifies the student's school and grade in school.

ANALYSIS

Survey Analysis

Table 4 presents operational or structural differences between charter and traditional public schools. We categorized these features into five categories: school-organizational features, school-level control, teacher quality issues, curriculum allocations, and principal background.

Because many California charter schools (and some traditional schools) incorporate home schooling as part of their instructional design (Guarino et al., 2005), we asked principals what portion of their student population is instructed at home.. Table 4 shows that home school instruction is much more popular among charter schools. Furthermore,

[6]Students were asked to report the education level of the most educated parent or guardian with whom they reside. The categories were non-high-school graduate, high school graduate, some college (including associate's degree), college graduate, and graduate school.

the percentage of students instructed at home increases at higher grade levels, with charter high schools having on average, more than 25 percent of their student population instructed through home schooling.

Table 4
School Characteristics by School Type for TPS and Charter Schools

	Elementary		Middle		High	
	TPS	Charter	TPS	Charter	TPS	Charter
School Features						
Students schooled at home (%)	4.1	11.6*	5.7	20.5*	7.0	25.6*
Instructional days per year	179.7	180.9	180.1	185.1*	177.8	186.0*
School-Level Control (4-Point Scale Where 4 = Full Control)						
Student disciplinary policies	3.1	3.5*	3.2	3.6*	3.2	3.7*
Student assessment policies	3.0	3.5*	3.0	3.6*	3.0	3.8*
Staff salaries and benefits	1.3	2.6*	1.4	2.9*	1.4	3.1*
Other budgetary expenses	2.9	3.4*	2.8	3.5*	2.8	3.5*
Curriculum	2.6	3.4*	2.6	3.6*	2.7	3.7*
Staff hiring, discipline, and dismissal	2.8	3.3*	2.9	3.4*	2.9	3.6*
Teacher Quality Issues						
Emphasis on full standard credential	3.7	3.7	3.6	3.5	3.6	3.4*
College major in teaching field	2.9	2.9	3.0	2.9	3.5	2.9*
Professional Development (Annual Participation Quartile)						
Workshops or conferences	3.5	3.6	3.4	3.5	3.2	3.5*
Courses for college credit	1.8	2.1*	1.8	2.1*	2.0	2.2
Teacher study groups	2.7	2.8	2.7	2.7	2.3	2.4
Mentoring or coaching	2.0	2.6*	1.7	2.4*	1.8	2.3*
Curriculum Allocations (5-Point Scale: 1 = 0 Hours/Week,..., 5 = 7 or More Hours/Week)						
English/language arts	4.7	4.4*	3.9	4.1	3.4	3.3
Mathematics	4.1	4.1	3.6	3.9*	2.1	2.3
Computer skills	2.1	2.2	2.3	2.3	0.5	0.7*
Social studies	3.1	3.2	3.4	3.4	2.9	2.9
Sciences	2.8	3.0	3.3	3.4	1.9	1.9
Foreign language	1.2	1.8*	1.6	1.8	0.7	0.9
Fine or Performing Arts	2.1	2.4*	2.2	2.3	0.9	1.1
Principal's Background (Years)						
Leadership at current school	4.5	3.6*	4.4	3.1*	4.8	2.6*
Administrative experience	12.2	8.7*	11.5	8.2*	11.9	9.6
Teaching experience	12.8	12.6	12.3	11.7	12.7	11.9
Sample Size	87	131	42	117	55	77

Notes: An asterisk indicates that the corresponding charter school value varies significantly from the TPS value at the 5 percent significance level. Some schools (especially charters) have grades that span across the classification of elementary, middle, and high schools. These schools are included in the

category for each type of school. The curriculum allocations reflect fourth, seventh, and twelfth grade students for elementary, middle, and high schools, respectively.

Another structural feature that may vary between charter and traditional public schools is the instructional days per year. Many charter school proponents argue that one way to improve learning is through more instructional time. For instance, the educational management organization (EMO) of Edison schools, which includes a large number of charter schools nationwide and in California, provides longer school years (Gill et al., 2005). The data in Table 4 indicates that charter schools in this study have longer instructional days than traditional public schools at middle and high school levels, but not at the elementary school level.

One of the strongest arguments put forth by charter advocates for these schools is the ability to make autonomous decisions to meet the needs of their students and allow greater innovation (Kolderie, 2004; Finn et al., 2000; Nathan 1996; 1998). However, in cases when the charter arrangement is formed between a district and a school, the district may restrict certain liberties. Therefore, we also asked both charter and traditional public school principals about the level of control over certain operational decisions within their schools. In the survey, principals responded to a four-point scale, where 1 represented no control and 4 represented full control. Table 4 indicates that charter school principals across all levels, reported a greater level of control than traditional public school principals on all the dimensions listed. These data suggest that charter school principals do indeed have a higher level of autonomy in their schools.

One of the ways in which charter schools could use this greater freedom is in the hiring and professional development of teachers.[7] To examine these issues, we asked principals how much emphasis (as measured in a four point scale that ranged from not important to very important) they put on hiring credentialed teachers and teachers who majored in the field in which they teach. We also asked what percentage of teachers (through a four quartile response, with 1 indicating 0 to 25 percent and 4 indicating a 75 to 100 percent) participated in different professional development activities, including workshops or conferences, courses for college credit, teacher study groups, and mentoring and coaching.

In terms of hiring practices, elementary and middle charter schools and traditional public schools placed a similar emphasis on hiring credentialed teachers as well as teachers who majored in the field in which they will teach. However, at the high school level, charter schools placed less of an emphasis on both. For professional development, charter schools at all levels placed a greater emphasis on mentoring and coaching than traditional schools. The rest of the results for professional development are more mixed with charter elementary and middle school emphasizing college courses more, while charter high schools emphasized workshops or conferences more.

Another way in which charter schools could use their autonomy is through the amount of instructional time spent on curriculum subjects. We asked both charter and traditional public school principals how much time they spent on various subjects (through a five-point scale in which 1 represented zero hours and 5 represented seven or

[7] Although evidence from the literature is mixed on whether credentialing matters in relation to student achievement (e.g., Goldhaber and Brewer, 2000, 2001), politicians and educators across the country often advocate increasing the proportion of credentialed teachers within the classroom, especially in low-income schools (e.g., Darling-Hammond et al., 2001).

more hours). Both charter and traditional public schools reported similar number of hours spent on core subjects, with only a few statistically significant differences. Charter elementary schools reported spending a little less time on English/language arts, and charter middle schools reported spending a little more time on mathematics. However, charter schools reported spending significantly more time on computer skills at the high school level and foreign language and fine or performing arts at the elementary level.

Finally, we examined the principal's background in both charter and traditional public schools. The literature has noted the importance of principal leadership (Gates et al., 2003) to student achievement. Leadership skills may be even more important for charter schools when the principals are not only the instructional leader but also manage the operation and finances of the school, in many cases from scratch. Table 4 shows that principals at charter schools have significantly less experience at their current school across all levels, less general administrative experience for elementary and middle charter schools, and teaching experience similar to their traditional public school counterparts at all levels.

In our student achievement analysis, we examine how variations in these operational and structural features affect performance by combining the survey data with the student achievement data.

Achievement Analysis

Model

The statistical model of student achievement in public schools is based on a multilevel approach where random effects are estimated for each school and each grade cohort within each school. The school-level random effect allows for unobserved

heterogeneity across schools—i.e., the learning environment may vary systematically at different schools in ways that have a common achievement effect on the students that attend those schools. The grade-cohort effect is designed to capture the possibility that some groups of students may have a persistent achievement score effect. For example, if third grade students at a particular school score high in math in one year (relative to the classes with similar student characteristics), then the forth grade students at the same school are also likely to excel in math because of unmeasured attributes of students in the grade cohort.

In addition to the random components, the model also adjusts for the individual characteristics of each student taking the test and the observed characteristics of the school as estimated in the school survey. The key student characteristics available are limited English proficiency, race/ethnicity (white non-Hispanic, black, Asian, and Hispanic), gender, and eligibility for the free or reduced-price school lunch program (a common measure of socioeconomic status). The California test data also include an indication of the parental education for each student. Finally, the data indicate whether students are in their first year at their current school. Students (and their parents) may have difficulty in making the transition to friends and teachers at a new school, so their test scores in the new school may be lower than those of similar students who remain at the same school (Zimmer et al., 2003; Buddin and Zimmer, 2005).

The school characteristics are drawn from the survey data described above. Five types of school operational measures are included in the analysis: school features, school-level control, teacher quality issues, curriculum allocations, and principal background.

The formal model describes the relationship between student-level test scores, student characteristics, school operational measures, a random school effect, and a random grade-cohort effect within each school. The model includes dummy variables to describe any possible time trend in test scores over the five years from 1998 through 2002. The dependent variable is the student percentile test score, T_{ijkt}, observed for student *i* in school *j* and grade cohort *k* at time *t*.[8] The formal model is

$$T_{ijkt} = x_{it}\beta + w_{jt}\gamma + \theta_j + \psi_{j(k)} + \varepsilon_{ijkt} \qquad (1)$$

where x_{it} *and* w_{jt} are vectors of measured time-varying student and school characteristics, respectively; β and γ are parameter vectors for student and school effects; and school and grade-cohort time heterogeneity are represented by θ_j and $\psi_{j(k)}$, respectively. The last component of the model is a random error term, ε_{ijkt}, which is orthogonal to all other effects in the model.

The model is somewhat simplified, because the student and school characteristic measures in the analysis do not vary over the five years of the data. Most student-level measures (race/ethnicity, gender, and parental education) do not vary. Limited English proficiency, free or reduced-price lunch status, and student mobility may vary from year to year. The school characteristics are based on a 2003 surveys of schools. These factors are unlikely to vary from year to year over the five-year analysis period.

The multilevel model in Equation 1 is run separately for several specifications, so model parameters are not inherently constrained across dissimilar groups of students or schools.

[8] Assessments of standardized achievement tests are often subject to score inflation (Hamilton, 2003). Researchers find that scores in a state or school tend to rise over time without any commensurate increase in general learning or proficiency. This is often attributed to "teaching to the test."

- **Reading and mathematics scores**. Separate models are estimated for reading and mathematics test scores because student and school characteristics may have different effects on the learning environment in each area.
- **Elementary, middle, and high schools**. The size and mission of schools vary substantially across these grade groups. The analysis plan allows flexibility so effects of school operational factors are not restricted to the same values across different types of schools.
- **Traditional and charter schools**. Models are estimated for traditional and charters schools separately to assess how differences in school operations among each type of school affects achievement. In addition, a pooled regression shows whether differences in operations between traditional and charter schools affect student achievement.

The results are reported in separate tables for elementary, middle, and high schools students (Tables 5, 6, and 7). In each table, reading and mathematics score regressions are reported for traditional and charter schools as well as for both types of schools pooled together.

The main focus of this analysis is on the effects of school operations variables on student achievement, and the regression controls for student characteristics are designed largely to isolate the effects of the operations measures. The patterns of student effects largely mirror those of previous student achievement analyses in California (Zimmer et al., 2003; Buddin and Zimmer, 2005). As expected, limited English proficiency, minority status, low socioeconomic status (eligibility for free or reduced-price school lunch or low parental education levels) are inversely related to reading and mathematics test scores in

elementary, middle, and high schools. Other things being equal, girls generally score higher than boys especially in the reading test. New students at a school consistently score lower on both tests than do students who are continuing in the same school. The overall trend in test scores is upward—an indication of overall improvement in students or schools or perhaps evidence of schools "teaching to the test." Student characteristics have similar qualitative effects on test scores in both traditional public and charter schools.

Elementary School Results

Home schooling is inversely related to reading and math test scores. While charters have more home-schooled students, the magnitude of this effect is similar in traditional public and charter schools. There is no clear evidence on whether the lower test scores for home school students reflect poorer learning opportunities or whether these students differ in some unmeasured way from students who receive classroom instruction.

The results show that the number of instructional days has no effect on achievement in reading or math. Calendars are largely standardized across districts and school types, so this result may reflect the limited variation in instructional days.

Controlling for differences in operational measures and students, the overall scores of charter school students are about 1 percentile point lower in math than those for traditional public school students. In reading, the differences in scores by school type are not statistically significant.

The results also indicate that greater school-level autonomy in charter schools has no significant effect on student achievement scores.. Table 1 showed that charter school

principals had more control over discipline, assessment, salaries, expenses, curriculum, and staff management than did traditional public school principals. After controlling for other student and school characteristics, the regression results in Table 5 show that school autonomy does not translate into better academic success in the classroom. Greater autonomy may have other benefits for teachers, parents, and students, but the evidence does not show that autonomy translates into test score improvement.

A school's emphasis on teacher quality issues is largely unrelated to test scores. An emphasis on teachers having a full teaching credential is positively related to reading and mathematics scores for traditional public schools, but not on scores in charter schools. Scores do not vary significantly based on whether the school focuses on hiring teachers with a major in their teaching field.[9] Professional development opportunities in both traditional public and charter schools are largely unrelated to the achievement scores of students in those schools.

The amount of time devoted to mathematics and foreign language study do appear to affect reading and math scores. More hours per week in mathematics correlate positively with higher math scores, but the effect is significantly different from zero only for traditional schools. Surprisingly, more math instruction is also associated with higher reading scores for public schools students. Time commitments to English, computer skills, social sciences, sciences, and fine or performing arts do not significantly affect reading or math scores in either traditional public or charter schools. Foreign language instruction may be "crowding out" other learning, however. Schools with more foreign

[9]Teaching in field is probably more relevant for middle and high school teachers. In these higher grades, schools may try to recruit teachers with math and science majors for instruction in these subjects. At the elementary level, teachers generally have a multi-subject credential, teach a variety of subjects in their classrooms, and have a college minor in elementary school education.

language instruction have consistently lower achievement scores in both reading and mathematics.

Principal experience has little impact on student achievement. However, the principal experience measures may not capture the leadership skills, enthusiasm, and creativity that may contribute to school success.

Table 5: Multilevel Regression Results for Traditional Public and Charter Elementary Schools

	Reading			Mathematics		
	TPS	Charter	Both	TPS	Charter	Both
Student Characteristics						
Limited English proficiency	-11.01*	-11.14*	-11.1*	-7.17*	-7.7*	-7.43*
	(0.17)	(0.22)	(0.14)	(0.18)	(0.23)	(0.14)
Black	-9.45*	-11.47*	-10.27*	-11.56*	-13.01*	-12.16*
	(0.23)	(0.3)	(0.18)	(0.24)	(0.31)	(0.19)
Asian	2.47*	2.86*	2.7*	7.62*	8.16*	7.86*
	(0.29)	(0.41)	(0.24)	(0.31)	(0.42)	(0.25)
Hispanic	-3.54*	-5.12*	-4.17*	-3.31*	-3.77*	-3.51*
	(0.17)	(0.23)	(0.14)	(0.18)	(0.24)	(0.14)
Non–high school graduate	-2.39*	-2.66*	-2.44*	-2.24*	-2.2*	-2.21*
	(0.22)	(0.27)	(0.17)	(0.23)	(0.28)	(0.18)
Some college	4.84*	3.91*	4.45*	4.38*	3.86*	4.17*
	(0.19)	(0.26)	(0.15)	(0.2)	(0.27)	(0.16)
College graduate	7.6*	8.54*	7.95*	7.21*	8.39*	7.66*
	(0.2)	(0.28)	(0.16)	(0.21)	(0.28)	(0.17)
Some graduate school	11.39*	13.68*	12.32*	10.77*	12.96*	11.66*
	(0.26)	(0.33)	(0.2)	(0.27)	(0.34)	(0.21)
Free/reduced school lunch	-4.55*	-5.26*	-4.86*	-4.84*	-4.71*	-4.78*
	(0.19)	(0.23)	(0.15)	(0.2)	(0.23)	(0.15)
Female	2.95*	2.74*	2.87*	0.32*	0.15	0.24*
	(0.11)	(0.14)	(0.08)	(0.11)	(0.14)	(0.09)
New school this year	-3.37*	-2.83*	-3.15*	-3.92*	-3.25*	-3.64*
	(0.14)	(0.18)	(0.11)	(0.15)	(0.19)	(0.12)
Year 1999	2.79*	3.38*	2.89*	2.63*	3.5*	2.83*
	(0.19)	(0.32)	(0.16)	(0.2)	(0.33)	(0.17)
Year 2000	3.92*	5.69*	4.52*	4.09*	5.61*	4.43*
	(0.28)	(0.42)	(0.23)	(0.29)	(0.43)	(0.24)
Year 2001	3.81*	6.08*	4.64*	3.49*	5.67*	4.09*
	(0.3)	(0.43)	(0.24)	(0.31)	(0.45)	(0.25)
Year 2002	2.4*	5.24*	3.48*	1.78*	3.96*	2.43*
	(0.31)	(0.45)	(0.25)	(0.33)	(0.46)	(0.26)
School Features						
Students schooled at home (%)	-0.05	-0.08*	-0.07*	-0.1*	-0.11*	-0.11*
	(0.04)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)
Instructional days per year	0.14	0.02	0.03	0.11	0.05	0.08

	(0.19)	(0.08)	(0.06)	(0.21)	(0.09)	(0.07)
Charter			0.55			-0.98*
			(0.31)			(0.32)
School-Level Control						
Student disciplinary policies	2.12	-1.14	-0.27	2.51	-1.31	-0.23
	(1.48)	(1.19)	(0.94)	(1.61)	(1.36)	(1.04)
Student assessment policies	-0.29	0.38	0	-0.16	-0.09	0.04
	(1.08)	(1.34)	(0.83)	(1.17)	(1.53)	(0.92)
Staff salaries and benefits	0.29	-1.02	-0.97	-0.6	-0.86	-1.18*
	(0.93)	(0.72)	(0.54)	(1.01)	(0.82)	(0.6)
Other budgetary expenses	-0.64	0.11	-0.22	-0.79	0.63	0.02
	(1.18)	(1.18)	(0.83)	(1.28)	(1.35)	(0.92)
Curriculum	0.13	0.47	0.66	-0.25	0.04	0.05
	(1.41)	(1.23)	(0.87)	(1.53)	(1.41)	(0.96)
Staff hiring, discipline, and dismissal	-0.43	0.99	1.01	0.09	1	1.16
	(1.23)	(1.05)	(0.81)	(1.34)	(1.2)	(0.9)
Teacher Quality Issues						
Emphasis on full standard credentials	3.04*	1.26	2.08*	3.2*	1.56	2.08*
	(1.47)	(1.13)	(0.85)	(1.6)	(1.3)	(0.94)
College major in teaching field	-0.58	-0.11	-0.09	-0.34	0.1	0.3
	(0.87)	(0.85)	(0.59)	(0.95)	(0.97)	(0.65)
Professional Development						
Workshops or conferences	-0.14	0.84	0.61	0.32	1.09	0.95
	(0.98)	(0.92)	(0.66)	(1.07)	(1.06)	(0.73)
Courses for college credit	-1.39	0.66	-0.03	-2.21*	0.48	-0.47
	(0.97)	(0.85)	(0.62)	(1.06)	(0.97)	(0.69)
Teacher study groups	1.4	0.52	0.79	1.56*	0.34	0.75
	(0.72)	(0.67)	(0.48)	(0.78)	(0.77)	(0.53)
Mentoring or coaching	-0.65	-0.26	-0.43	-0.31	-0.53	-0.32
	(0.83)	(0.66)	(0.51)	(0.9)	(0.75)	(0.56)
Curriculum Allocations						
English/language arts	0.49	0.55	1.04	0.32	1.19	1.8
	(1.45)	(1.3)	(1)	(1.58)	(1.49)	(1.11)
Mathematics	3.44*	2.69	2.51*	4.09*	3.13	2.53
	(1.73)	(1.73)	(1.19)	(1.88)	(1.97)	(1.33)
Computer skills	-1.39	1.52	0.49	-1.44	1.71	0.53
	(1.5)	(0.99)	(0.8)	(1.64)	(1.13)	(0.89)
Social studies	-3.27	-1.71	-1.63	-1.99	-1.47	-0.91
	(1.68)	(1.39)	(1.08)	(1.83)	(1.6)	(1.2)
Sciences	1.83	-0.25	0.26	1.1	-0.53	-0.24
	(1.54)	(1.25)	(0.97)	(1.68)	(1.44)	(1.07)
Foreign language	-1.84*	-2*	-1.64*	-1.66	-1.74*	-1.44*
	(0.84)	(0.66)	(0.59)	(0.92)	(0.76)	(0.65)
Fine or performing arts	1.68	-0.08	0.36	1.12	-0.86	-0.21
	(1.27)	(0.99)	(0.77)	(1.38)	(1.13)	(0.86)
Principal's Background						
Leadership at current school	-0.2	0.03	-0.06	-0.16	0.16	0.03
	(0.2)	(0.21)	(0.15)	(0.22)	(0.24)	(0.17)
Administrative experience	0.28*	0.06	0.14	0.25	0	0.1
	(0.13)	(0.11)	(0.08)	(0.14)	(0.13)	(0.09)

Teaching experience	0.04	0.08	0.05	0.03	-0.02	-0.01
	(0.1)	(0.09)	(0.06)	(0.11)	(0.1)	(0.07)
Constant	-1.84	23.37	16.68	4.29	19.43	10.08
	(32.84)	(16.49)	(12.87)	(35.82)	(18.81)	(14.27)
Random Effects						
School	6.78	6.44	6.50	7.37	7.42	7.19
	(0.59)	(0.57)	(0.40)	(0.64)	(0.63)	(0.44)
Grade cohort within school	3.95	4.33	4.01	4.63	4.87	4.81
	(0.16)	(0.20)	(0.13)	(0.17)	(0.20)	(0.14)
R-squared	0.12	0.14	0.13	0.09	0.11	0.10
# of observations	123,510	82,624	206,134	123,510	82,624	206,134

Notes: An asterisk indicates that the corresponding regression coefficient is significantly different from zero at the 5 percent confidence interval. Standard errors are reported in parentheses. The r-squared statistic shows the reduction in the variance components for this model relative to an unconditional mean model that only adjusts for the two random effects (Bryk and Raudenbush, 2002.

Middle School Results

School features have somewhat different effects for traditional public and charter middle schools. Reading and math scores are inversely related to the percentage of students receiving home school instruction for charter students, but not for traditional school students. Charter students have about five more days of instruction per year than do traditional students, but this difference has no effect on either reading or math scores. Finally, the results show that, controlling for student and school operations factors, the reading and test scores are about two and three percentile points lower in charter schools than in traditional public schools.

Charter middle schools have substantially more autonomy than traditional middle schools, but these differences have little corresponding effect on classroom test scores. The evidence does show that charter schools with more control of student assessment practices have higher test scores in both reading and math.

The handling of teacher quality issues at different schools has little effect on student achievement. In particular, the emphasis on teachers having full teaching credentials has no effect on reading or math scores in either traditional or charter middle

schools. Similarly, the professional development opportunities offered by different schools do not translate into any differences in achievement.

Unlike elementary schools, the amount of time each school spends on various subjects generally has little effect on test scores for either type of school.

The background of each middle school's principal also has little effect on test scores. However, the evidence does show that mathematics scores in traditional middle schools are positively correlated with the number of years that the principal has been at the school.

Table 6: Multilevel Regression Results for Traditional Public and Charter Middle Schools

	Reading			Mathematics		
	TPS	Charter	Both	TPS	Charter	Both
Student Characteristics						
Limited English proficiency	-14.57*	-13.40*	-14.45*	-10.01*	-10.47*	-10.12*
	(0.23)	(0.60)	(0.22)	(0.23)	(0.59)	(0.22)
Black	-9.46*	-8.33*	-9.13*	-10.46*	-9.25*	-10.12*
	(0.26)	(0.45)	(0.22)	(0.26)	(0.45)	(0.23)
Asian	3.00*	2.75*	2.99*	9.32*	7.39*	9.06*
	(0.29)	(0.79)	(0.27)	(0.29)	(0.78)	(0.28)
Hispanic	-3.78*	-2.86*	-3.53*	-3.44*	-2.57*	-3.25*
	(0.20)	(0.37)	(0.18)	(0.21)	(0.37)	(0.18)
Non–high school graduate	-1.12*	-3.17*	-1.63*	0.00	-1.88*	-0.47
	(0.27)	(0.53)	(0.24)	(0.27)	(0.52)	(0.24)
Some college	4.11*	3.28*	3.89*	4.37*	3.65*	4.19*
	(0.20)	(0.38)	(0.18)	(0.21)	(0.37)	(0.18)
College graduate	5.58*	6.14*	5.69*	6.04*	6.53*	6.13*
	(0.21)	(0.38)	(0.18)	(0.21)	(0.38)	(0.18)
Some graduate school	11.78*	11.46*	11.63*	12.48*	11.83*	12.26*
	(0.25)	(0.50)	(0.23)	(0.26)	(0.5)	(0.23)
Free/reduced-price school lunch	-5.38*	-4.55*	-5.15*	-5.26*	-3.04*	-4.56*
	(0.21)	(0.32)	(0.18)	(0.22)	(0.32)	(0.18)
Female	3.06*	3.05*	3.06*	0.48*	0.26	0.43*
	(0.12)	(0.23)	(0.10)	(0.12)	(0.23)	(0.1)
New school this year	-1.56*	-1.42*	-1.67*	-1.62*	-1.08*	-1.48*
	(0.15)	(0.29)	(0.14)	(0.17)	(0.29)	(0.14)
Year 1999	0.54*	1.28	0.64*	0.11	1.18	0.18
	(0.21)	(0.87)	(0.21)	(0.22)	(0.89)	(0.22)
Year 2000	0.35	-9.49*	0.06	-1.72*	-9.71*	-1.5*
	(0.35)	(1.29)	(0.34)	(0.37)	(1.31)	(0.35)

Year 2001	-0.78*	-9.47*	-1.01*	-4.20*	-10.72*	-3.65*
	(0.38)	(1.29)	(0.36)	(0.42)	(1.32)	(0.38)
Year 2002	-2.23*	-11.34*	-2.78*	-6.55*	-12.91*	-5.97*
	(0.42)	(1.30)	(0.39)	(0.47)	(1.34)	(0.42)
School Features						
Students schooled at home (%)	0.05	-0.05*	-0.03	0.02	-0.07*	-0.07*
	(0.05)	(0.02)	(0.02)	(0.06)	(0.03)	(0.02)
Instructional days per year	1.58	-0.02	-0.02	1.91	0	0
	(1.19)	(0.05)	(0.05)	(1.34)	(0.06)	(0.06)
Charter			-1.99*			-2.76*
			(0.54)			(0.56)
School-Level Control						
Student disciplinary policies	0.97	-0.52	-0.32	0.53	-0.87	-0.39
	(3.15)	(1.74)	(1.45)	(3.55)	(2)	(1.61)
Student assessment policies	3.32	8.03*	2.38	4.91	8.35*	3.4*
	(2.29)	(2.58)	(1.55)	(2.58)	(2.94)	(1.73)
Staff salaries and benefits	-1.62	0.57	0.44	-1.69	0.55	0.62
	(1.72)	(0.89)	(0.77)	(1.94)	(1.02)	(0.85)
Other budgetary expenses	-2.53	0.62	-0.15	-2.61	-0.08	-0.63
	(1.95)	(1.55)	(1.16)	(2.20)	(1.78)	(1.29)
Curriculum	1.68	-4.28	-1.10	0.95	-5.79*	-2.63
	(2.36)	(2.44)	(1.43)	(2.66)	(2.79)	(1.59)
Staff hiring, discipline, and dismissal	-0.22	1.88	0.19	-0.76	2.97	0.56
	(1.99)	(1.63)	(1.21)	(2.24)	(1.86)	(1.35)
Teacher Quality Issues						
Emphasis on full standard credentials	3.18	-0.28	0.44	4.11	0.25	0.99
	(2.04)	(1.17)	(0.99)	(2.30)	(1.34)	(1.1)
College major in teaching field	-4.69*	0.67	-0.13	-4.21	1.59	0.67
	(1.91)	(1.07)	(0.89)	(2.16)	(1.22)	(0.99)
Professional Development						
Workshops or conferences	-1.29	1.87	1.53	-1.14	1.87	1.44
	(1.99)	(0.98)	(0.87)	(2.24)	(1.12)	(0.97)
Courses for college credit	-0.36	-1.70	-1.24	-0.20	-1.7	-1.29
	(1.51)	(0.87)	(0.77)	(1.70)	(0.99)	(0.86)
Teacher study groups	2.23*	0.85	1.04	2.24	0.23	0.76
	(1.10)	(0.80)	(0.64)	(1.24)	(0.91)	(0.71)
Mentoring or coaching	0.62	0.26	0.09	0.19	0.74	0.32
	(1.58)	(0.73)	(0.67)	(1.78)	(0.83)	(0.75)
Curriculum Allocations						
English/language arts	-4.29	-0.47	-0.78	-5.60	-0.07	-0.93
	(2.65)	(1.80)	(1.45)	(2.99)	(2.06)	(1.62)
Mathematics	2.17	-0.27	0.44	3.14	1.44	2.02
	(3.32)	(2.28)	(1.81)	(3.74)	(2.62)	(2.02)
Computer skills	-1.40	0.27	-0.71	-1.21	-0.97	-1.4
	(1.64)	(1.13)	(0.93)	(1.86)	(1.29)	(1.03)
Social studies	6.85	-1.74	-0.99	6.14	-2.44	-1.92
	(5.79)	(2.04)	(1.90)	(6.50)	(2.33)	(2.11)
Sciences	-2.17	0.16	0.81	0.44	0.94	1.95
	(5.98)	(1.91)	(1.83)	(6.72)	(2.18)	(2.04)
Foreign language	1.96	1.24	1.37	2.40	1.28	1.77*

	(1.30)	(0.88)	(0.73)	(1.47)	(1.01)	(0.81)
Fine or performing arts	-2.97	1.43	0.94	-3.25	0.67	0.42
	(1.79)	(0.92)	(0.84)	(2.03)	(1.05)	(0.93)
Principal's Background						
Leadership at current school	0.38	-0.21	0.22	0.80*	-0.09	0.44*
	(0.31)	(0.25)	(0.19)	(0.35)	(0.28)	(0.22)
Administrative experience	0.29	-0.25	-0.08	0.09	-0.29*	-0.18
	(0.22)	(0.13)	(0.11)	(0.25)	(0.15)	(0.12)
Teaching experience	0.05	-0.07	-0.01	-0.20	-0.15	-0.13
	(0.20)	(0.12)	(0.09)	(0.23)	(0.13)	(0.1)
Constant	-245.62	37.79*	43.52*	-307.92	32.41	38.3*
	(210.13)	(14.96)	(12.41)	(237.41)	(17.12)	(13.85)
Random Effects						
School	7.99	6.52	7.31	8.86	7.46	8.06
	(1.96)	(0.62)	(0.52)	(1.27)	(0.71)	(0.59)
Grade cohort within school	2.88	3.83	3.54	5.45	4.99	4.09
	(0.20)	(0.28)	(0.18)	(0.31)	(0.29)	(0.21)
R-squared	0.13	0.09	0.12	0.10	0.08	0.10
# of observations	99,238	32,181	131,419	99,238	32,181	131,419

Notes: An asterisk indicates that the corresponding regression coefficient is significantly different from zero at the 5 percent confidence interval. Standard errors are reported in parentheses. The r-squared statistic shows the reduction in the variance components for this model relative to an unconditional mean model that only adjusts for the two random effects (Bryk and Raudenbush, 2002).

High School Results

The effect of school features, at the high school level, is somewhat similar to those in elementary and middle schools. As before, the number of instructional days has no effect on either reading or math scores. Other things being equal, charter school students have lower reading scores than students in traditional schools, but their math scores do not differ from one another significantly.

The percentage of students instructed at home has different effects for the two types of schools. Twenty-six percent of students in the average charter high school are instructed at home, compared with only 7 percent of students in traditional public high schools. Test scores are inversely correlated with the percentage of home school students for the traditional high schools only. The explanation for this result is unclear. It may be that home school instruction means somewhat different things in the two types of

schools. For example, home school instruction may be aimed at poorly motivated students with a history of disciplinary problems in traditional public high schools, while charter high schools might offer alternative curriculum options to better-motivated students.[10] The evidence is insufficient to distinguish between these alternative explanations.

The evidence shows that differences in school autonomy or control have no effect on student achievement. The reading scores of charter students are higher if the schools have greater control of staff salaries and benefits. This lone significant coefficient is an anomaly, however, and the coefficients for all other indications of school control are not significantly different from zero.

Teacher quality issues, however, have interesting effects on achievement scores for high school students. Traditional and charter high schools both place comparable emphasis on recruiting teachers with full standard credentials. In traditional schools, this emphasis is associated with higher test scores, but charter students seem to perform better at schools where there is less emphasis on teacher credentials. The results provide some support for the hypothesis that "teaching in field" is helpful to both reading and math scores. The results show that professional development alternatives available for high school teachers have no effect on their students' achievement.

The amount of time allocated to various subjects has little or no overall effect on measured achievement in reading and math. The only significant coefficient indicates that additional science instruction is positively related to higher math scores in traditional high schools.

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[10] Anecdotal evidence from principals suggested that many of the traditional public school-affiliated students who receive instruction at home have health issues that limit their attendance or have disciplinary problems.

The effects of principal's background on school achievement scores is weak and inconsistent between traditional and charter high schools. Tenure as principal at the school is tied to higher math scores for traditional high schools only, but has no significant effect on reading in either traditional or charter schools. Administrative experience actually has a negative effect on reading and math at traditional high schools. The results consistently show that prior teaching experience by the principal has no affect on student test scores.

Table 7: Multilevel Regression Results for Traditional Public and Charter High Schools

	Reading			Mathematics		
	TPS	Charter	Both	TPS	Charter	Both
Student Characteristics						
Limited English proficiency	-16.46*	-10.18*	-16.03*	-8.97*	-3.3*	-8.63*
	(0.16)	(0.54)	(0.16)	(0.17)	(0.53)	(0.17)
Black	-10.74*	-9.14*	-10.74*	-11.82*	-7.82*	-11.48*
	(0.18)	(0.43)	(0.16)	(0.19)	(0.42)	(0.17)
Asian	3.03*	0.99	2.98*	11.81*	3.95*	11.62*
	(0.17)	(0.88)	(0.16)	(0.18)	(0.86)	(0.17)
Hispanic	-5.08*	-3.38*	-4.92*	-5.57*	-2.84*	-5.31*
	(0.12)	(0.32)	(0.11)	(0.13)	(0.31)	(0.12)
Non–high school graduate	-0.75*	-1.95*	-0.99*	0.01	-1.19*	-0.25
	(0.18)	(0.42)	(0.17)	(0.19)	(0.41)	(0.17)
Some college	5.48*	5.65*	5.44*	4.63*	4.28*	4.51*
	(0.15)	(0.34)	(0.13)	(0.16)	(0.33)	(0.14)
College graduate	7.22*	5.41*	6.93*	6.91*	3.76*	6.44*
	(0.14)	(0.35)	(0.13)	(0.15)	(0.34)	(0.14)
Some graduate school	15.62*	13.03*	15.31*	14.9*	9.67*	14.38*
	(0.17)	(0.57)	(0.17)	(0.19)	(0.56)	(0.17)
Free/reduced-price school lunch	-4.40*	-1.43*	-3.81*	-3.55*	-0.67*	-3.01*
	(0.15)	(0.31)	(0.14)	(0.16)	(0.3)	(0.14)
Female	3.01*	2.82*	3.00*	-0.97*	-0.78*	-0.93*
	(0.08)	(0.22)	(0.08)	(0.09)	(0.22)	(0.08)
New school this year	-1.69*	-1.33*	-1.77*	-1.04*	-0.17	-1.01*
	(0.12)	(0.29)	(0.11)	(0.13)	(0.28)	(0.12)
Year 1999	0.58*	-1.05	0.55*	-0.05	-4.2*	-0.11
	(0.16)	(0.97)	(0.16)	(0.17)	(0.98)	(0.17)
Year 2000	-2.28*	-3.19*	-1.59*	-2.9*	-6.72*	-2.33*
	(0.29)	(1.49)	(0.29)	(0.32)	(1.48)	(0.3)
Year 2001	-2.01*	-3.44*	-1.45*	-4.2*	-9.1*	-3.75*
	(0.32)	(1.51)	(0.31)	(0.35)	(1.51)	(0.33)

Year 2002	-4.46*	-7.98*	-4.38*	-8.03*	-15.06*	-7.99*
	(0.35)	(1.52)	(0.33)	(0.39)	(1.53)	(0.36)
School Features						
Students schooled at home (%)	-0.15*	0.08	0.02	-0.26*	0.07	0.01
	(0.07)	(0.05)	(0.04)	(0.08)	(0.06)	(0.04)
Instructional days per year	-0.75	-0.07	-0.03	-1.18	-0.11	-0.02
	(0.53)	(0.06)	(0.05)	(0.66)	(0.07)	(0.06)
Charter			1.86*			0.9
			(0.6)			(0.65)
School-Level Control						
Student disciplinary policies	-2.35	1.23	-2.48	-1.96	0	-3.04
	(2.18)	(3.2)	(1.71)	(2.74)	(3.66)	(2.04)
Student assessment policies	0.06	-0.92	0.07	-0.29	5.43	1.65
	(1.16)	(3.07)	(1.19)	(1.47)	(3.49)	(1.42)
Staff salaries and benefits	-0.66	2.77*	1.49	-2.52	1.94	0.77
	(1.26)	(1.37)	(0.95)	(1.58)	(1.56)	(1.13)
Other budgetary expenses	1.32	3.14	-0.11	1.65	-1.37	-1.39
	(1.8)	(2.79)	(1.56)	(2.26)	(3.17)	(1.86)
Curriculum	0.74	-3.15	-0.3	0.14	-1.43	-0.86
	(1.33)	(3.3)	(1.21)	(1.67)	(3.76)	(1.44)
Staff hiring, discipline, and dismissal	2.14	-4.44	-0.88	4.49	-1.69	0.96
	(1.86)	(2.61)	(1.47)	(2.33)	(2.97)	(1.76)
Teacher Quality Issues						
Emphasis on full standard credentials	4.5*	-5.04*	-2.91*	4.58	-4.84*	-2.44
	(2.11)	(1.76)	(1.28)	(2.65)	(2.01)	(1.54)
College major in teaching field	1.65	1.69	3.02*	3.53	3.99	4.75*
	(1.56)	(1.82)	(1.12)	(1.94)	(2.07)	(1.34)
Professional Development						
Workshops or conferences	0.62	-1.45	-1.07	0.36	2.54	-0.24
	(1.25)	(1.99)	(1.06)	(1.57)	(2.28)	(1.27)
Courses for college credit	1.56	-0.95	-0.3	1.44	-2.38	-0.27
	(1.38)	(1.59)	(1.01)	(1.73)	(1.82)	(1.21)
Teacher study groups	-1.51	-0.08	-0.08	-2.17	-0.41	-0.56
	(1.11)	(1.16)	(0.75)	(1.4)	(1.33)	(0.9)
Mentoring or coaching	-0.04	-1.05	-0.86	0.66	-1.52	-0.52
	(1.19)	(1.28)	(0.86)	(1.5)	(1.46)	(1.02)
Curriculum Allocations						
English/language arts	-1.62	-0.82	-0.34	-3.81	-0.08	-0.77
	(2.03)	(2.74)	(1.6)	(2.56)	(3.13)	(1.91)
Mathematics	-2.86	4.95	-1.22	-3.33	4.78	-2.02
	(2.41)	(3.84)	(1.92)	(3.03)	(4.35)	(2.3)
Computer skills	-1.26	-1.13	0.56	-2.19	-2.94	-1.57
	(2.62)	(2.02)	(1.38)	(3.27)	(2.3)	(1.66)
Social studies	0.24	-2.67	-1.33	-0.31	-1.61	-0.91
	(1.85)	(3.4)	(1.69)	(2.34)	(3.88)	(2.02)
Sciences	4.55	-2.67	2.33	8.93*	-2.56	4.25
	(3.07)	(3.48)	(2.33)	(3.85)	(3.96)	(2.78)
Foreign language	2.35	3.19	1.49	1.55	1.83	1.33
	(1.56)	(2.3)	(1.28)	(1.97)	(2.62)	(1.54)
Fine or performing arts	-4.17	0.98	-1.18	-3.78	0.73	-0.64

	(3.21)	(2.06)	(1.57)	(4.02)	(2.35)	(1.88)
Principal's Background						
Leadership at current school	0.51	-0.76	0.26	0.78*	-0.84	0.31
	(0.29)	(0.43)	(0.25)	(0.37)	(0.49)	(0.29)
Administrative experience	-0.47*	-0.06	-0.03	-0.6*	0.08	0.06
	(0.2)	(0.2)	(0.14)	(0.25)	(0.23)	(0.17)
Teaching experience	-0.01	0.15	0.02	0.06	-0.14	-0.03
	(0.14)	(0.22)	(0.12)	(0.18)	(0.25)	(0.14)
Constant	160.55	83.87*	63.62*	239.52*	66.05*	56.32*
	(90.03)	(20.45)	(13.92)	(112.48)	(23.26)	(16.64)
Random Effects						
School	5.63	7.32	7.28	8.65	8.27	7.01
	(0.85)	(1.10)	(0.66)	(0.81)	(1.30)	(1.09)
Grade cohort within school	3.09	3.68	3.23	4.85	5.34	4.93
	(0.17)	(0.37)	(0.16)	(0.22)	(0.42)	(0.27)
R-squared	0.18	0.11	0.17	0.14	0.09	0.14
# of observations	199,654	28,801	228,455	199,654	28,801	228,445

Notes: An asterisk indicates that the corresponding regression coefficient is significantly different from zero at the 5 percent confidence interval. Standard errors are reported in parentheses. The r-squared statistic shows the reduction in the variance components for this model relative to an unconditional mean model that only adjusts for the two random effects (Bryk and Raudenbush, 2002).

CONCLUSIONS

As the charter movement presses forward, we argue that it is important for researchers to take a closer look at the operation and structure of charter schools to examine features that may affect student achievement. In this paper, we have taken an initial step towards this goal by comparing survey data of operational and structural features of charter schools and traditional public schools with student achievement data from these same schools.

While the findings do not point to specific and consistent patterns of successful or failing schools, some interesting results emerge. One of the more interesting results goes to the heart of the charter movement, which has called for greater school autonomy. Our analysis suggests that while charter school principals do have greater control over decisionmaking than their counterparts in traditional public schools, we found no strong evidence that this autonomy leads to higher test scores. In addition, while charter schools

tend to provide more instructional hours in noncore subjects, more time does not lead to improved student achievement. In fact, greater emphasis in foreign languages may result in to poorer math and reading test scores. On the other hand, many parents may not be as concerned with math and reading test scores and appreciate the greater emphasis on noncore subjects found in charter schools. Also, the analysis generally suggests that the greater the proportion of students instructed at home, the lower the test scores of the school. Other results vary by grade arrangements or school type. For instance, emphasizing hiring teachers with full standard credentials has a positive effect in traditional public high schools, negative effect in charter high schools, and no effect in middle and elementary charter or traditional public schools.

We believe that as researchers delve deeper into the operation and structural features of schools, we will begin to understand how to reform schools in smart and strategic ways. We argue that this study is a first step towards that goal, and we hope that sparks other additional steps towards understanding the correlates of successful schools.

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