Lessons from California's Public Elementary Schools Where Performance Exceeds Predictions*

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About the Author

Rob Wassmer has authored or coauthored over 20 published articles on subjects related to public economics in journals, such as *Research in Higher Education, Economics of Education Review, Public Finance Review, Urban Studies, National Tax Journal,* and the *Journal of Urban Economics*. He has also edited one book on *Readings in Urban Economics: Issues and Public Policy* (Blackwell, 2000) and coauthored a second one on *Bidding for Business: The Efficacy of Local Economic Development Incentives in a Metropolitan Area* (W.E. Upjohn Institute, 2000). As the past coordinator of the system wide California State University Faculty Research Fellows Program, Professor Wassmer managed a group of academic public policy consultants to the state of California. In the fall of 2000, Dr. Wassmer received the President's Award for Research and Creative Activity from California State University, Sacramento.

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I. Introduction

When schools have similar characteristics, yet their student bodies demonstrate radically different levels of measured academic achievement, it makes sense to try to learn why. This paper describes a statistically based effort to do that. Its goal is to determine what California's high-performing public elementary schools are doing differently than low-performing public elementary schools with similar characteristics. We already know that socioeconomic advantaged students more frequently attend schools that produce high-test scores. Here we are looking beyond that, at the value added when schools show they can do a first-class job of educating students who are not from advantaged backgrounds.

The motivation for this study began in 1999 with the Public Schools Accountability Act (PSAA), enacted by the California Legislature with the signature of Governor Gray Davis to hold schools accountable for improving students' academic performance. At the core of California's PSAA is the Academic Performance Index (API), a benchmark score given schools statewide based on results from the Standardized Testing and Reporting (STAR) test. For the period covered by this study, the API relied upon one annual student assessment test known as the SAT 9. Under terms of the PSAA, schools are expected to improve their API scores each year. Those that perform well are rewarded. Those that do not – and fail to improve within 2 years – could have been penalized, beginning in the 2002-03 academic year.

The aim of this study is to suggest ways to assist low-performing schools by uncovering the instructional, administrative, or other practices that high-performing schools are using, but that low-performers are not. We come about these suggestions through a five-stage process. In Stage One, we take care to review the relevant previous research that has been done on this topic. The methods and findings of the previous research are used to craft an empirical method. In Stage Two, our empirical method started with an analysis of data from both the 1999-00 and 2000-01 school years (the only data available at the time the study began) that used regression analysis to forecast how known inputs in the education process contribute to an elementary site's API score. From this regression analysis, we predicted how each elementary site in the state would have performed if it operated like the typical site in California utilizing the same education inputs, and then calculated the percentage difference in what a site's actual and predicted API score is. In Stage Three, the results from this analysis were supplemented with data from publicly available statewide databases, and the teacher characteristics, type of year-round operations, and magnet/charter status at high-performing schools were compared with those at low-performing.

The results of a written survey of the principals at the identified high- and low-achieving schools were used in Stage Four to determine any differences in education practices at the schools. The final stage, or Stage Five, consists of summarizing the teacher characteristics and education practices differences found between high and low performing schools and drawing policy

suggestions from them. We devote over half this paper to a description of the processes used to derive the final policy recommendations for two reasons. The first is that we desire analysts to be able to reproduce and refine our methods with other similar data sets. The second is that policymakers can trust the validity of our findings only if they have a basic understanding of from where they came.

The remainder of this paper proceeds as follows. In the next section, we briefly describe public school performance as a policy concern and earlier studies of performance based on the recently produced API test results. In Section III, we summarize some of the current thinking on what matters in school performance. Section IV describes our method of study in more detail, and Section V offers the results of the regression analysis used to predict the expected performance of a California public elementary school. Differences in teacher characteristics, year-round operations, and magnet/charter status are summarized in Section VI. Differences in education practices are summarized in Section VII. We offer policy implications in the concluding section.

II. School Performance as a Policy Concern

Raising student achievement, particularly among students from low-income and minority communities, is a prominent public concern. As public attention has increasingly focused on this issue, efforts to address it have increased as well. In an attempt to tackle the challenges facing low-performing schools, states have imposed various forms of performance-based accountability systems. These systems combine statewide standards and

assessment with increased teacher accountability and usually contain clear instructional goals, comprehensive assessment techniques based on content standards (criterion-referenced testing), and consequences for all involved participants (sanctions and rewards).

Following the path of other states, the California Legislature passed the Public Schools Accountability Act (PSAA) in 1999. The PSAA is designed to hold schools accountable for improving students' academic performance by establishing an incentive system that offers rewards for schools that demonstrate improvement, as well as interventions and sanctions for schools that fail to meet established growth targets. At the base of this system is the Academic Performance Index (API). The API scores calculated for California schools in 1999-00 (1999 API) and 2000-01 (2000 API) are entirely based upon results from a norm-referenced state test, the SAT 9, standardized to vary between a score of 200 and 1,000.

The sanctions and rewards of the PSAA are, respectively, the Immediate Intervention/Under-performing Schools Program (II/USP) and the Governor's Performance Awards Program (GPA). The II/USP offers financial support to schools that rank in the lowest five deciles of performance among all California schools and fail to meet a target for expected growth in their scores. The GPA provides rewards to schools demonstrating strong improvement or unusually high achievement on their API scores. II/USP schools that fail to meet their growth targets for 2 consecutive years are subject to state sanctions -- the most severe being a shutdown or state takeover of the school. Schools that meet

their API annual growth targets and meet the growth targets for their identified subgroups receive performance awards. The purpose of the research described here is to look at high-performing schools in California to learn performance-enhancing lessons that could help in crafting sanctions and interventions that could most improve the low-performing schools identified through the PSAA.

Previous Studies on API Scores and School Site Characteristics

In addition to reporting annual API scores and rankings, schools in California are asked to report on a number of attributes that include characteristics of students and the percentage of teachers holding full and emergency credentials. Existing studies have used this data to examine relationships between school site characteristics and API scores.

In 2001, the California Teachers Association (CTA) issued a report titled *Low-Performing Schools = High-Priority Schools: Analysis of the 2000 Academic Performance Index*. In this analysis, elementary, middle, or high school sites were grouped into categories on the basis of where they placed within each decile of the distribution of API scores recorded in 2000. In these subcategories, an average value was found for each of 18 descriptive variables collected at each school site. On average, the CTA found that schools in the lower deciles had higher levels of noncredentialed teachers, higher levels of socioeconomic disadvantaged students, and higher percentages of year-round schools.

The CTA findings are synonymous with findings recorded in the first annual *School Improvement Report* published by the U.S. Department of

Education (USDE) in January 2001. The USDE found schools in need of improvement serve disproportionately poor and minority communities with fewer resources and credentialed staff, and less district support. When evaluating the CTA and USDE results, though, one must understand that the reported relationships are simple correlations and show the relationship between two variables only, without controlling for the effects of multiple causal factors. As we show later, this is an important distinction.

A better method to help design policy responses to low-performing public schools considers the influence of a change in a casual factor on the school's academic performance as if other relevant causal factors did not change. For instance, consider two schools that are identical in other measured characteristics except that one school exhibits a greater amount of something thought to influence academic achievement. The important policy question is: What is the independent influence of this larger measure on the academic achievement observed at the school?

In 2001, the California Budget Project (CBP) produced a study, *What Do the 2000 API Results Tell Us About California's Schools*, based on 1999-00 API data. Using a multiple regression analysis, the CBP explored how school size, parent education, teacher quality (as measured by full and emergency credentialing), and student diversity each contributed to variations in API scores holding other relevant causal variables constant. After controlling for other causal factors, the CBP report confirmed many of the findings presented by the CTA study. According to the CBP's findings, as school enrollment

increases, API scores decrease. As the number of teachers with emergency credentials increases, a school site's API score decreases. Holding other factors constant, year-round schools had lower API scores than schools on traditional calendars. An important way this analysis differs from what we do later is that no distinction was made among elementary, middle, and high schools.

III. What Matters in School Performance

A key objective of public education is the generation of academic achievement. The goal of this paper is to assist policymakers in their identification and understanding of factors that are related to academic achievement (as measured by the API) at California school sites. To achieve this goal, we provide a multipronged analysis that determines the relative influence of both controllable and uncontrollable factors on academic achievement. To do this appropriately, we offer in this section a brief review of the academic thinking and previous results behind such an analysis.

Three Lenses for Viewing the Academic Productivity of Schools

As described in *Making Money Matter* (National Research Council, Chapter 5, 1999) -- a report on strategies to better ensure that all U.S. students achieve high levels of learning -- at least three different lenses have been used to identify the important relationships that exist between educational resources and academic achievement. The first lens involves statistical studies that search for an educational production function. The second lens utilizes studies of "effective" educational practices. The third lens

looks at the influence of school environment on academic achievement. We describe each of these approaches.

The production-function approach to determine the factors that influence academic achievement is rooted in economic analysis. A single measure of academic achievement (for instance an API score) is considered an output produced at a school site. Researchers usually assume that this output is determined by at least three different categories of inputs: student, social, and school. Student inputs used to produce academic achievement include the ability and effort of the students themselves. Social inputs include such things as the effort put forth by parents in assisting students in school and the influence of peers with whom the students associate. School inputs include traditional measures, such as teacher quality, books, and physical characteristics of the site. Multiple regression analysis is then used to determine the influence that a one-unit change in a given input exerts on the chosen measure of academic achievement. In production-function analysis, the actual process of transforming education inputs into the desired output is treated as a "black box." The focus is instead on the derived statistical relationships between inputs and output. These relationships represent what an average school in the sample is capable of producing with an additional unit of input.

Alternatively, the effective educational-practices approach to the academic productivity of schools is an explicit attempt to understand the technology of how school inputs are "best" transformed into high academic

achievement. This approach begins with the selection of a group of school sites that are unusually successful. Success is usually defined by high academic achievement given the inputs with which the site must work. Surveys, site visits, and focus groups are then used to find and describe the practices that yield the high academic achievement. This approach is a direct response to a criticism that very little of what has been found to influence academic achievement in the classroom is ever evaluated as an input in the education production-function approach. These typically unmeasured attributes can include curricula, teacher quality, student engagement, and the autonomy of the school site.

One criticism of the effective educational-practices approach to determining successful education practices is that by focusing only on unusually successful outcomes, one can never be certain whether the observed practices at the site caused the high academic achievement, or whether the high academic achievement generated the use of these practices. For example, high-quality teachers may be attracted to schools with high academic achievement, and thus the high-quality teachers do not necessarily cause the high achievement. One way to try to overcome this -- which is used here -- is to also study the characteristics of teachers at low-performing schools and compare their characteristics to those observed at high-performing schools.

Finally, a third lens through which to evaluate the academic productivity of schools is an institutional one. In this approach, the emphasis is on assessing the environment in which a low-performing school operates and

determining whether there is something in it that produces academic outcomes that no one really wants. Here, evaluations on the causes of academic productivity are based on the organizational framework of a school system and school site. The goal is to determine, for instance, whether teachers and administrators are prohibitively constrained in their quest for academic achievement or, alternatively, whether a low-performing school needs merely to slightly realign its institutional structure.

Results From the Three Lenses

Because of their specific foci, each of the three forms of analyzing academic productivity at school sites has yielded different, but equally interesting, findings. We next describe the highlights of these findings.

A widely cited and debated report by Coleman and colleagues (1966) used the production-function approach to analyze academic productivity, determining that school resources (as they measured them) did not have much of an effect on the academic achievement of students. Instead, the socioeconomic characteristics of the students, their parents, and the neighborhood they lived in were the primary driving forces in determining a school's standardized test scores. Since then, as reviewed by Hanushek (1996), hundreds more of these production-based statistical studies have been conducted using U.S. data. Just counting the number of statistically significant relationships between input variables and academic achievement, Hanushek found -- 30 years after the Coleman report -- little evidence to support the contention that purchased school inputs (books, computers, "quality" teachers,

etc.) do much to improve the academic achievement of students. However, other researchers, such as Hedges and colleagues (1994), disputed Hanushek's findings and offered their own summary analyses of the production-function literature that shows some purchased inputs can influence educational outcomes. The debate on this issue continues, but more recent evidence (see Burtless, 1996) leans toward the conclusion that some forms of purchased educational inputs can raise academic outcomes at a school site.

Unlike the production-function literature on what determines academic performance, the literature on effective practice has yielded what could be considered more conclusive and consistent findings. Most of these findings revolve around the success of school-based reforms that focus on methods of classroom instruction and administrative structure. The terms "capacity building" and "decentralized decision making" often emerge from this literature as widely observed effective practices. Capacity building usually refers to the professional development of teachers, and decentralized decision making involves granting some degree of autonomy to a school site and encouraging teacher, parent, and community involvement in the administration of the site.

Particularly relevant to our research are effective practice studies that focus on low-income schools that exhibit relatively high academic test scores. In *Effective Elements*, commissioned by the California Department of Education, Rossi (2000) reported on effective practices at 18 low-income/high-performing middle and high schools in California. A research team interviewed principals, teachers, and administrators at the selected sites and found four

elements that made the identified schools more effective at raising the achievement levels of low-income students.[1] These included the following:

- *Instructional Approaches* – There was a reading emphasis, out-of-classroom tutoring, integrated special-support classes, etc.
- *School Climate* – Full-time personnel handled discipline, professional development was encouraged, the principal was given considerable latitude, etc.
- *School Community* – School accomplishment was stressed, teachers worked in teams, learning goals were shared, etc.
- *Parental Involvement* – Parental concerns were actively assessed, decision making was open to parents, etc.

In a similar manner, 12 high-poverty/high-performing California schools were selected to participate in a symposium held December 2000 in Sacramento (see Bell, 2001). Representatives from each school met with school researchers and later participated in shared-learning sessions attended by all. From this, 13 key effective practices were determined: (1) rigorous standards, (2) high-quality teaching and learning as the primary goal, (3) emphasis on high expectations, (4) discipline and safe environment, (5) district support, (6) strong instructional and ethical leadership by principal, (7) innovation by principals in acquiring needed funding, (8) promotion of shared leadership, (9) collaboration among staff, (10) assessment as a regularly used diagnostic tool, (11) early intervention to promote student learning, (12) inclusiveness and a sense of family, and (13) extending the school mission into students' homes.

[1] A possible shortcoming of classifying high-performing schools in this manner is the limited generalizability of the conditions that make these schools do so well or so poorly compared with the overall school population. This is due to the fact that other factors that contribute to these schools' academic performance, besides low income, are not controlled. We attempt to correct this flaw in our study by controlling for the multiple factors that could drive differences in school test scores.

A report by Carter at the Heritage Foundation (2000) used methodology similar to the two previous studies and concluded with seven common traits of this type of school: (1) principals free to make spending, hiring, and curriculum decisions; (2) measurable goals establish a culture of achievement, (3) master teachers bring out the best in faculty, (4) rigorous and regular testing, (5) achievement is a key to discipline, (6) principals work actively to make homes into learning centers, and (7) effort creates ability. Finally, the *School Improvement Report*, released by the U.S. Department of Education (see Cohen and Ginsburg, 2001), surveyed the national literature on effective public-school practices and identified seven characteristics of high-performing schools. The cited characteristics overlap with the previously identified elements.

Institutional research on the relationship between education inputs and academic achievement at public school sites is really an extension of the effective practice findings just discussed. The issue is this: Even if we know what effective practices are, can they be implemented or sustained given the institutional environment in which U.S. public schools operate? Two points of view have emerged in answer to this valid question. One says that there is nothing wrong with a system of public education controlled by policymaking boards and administered in a bureaucracy. High academic achievement can occur within this system if all its parts are correctly "aligned" (see Hill et al., 1997). Alternatively, skeptics such as Chubb and Moe (1990) argue that real school improvement is hampered by the embedded institutional arrangements

in which it is delivered. Parental choice in deciding where a child attends school has been suggested as an alternative institutional arrangement.

IV. Method of Study

As described in the previous section, a large body of literature already exists on the links between school inputs and the level of average academic performance at a school site. The production-function approach to examining these links concentrates on measurable inputs that usually fall into three broad categories: student, social, and school. The consensus among these production-function-based studies is that student and social inputs -- largely out of the control of educators and policymakers -- explain more than half of the variation in school scores.

But schools and districts do have greater control over the factors that fall into the school-input category. Studies using the production-function approach have restricted school-input variables to factors such as student/teacher ratio, percentage of teachers holding a credential, per-student money spent on books, and son. Schools also control the way that all inputs are put together to create academic performance as an output. As the effective-practice and institutional literature demonstrates, things like instructional delivery, governance, leadership, teacher accountability, bureaucracy, and choice also matter. Understanding this, we describe in this section a method of study that attempts to account for how all of these factors contribute to the determination of school-site performance in California's public schools. Specifically we

concentrate on trying to determine the factors that distinguish a high- from a low-performing school site.

A Three-Step Approach

Our method of study first uses the production-function approach and one publicly available data set to model the measurable determinants of API scores at California elementary school sites in 2 different academic years. We then use two variants of the effective-practice approach to assess the other characteristics that distinguish a high-performing elementary, middle, or high school site from a low-performing one. The three steps inherent in this approach are described next.

Step One: The first step in our research process is to perform a statistical regression analysis of how various inputs contribute to API scores at a California elementary school site. Considering school-site characteristics publicly available from the California Department of Education[2] (CDE) and breaking them down into the now-familiar student, social, and school categories results in the following classifications:

- Student inputs = f (percentages of students who are African American, Native American, Asian-American, Filipino-American, Hispanic, Pacific Islander, Caucasian; percentage of students who take reduced-price meals, who are English-language learners, who are first-year attendees [a measure of student mobility]),[3]

[2] See www.cde.ca.gov/psaa/api .

[3] Parental income and education have been shown in past studies of this type to be important determinants of student achievement. It is important to note that the measures used here for these two factors are not perfect. Parental education is self-reported by the student and probably exhibits greater error at the elementary level due to more students not knowing the education status of their parents. Parental income is only controlled here by percentage at the lower end of the income distribution receiving subsidized school meals.

- Social inputs = f (average parent-education level),
- School inputs = f(average class size for grades K-3, average class size for grades 4-6, percentage of teachers fully credentialed, percentage of teachers emergency credentialed, total enrollment, a control for year-round schools).[4]

In classifying these explanatory variables in these three categories, we realize that some of the inputs in the student category can also act as proxies for social inputs that influence educational outcomes.[5]

In addition, we include as explanatory factors in the API regression analysis controls for differences in the percentage of total students at a school site who took the standardized test. These are measured as follows:

- Student population tested = f(percent of first-day enrollees tested, percentage of first-day enrollees excused due to an individual-education program statement, percentage of first-day enrollees excused due to parental written requests).

The regression, that is the basis of the first step of our analysis, includes the average API score in 1999-00 for each available elementary site as the dependent variable. This dependent variable is explained by each of the factors

[4] Based on the CDE data we use, "percentage of teachers fully credentialed" plus "percentage of teachers emergency credentialed" sometimes add up to greater than 100 percent because the emergency-credential category, for purposes of the API, includes teachers only on emergency permits. These teachers may hold full credentials but be teaching in areas outside their credentialed fields. Excluded categories are percentages of other noncredentialed teachers, including those with credential waivers and those in the university intern, district intern, and pre-intern programs. It should also be noted that the "control for year-round schools" is set equal to one if the year-round program is any of the multiple-track options that are available. These are distinguished by the number of days on/days off and can range in value from 45 days on/15 days off to 90 days on/30 days off (see www.cde.ca.gov/facilities/yearround/calendar.htm). Otherwise this variable equals zero.

[5] The explanatory variables included in the regression analysis exhibit high partial correlation coefficients, i.e., they move closely together with each other. For instance, a school that is high in reduced-price meals is also likely to be high in student mobility. The statistical problem this creates (multicolinearity) results in some variables being interpreted as exhibiting a statistically insignificant effect on the dependent variable, when in reality they really do exert an influence. The accepted solution to this problem is to reduce the number of explanatory variables included in the regression. We chose to not do this because (1) it would reduce the explanatory power of the regression (the main reason we are using it) and (2) in the first step of our analysis, we are not concerned about interpreting the particular effect that one casual variable has on API score.

that are included under the student input, social input, school input, and student population tested in the categories listed above. This regression is also repeated using 2000-01 data.

As recorded in the next section of the article, the resulting regression findings indicate the percentage effect that a one-unit change in an explanatory variable has on the average California public elementary site's API score if other included causal factors are held constant. We use these regression results to predict a school's API score in a given year if it had the same input characteristics that it does exhibit, but instead was producing academic achievement (API score) in the same manner as the average site of that type of school in California.

The predicted values of API scores for each school site are our basis for defining high- and low-performing schools. We calculate a "performance percentage" for each site for both years by subtracting a site's predicted API score from its actual, dividing this difference by its actual, and multiplying the result by 100. Elementary school sites for each year are then ordered from high to low by comparing these calculated performance percentages. For each year, the top 5 percent in these ordered lists are defined as high-performing, and the bottom 5 percent are defined as low-performing. This process follows the effective educational practice approach of the past in that these two groups are "unusually" successful or unsuccessful. "Unusual" is used in the sense that they are doing much better or much worse than the average California school site of their type would do if given the same inputs. As a check to insure that

the high- and low-performing designation we assign is not a fluke achieved in only a given year, our final list of these two types of schools includes only those schools that appeared as respectively high- or low-performing in both years.

Step Two: The second step in our research methodology involves a probe into the types of teacher inputs, year-round operations, and magnet/charter status that distinguish a high-performing site from a low-performing one.[6] In the regression analysis that generated the list of high- and low-performing schools, the only account of teacher quality at an elementary site was the percentage of teachers who hold full teaching credentials or who hold emergency credentials. To further examine differences in the characteristics of teachers at high- and low-performing schools, we look to individual teacher data provided at the CDE's Web site through the Professional Assignment Information Form (PAIF).[7] Using codes that teachers provided to show where they worked in fall 1998, we aggregate teacher characteristics for all sites in the high- and low-performing lists. An average measure of variation is then calculated for each relevant teacher characteristic for all high- and low-performing sites at each level of school (elementary, middle, high).

As provided at the CDE Web site, information is also available from the California Basic Educational Data System (CBEDS) and California School Information Systems (CSIS) for fall of 2000 on whether a school site had its

[6] One issue to note about this method of looking for differences in high- and low-performing schools, one characteristic at a time, could arise if two or more characteristics being considered for differences really proxy for the same overriding characteristic. If these same two or more characteristics were included in the first-step regression analysis, then it is feasible that only one of them could be found to exert a statistically significant influence on API score, whereas in our method we may find that more than one does.

year-round operations on a single- or multi-track, and the type of calendar (days on, days off, length of school year). In Section VI, we look for differences in these measures between designated high- and low-performing schools. Finally, we address an issue raised by the institutional approach to academic productivity and check whether high-performing school sites are more likely to be neighborhood, "magnet," or "charter" schools. Data on this for a particular school site are also available from CBEDS and CSIS.

Step Three: Important information missing from previous steps one and two are the school community, school climate, and the approaches to instruction and parental involvement at the identified high- and low-performing school sites. Step Three of our research methodology determines this through a survey of school principals at these sites. The 14 questions included in the survey are designed to find out whether high-performing schools are more likely to follow the practices most often identified in the effective-practice findings cited in the previous section. The method asks the principals if they "agree," "somewhat agree," "somewhat disagree," or "disagree" that a particular practice or situation is occurring at their schools. Because the data are available nowhere else, we also inquire about the years of experience principals have at the current site, their total years of experience as a principal, and whether they hold a master's or doctorate degree. We look for significant differences in the responses between high- and low-performing schools. That is,

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[7] See www.cde.ca.gov/demographics

are the sites we identified as high-performing more likely to be practicing what have been identified as effective ways to generate academic achievement?

V. Step One: Regression Analysis

A school site's API score was transformed to its natural log form before the regression was performed. There are two reasons for this transformation. Without a log transformation of the dependent variable, the regression findings could only indicate the fixed change in API score given a one-unit change in a respective explanatory variable. With a log transformation, the regression results indicate the percentage change in API score given a one-unit change in an explanatory variable. Based upon previous production function findings, allowing for such a nonlinear approach better characterize the way that inputs influence the production of academic achievement at school sites. The second reason for taking the natural log of the regression's dependent variable is that it has been shown to reduce the bias in the statistical significance of regression findings that can arise when there is great variation in the scale of operation (number of students) at school sites. Statisticians refer to this as heteroskedasticity, and it is much less likely to be an issue in our findings.

The regression coefficients for California's public elementary schools for the years 1999 and 2000 are in Table 1 below. The top entry in each cell of the table, if multiplied by 100, indicates the percentage influence that a one-unit change in the explanatory variable has on API score if the other included causal factors are held constant. Only the entries with asterisks next to them should be considered as exerting an effect that is statistically different from

zero. Most of the explanatory variable descriptions in the first column of Table 1 are self-explanatory. The exceptions may be (1) average parent education level x 10, (2) dummy (or control factor) if a year-round school, (3) average class size, and (4) total enrollment in hundreds.

"Average parent education level x 10" is the average of all the student-reported parent-education levels at a school multiplied by 10 for only a scaling factor. A value of 10 is recorded if students believed parents had less than a high school education, 20 if they believed parents were high school graduates, 30 if they reported some college education, 40 if they thought parents were college graduates, and 50 if they thought parents had some graduate school. The average value of this variable for elementary sites in both 1999 and 2000 was 27.4.

"Dummy if a year-round school" is an explanatory variable equal to one if the school is under a year-round, multitrack academic calendar and zero if it is not. This explanatory variable measures the influence of a school going to any type of year-round operations if all of the other explanatory variables are held constant.

Average class size measures the average number of students in the site's grade K-3 and grade 4-6 classrooms; in 1999-00 (2000-01), the respective average values of this variable were 19.32 (19.32) and 28.94 (28.91). Total enrollment in hundreds is just the total number of students at a site measured at the scale of 100. In 1999, the average value of this variable for all elementary sites was 4.42 (4.40).

Table 1
Regression Results Using Log 1999 and 2000 API Elementary Scores as Dependent Variables

Variable	1999 Coefficient (Standard Error)	2000 Coefficient (Standard Error)
Constant	6.192*** (0.077)	6.212*** (0.071)
% Students, African American	-0.002169*** (0.001)	-0.002016*** (0.001)
% Students, Native American	-0.004309*** (0.001)	-0.004018*** (0.001)
% Students, Asian-American	0.001632*** (0.001)	0.001547*** (0.001)
% Students, Filipino-American	0.001025 (0.001)	0.001245** (0.001)
% Students, Hispanic	-0.001297** (0.001)	-0.001061** (0.001)
% Students, Pacific Islander	-0.0002887 (0.001)	0.0006569 (0.001)
% Students, Caucasian	-0.0001934 (0.001)	-0.0001624 (0.001)
% Students, Reduced-price Meals	-0.002466*** (0.000)	-0.002263*** (0.000)
% English-Language Learners	-0.002089*** (0.000)	-0.002008*** (0.000)
% Students, First Year Attendance	-0.0008773*** (0.000)	-0.0006984*** (0.000)
Average Parent Education Level x 10	0.006074*** (0.0004)	0.005027*** (0.0003)
Dummy if Year-Round School	-0.02097*** (0.004)	-0.01928*** (0.004)
Average Class Size, Grades K-3	0.001200 (0.001)	0.00005466 (0.001)
Average Class Size, Grades 4-6	0.001532*** (0.000)	0.001050** (0.000)
% Teachers, Full Credential	0.001887*** (0.000)	0.001978*** (0.000)
% Teachers, Emergency Credential	0.0009688*** (0.000)	0.001052*** (0.000)
Total Enrollment, in Hundreds	-0.0005952 (0.000)	-0.002410*** (0.000)
% First-Day Enrollees Tested	0.0009119 (0.001)	0.001692*** (0.001)
% First-Day Enrollees, IEP Excluded	0.00009858 (0.001)	0.001089** (0.001)
% First-Day Enrollees, Parent Excluded	0.001363* (0.001)	0.001111* (0.001)
# Observations	4305	4380
Adjusted R-Squared	0.845	0.835
R-Squared	0.846	0.835

*Statistical significance: *** 99% or greater in two-tailed test, ** 95-99%, and * 90-95%.*

Most of the regression findings are in line with results reported in earlier production-function studies of education output and correspond to expectations. Even so, the reader needs to take care in attaching any major significance to these findings for three reasons. The first is that our regression model does not include all of the relevant factors important to explaining differences in API scores. Such "omitted variable bias" can yield regression coefficients different than expected. In fact, the intent of the second and third steps of our analysis, designed to look at other important factors thought to influence differences in API scores, is to assess the effect of the omitted variable bias that may exist in this first-step regression. These second and third steps, in which we examine schools designated as high- and low-performing based upon the characteristics in the first-step regression, look to see if previously proposed omitted explanatory variables differ in average magnitude between high- and low-performers.

Predicting an Expected Academic Performance Index

We have generated these regressions to predict a school site's API score in a given year if it produced this score in the same manner as the average elementary school with the inputs we included. This is accomplished for each elementary school site, for each of the 2 years under consideration, by taking the actual data for the explanatory variables in the regressions and multiplying them by the appropriate regression coefficients. The resulting values, for a specific site in a given year, are then summed together and a predicted log API score is attained for each site.

After the antilog of the predicted API is derived, a "performance percentage" is then calculated for each site by subtracting its predicted score from its actual score and dividing this difference by its actual score. This value, multiplied by 100, indicates in percentage terms how much better (if positive value) or worse (if negative value) a site did than it was predicted to do. This performance percentage is sorted from high to low for each year. The top 5 percent are identified as high performing, while the bottom 5 percent is low performing. If a school site is classified as high or low performing in both the school years that began in 1999 and 2000, then it is included in our final samples of these kinds of sites. This results in 141 elementary school sites considered high performing and 120 elementary school sites considered low performing.

Table 2 contains a list of the top 35 elementary schools considered to be high performing. For instance, Kelso Elementary achieved an API score of 808 in 2000. It is considered high performing because its predicted score was 61.2 percent lower at 501.4. Table 2 also contain data for 2000 on the percentage of these schools' students who were African American or Latino, received reduced-price meals, attended for the first year, and the average education of their parents.

The summary statistics reported at the bottom of this table should be heartening to California policymakers grappling with raising standardized test scores in the state's under-performing schools. California's highest-performing 35 elementary sites had, on average, student bodies that were composed of

higher ratios of African-American, Latino, poor, and English-learning students than the averages reported for all of the state's elementary schools. Students at these highest-performing elementary sites also reported that their parents' level of education was below the average reported for all elementary schools. Recall that the only race/ethnicity characteristic of students at a school site that exhibited a statistically significant positive influence on API in both 1999 and 2000 was percentage of students Asian-American. The average value for this variable at all California elementary school sites in 2000 was 8.12 percent. Nine of the school sites included in the top-35 performers in Table 2 exhibited an Asian-American student body that was greater than this California average. Though this is important to consider, even those schools in Table 2 with a high percentage of Asian-American students were expected, given their other input characteristics, to do worse than they actually did.

Table 2 clearly shows that some California schools have overcome the predicted odds against them by doing a very good job of educating students from socioeconomic disadvantaged backgrounds. The next step is to attempt to determine the reasons these schools are achieving higher-than-expected performances. If this information is known, then perhaps policymakers can better devise policies to duplicate those results in low-performing schools that exhibit many of the same characteristics.

Table 2
Information for Top-35 Performing California Public Elementary Schools

	School	District	2000	2000	2000	2000	2000	2000	2000	2000	2000
	Name	Name	Performance Percentage	Actual API	Predicted API	% Student African American	% Student Latino	% Student Asian American	% Students Reduced Price Meals	% English Language Learners	% Students First Year Attend
1	Kelso (William H.) Elementary	Inglewood Unified	61.15	808	501.4	45	50	0	100	27	10
2	Hudnall (Claude) Elementary	Inglewood Unified	60.50	781	486.6	37	62	0	99	40	21
3	Highland Elementary	Inglewood Unified	52.68	761	498.4	56	37	0	85	30	23
4	Central Elementary	San Diego City Unified	51.94	736	484.4	13	71	13	100	74	18
5	Payne (Buelah) Elementary	Inglewood Unified	47.29	748	507.9	9	87	1	85	52	10
6	Bennett/Kew Elementary	Inglewood Unified	43.39	775	540.5	52	41	1	99	18	12
7	Costano Elementary	Ravenswood City Elementary	38.67	751	541.6	30	47	0	99	27	29
8	Moscone (George R.) Elementary	San Francisco Unified	38.61	801	577.9	7	40	38	92	47	5
9	Centinela Elementary	Inglewood Unified	38.16	670	484.9	23	76	0	100	44	15
10	Lane (Robert Hill) Elementary	Los Angeles Unified	36.21	749	549.9	0	91	4	85	35	30
11	Spring Valley Elementary	San Francisco Unified	34.10	733	546.6	4	31	53	91	77	4
12	Addams Elementary	Long Beach Unified	32.05	632	478.6	16	68	3	91	66	16
13	Lafayette Elementary	Long Beach Unified	31.42	604	459.6	18	70	3	100	68	12
14	Wash (John S.) Elementary	Sanger Unified	31.05	795	606.7	0	0	1	33	12	12
15	Hedrick (Margaret) Elementary	El Centro Elementary	30.84	783	598.5	4	74	5	96	26	24

Table 2 (cont.)
Information for Top-35 Performing California Public Elementary Schools

	School	District	2000	2000	2000	2000	2000	2000	2000	2000	2000
	Name	Name	Performance Percentage	Actual API	Predicted API	% Student African American	% Student Latino	% Student Asian American	% Students Reduced Price Meals	% English Language Learners	% Students First Year Attend
16	Woodworth (Clyde) Elementary	Inglewood Unified	30.30	597	458.2	31	66	0	99	62	15
17	Hobart Boulevard Elementary	Los Angeles Unified	29.64	645	497.5	2	77	20	91	77	9
18	Commonwealth Ave. Elementary	Los Angeles Unified	29.50	650	501.9	2	88	4	97	64	1
20	Fremont Primary	Calipatria Unified	28.63	668	519.3	5	77	0	77	55	13
21	Lau (Gordon J) Elementary	San Francisco Unified	28.62	726	564.5	1	37	52	88	69	5
22	Lambert (C.C.) Elementary	Tustin Unified	28.20	572	446.2	1	96	2	100	83	38
23	Elder Creek Elementary	Sacramento City Unified	27.83	756	591.4	9	18	58	100	55	23
24	Oak Street Elementary	Inglewood Unified	27.66	672	526.4	14	84	0	79	38	14
25	Freeman (Daniel) Elementary	Inglewood Unified	27.58	728	570.6	92	7	0	61	3	24
26	Playa del Rey Elementary	Los Angeles Unified	26.94	674	531.0	12	70	3	72	44	7
27	Jefferson Elementary	Kings Canyon Unified	26.81	601	473.9	0	93	0	97	74	10
28	Stevenson Elementary	Long Beach Unified	25.75	597	474.8	14	74	7	100	71	15
29	Towne Avenue Elementary	Los Angeles Unified	24.69	669	536.5	21	64	1	85	27	29
30	Manchester Gate	Fresno Unified	24.69	948	760.3	7	27	16	39	2	28

Table 2 (cont.)
Information for Top-35 Performing California Public Elementary Schools

	School	District	2000	2000	2000	2000	2000	2000	2000	2000	2000
	Name	Name	Performance Percentage	Actual API	Predicted API	% Student African American	% Student Latino	% Student Asian American	% Students Reduced Price Meals	% English Language Learners	% Students First Year Attend
31	Camellia Elementary	Sacramento City Unified	24.66	847	679.5	22	19	29	53	31	13
32	Taft Elementary	Santa Ana Unified	24.40	796	639.9	5	69	10	53	31	22
33	Vine Street Elementary	Los Angeles Unified	24.23	582	468.5	4	90	2	96	67	8
34	Adams Elementary	Santa Barbara Elementary	23.42	692	560.7	3	69	1	58	47	13
35	Dewey Elementary	San Diego City Unified	23.32	789	639.8	17	36	2	79	20	10
	Average for these 35 Public Elementary Schools		33.25	714	537.5	**17.69**	**58.91**	9.40	**84.94**	**45.69**	16.26
	State Average all Public Elementary Schools		NA	607	NA	8.35	38.51	8.12	50.77	24.70	18.46

VI. Step Two: Differences in Teacher and Other School Characteristics

In this section, we examine differences in teacher characteristics, year-round operations, and magnet/charter status at California's public elementary school sites that have been determined to be in the top and bottom 5 percent in regards to difference between actual and predicted API. As described earlier, the motivation to look for differences in these characteristics comes from the theory that the average academic performance measured at a school site is generated through an education-production process in which school inputs play an important role. In the first step (regression) of our research, we accounted for some of these school inputs by controlling for whether a school is year-round and multitrack, the average class size for grades K-3 and for grades 4-6, and the percentages of teachers with full credentials and some emergency credentials (emergency permits). In this section, we look to see if some previously unaccounted-for measures of other school inputs vary in observed occurrence between top- and bottom-performing schools.

Teacher Characteristics

Data on teacher characteristics were gathered from publicly available information provided by the California Department of Education from the Professional Assignment Information Form (PAIF) that all California teachers are required to fill out. The reported values fall into the general categories of gender, ethnicity, education level, teacher experience, teacher status, type of staff, full time/part time, teacher credential type, and authorized teaching areas.

For elementary schools, the sample of 141 high-performing schools exhibits a statistically significant greater percentage of female teachers than the sample of

120 low-performing schools. In addition, high-performing sites exhibit a greater percentage of teachers of Asian heritage, and smaller percentages of teachers of Pacific Islander and Latino heritage. It is difficult to draw any policy implications from these findings. Male, Latino, and Pacific Islander teachers could be attracted to low-performing schools because they want to assist where help is most needed rather than the alternative causation that these types of teachers negatively influence test outcomes.[8]

But, there may be policy implications to be drawn from the fact that high-performing elementary schools are more likely than low-performers to have teachers who have completed master's degrees. The average level of teaching experience, both at a teacher's current school site and in the district, also appears to play a role in the determination of a high-performing elementary school. The number of years teaching in the district averaged 22.2 for teaching staff at high-performing elementary sites as compared with 19.8 for low-performing elementary sites. An extremely interesting finding is that on average nearly 13 percent of the faculty at high-performing elementary sites was long-term substitute teachers, but this value averaged only 8.4 percent at low-performing sites. This may be due to the flexibility that part-time hires can provide principals in shaping a teaching staff the principals believe could best achieve high academic standards. In addition, there are significant differences in the percentages of teachers considered full- and part-time at the top and bottom elementary school sites in California. On average, only 2.6 percent of teachers at

[8] Another possibility is that Asian-American teachers are more likely to be credentialed than teachers of Pacific Islander or Latino heritage. This hypothesis, along with alternatives that could be formulated, deserves further

low-performing high schools were part-time, but about 3.7 percent of the teaching staff at high-performing high schools was part time. There is evidence that top-performing California schools exhibit a more flexible teaching staff, through the use of more long-term substitutes and part-timers, than low-performing ones. We further test this hypothesis in the survey stage of our analysis.

As described in Table 3, we also gathered information on the type of credentials held by teachers at our high- and low-performing sites. The overall use of noncredentialed staff is very similar for high- and low-performing schools, although the number of teachers with a credential is actually lower at high performing schools. Top elementary sites were found to have fewer university interns and fewer pre-interns.

Table 3
Percentage Credentialed and Noncredentialed Teachers for High- and Low-Performing Elementary Schools

	% Credentialed	% Noncredentialed					% Total, Noncredentialed
	Full Credential	% Waiver	% Emergency Permit	% Univ. Intern	% District Intern	% Pre-Intern	
High-Performing	79.8	14.6	1.0	2.2	1.3	2.2	**21.3**
Low-Performing	82.5	13.0	1.4	3.2	1.4	3.2	**22.2**

Take note, however, that although some percentage differences relate to credential type, their order of magnitude is not large. Remember that a one percent difference in the number of teachers holding a certain credential at a site employing 100 teachers translates into only one more teacher with that credential.

Type of Year-Round Operations

exploration in future studies.

Recall from the regression analysis that, holding other explanatory factors constant, an elementary school on year-round operations exhibits an average API score that is about 2 percent lower than one on a standard calendar. Upon finding this, and knowing that some policymakers in California have advocated switching to year-round operations as a way to improve the academic performance of low-scoring schools, we decided to investigate if type of year-round, multitrack operation makes a difference.

Using the CBEDS and CSIS for fall 2000, we checked whether sites in our designated high- and low-performing samples were operating year-round and, if so, the type of calendar used to conduct the year-round operation. Year-round, low-performing elementary schools were more likely to be on a 90-day instruction/30-day vacation calendar than year-round, high-performing sites: 34 percent of all year-round, low-performing sites and only 13 percent of year-round, high-performing sites. Year-round, low-performing elementary schools were also more likely to adopt a "Concept 6" calendar (81 days instruction/43 days vacation) than year-round, high-performing sites: 30 percent of year-round, low-performing schools and 10 percent of year-round, high-performing schools. These tracks, characterized by long instruction periods and long vacations, were more likely to have been adopted to make maximum use of the available facilities and may be in place for reasons other than a desired improvement in pedagogy.

In addition, 36 percent of all year-round, high-performing schools had adopted a year-round calendar of 60 days on/20 days off, and 14 percent of these high performers use a custom year-round calendar (less than 8 weeks on). The comparable rates of adoption for year-round, low-performing schools were less at,

respectively, 15 percent and 2 percent. Thus, there is some relationship between falling into the high-performance category and adopting a year-round schedule that has shorter periods of time on and off. The obvious policy recommendation is that a switch to year-round operations will likely not exert a positive influence on a school site's academic performance unless it is tailored to have short breaks between instruction periods. This finding is not surprising because advocates of year-round education insist its benefits occur through minimizing the time away from the classroom during school vacations.

Magnet and Charter Schools

The California Department of Education defines a magnet school as one designed to attract students away from their neighborhood school of residence. Such a school exists within a school district and operates under the same rules and financing constraints as other public schools in the district, but follows a unique curriculum theme or instructional mode. A charter school is a public school formed through the initiative of teachers, parents, community leaders, and/or a community-based organization. In California, a local public school board or county board of education usually sponsors a charter school. Goals and operating procedures must be specified in a detailed "charter" between the sponsoring board and organizers. Except where noted by law, charter schools are exempt from most state laws governing school districts. Charter schools may not charge tuition and their admission practices cannot discriminate against pupils on the basis of ethnicity, origin, gender, or disability.

The reason we look for the prevalence of these two types of schools among our derived samples of high- and low-performing schools is to test whether the

institutional form that a public school operates in exerts an influence on its ability to transform given inputs into academic productivity. That is, holding the production factors (student inputs, social inputs, school inputs, and student population tested) contained in the regression analysis constant, is there any indication that there is a greater prevalence of magnet or charter schools in the high-performance group?

Of the 141 high-performing elementary schools, 13 are magnets. Of the 120 low-performing, only 4 are magnets. This translates into a statistically significant difference of about 9 percent of high-performing schools being magnet schools, while only 3 percent of low-performing schools are. Similar evidence points to a slightly greater likelihood of charter schools existing in the low-performing sample for both elementary and middle schools, though this likelihood is not statistically significant.

VII. Step Three: Survey of School Principals

Information relevant to determining what causes differences in academic performance was also gathered through a survey of principals at the 141 high-performing and 120 low-performing elementary sites. We designed the survey to look for differences in the instructional practices, school climate, school community, and parental involvement approaches that are practiced at the designated high- and low-performing sites. In this section we briefly describe the survey method, our analysis of the survey results, and findings relevant to why schools with many of the same characteristics perform so differently on standardized tests.

Survey Method

In our one page survey, 14 questions were designed to capture as many as possible of the "best" or "effective-practice" principles listed earlier in Section II. We also took care to insure that each question asked about only a single best practice. The principal was asked to "disagree," "somewhat disagree," "somewhat agree," or "agree" that these practices are occurring at his or her school. The survey instrument was first mailed out in late October of 2001. The survey was officially terminated in early January 2002 with a final response rate of 55 percent returned from high-performing and 61 percent from low-performing elementary sites. Survey results from each responding school were entered into a spreadsheet and statistical calculations done that maintained the separate identity of responses garnered from low- and high-performing elementary schools.

Survey Analysis

Recall that the primary goal of the survey was to test whether responses to questions on effective practices differed between principals at high- and low-performing schools.[9] We carried out this test by comparing the average response value for each question (by type of site) to see if there were statistically significant (90 percent degree of confidence) differences between high- and low-performers. If there were, then we can be fairly certain that something different is going on at a high-performing site than at a low-performing site.

Perhaps the most striking overall result from the survey is the lack of statistically significant differences between the average response garnered from a

[9] A reasonable criticism of this survey is that it may invoke "desirability bias" from the principals asked to respond to it. Most principals know what the accepted best-practice response should be and are hence biased toward choosing it even if it does not represent the practice of their school. Perhaps this possible bias is at least part of the reason that we find as little differences between high and low performers as we

high- and a low-performing school. Our survey detected no differences in the average response of principals at high- or low-performing elementary schools regarding whether (1) they can succeed with any student, (2) parents are involved, (3) tutoring is provided, (4) adequate personnel exists to handle discipline, (5) frequent assessment is used, (6) district grants flexibility to principal in resource use, (7) reading is emphasized, (8) physical condition is adverse to learning, (9) English-learner support exists, or (10) Title I funds are used to hire nonprofessionals.

Given that the responses of principals at California's highest- and lowest-performing sites are not that different for the vast majority (10/14 or 71 percent) of questions, we should pay particular attention to responses in which statistically significant differences were found. One of these concerned the importance of preschool education. As expected, principals at high-performing elementary sites were more likely to agree that most of their students had attended a preschool program. In addition, principals at high-performing schools were more likely to agree to the following: "At our school, all teachers and learning specialists work in teams to improve a student's academic performance."

But contrary to the case-study literature, we find that principals at low-performing elementary sites were more likely to agree with the statement that they are free to hire the teachers they wish to and are able to supplement public funding. This is very interesting in that high performance is usually associated

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do. But, quit important, this bias should generate greater faith in true differences between the practices at high- and low-performing schools when we do find them.

with the administrative flexibility that comes with greater freedom in personal decisions and greater resources gained from nondistrict funding. A reasonable explanation for these contrary findings may be that principals at high-performing sites may have greater expectations in regard to what constitutes "free to hire" and "supplementing public funding" and thus may be more likely to not be satisfied with the current condition.

Regarding principal experience, our survey uncovered significant differences between high and low performers. For years at current site, high-performing principals exhibited an average tenure of 5.5 years, but the principal at a low-performing school on average had only been there 4 years. The same held true for principal experience at any site. Principals at high-performing sites had on average about 9 years of total experience as such an administrator, although principals at low-performing sites had on average just over 7 years. There were no differences between high- and low-performing elementary sites as to whether principal held a master's or doctorate degree.

VIII. Step Four: Policy Implications

This report has described the empirical methods used to better understand why some high-poverty, high-English-language-learner, and so forth, schools in California have beaten the odds and produced higher standardized student test scores than the typical California school in the same situation. Our belief in conducting this research has been that a study of high-performing schools, doing much better than a typical California school in the same situation, can offer important suggestions to policymakers for assisting the low performers. We now turn to a synthesis of the policy recommendations derived from this research.

As stated earlier, we will not draw any policy implications from the regression coefficients derived in Step One of our research. Though these regression coefficients indicate the influence that a one-unit change in a particular explanatory variable has on a school's API score (in percentage terms), the only intent of running them was to produce a predictive tool. Though these regressions are fine for the purpose for which we use them, the magnitude and direction of these particular effects could be biased by the exclusion of other factors that also determine a school's API. The policy implications described next in Table 4 are derived from data-based findings that came out of Step Two (using existing data sources) and Step Three (using our own survey) of our analysis. In this table, we have taken care to offer only policy suggestions that we believe are practical to implement; hence, we do not cite all of the statistically significant findings.

Practical Findings and Implications

The findings in Table 4 offer a base of information that the California Legislature, California Department of Education, California Teacher's Association, or school boards throughout the state can consider when crafting their owns plans to deal with California schools that have failed to show the improvements in API scores mandated by the PSAA.

The policy course we have just outlined is based upon our research that shows observed differences in the two extreme sets of schools that have done much better or much worse than expected given their measured school, student, and social inputs. In many cases, we were struck more by what we did not find than what we found. From a research perspective, this is not surprising.

Isolating school-controlled variables that best explain and predict school performance and discovering how these variables relate or behave together to influence school performance is a complicated task. Additionally, in searching for other variables that may more fully explain the differences in school performance, we may not be looking for a single factor, but rather a group of factors that may relate to one another and that may be different among elementary, middle and high schools.

Table 4
Policy Implications From Comparison of California's High- and Low-Performing Elementary Public School Sites

Teamwork:	Policymakers grappling with how to improve California's lowest-performing schools should note that principals in the top-performing category were more likely than principals in the low-performing to agree that "teachers and learning specialists work in teams to improve a student's academic performance." The clear policy implication of this is state encouragement and funding for such practices at persistently low-performing school sites. More research would be helpful to determine what specific kinds of teamwork are being utilized in high-performing schools -- student study teams, team teaching, instructional program planning and development, integration of teaching resources, or other teamwork.
Teacher Education and Experience	More experienced teachers, who have earned post-baccalaureate degrees, should be encouraged to teach at California's identified low-performing schools that have been unable to raise test scores.
Teachers Without Full Credentials	Not surprisingly, low-performing schools should avoid the use of teachers who are not fully credentialed in the areas they are teaching. This means avoiding or limiting the use of teachers with emergency permits or credential waivers, and interns or pre-interns.
Principal Experience	Experienced principals should be encouraged to work at low-performing schools. Principals successful at producing high API scores, given the characteristics of

	the schools and students with whom they are working, should be encouraged to train other principals to lead underperforming schools[10] or even be encouraged to transfer there themselves.
Flexible Teaching Schedules	Principals should be allowed flexibility and greater choice in hiring at low-performing schools. Also, principals at low-performing schools may want to consider offering more flexible teaching positions to attract high-quality teachers. High-performing schools had a greater percentage of part-time teaching staff and chose to use a greater percentage of long-term substitute teachers. Additional research is needed to understand what is behind the greater utilization of part-time teachers and long-term substitutes at high performing elementary, middle and high schools -- whether it is team-teaching, job-sharing, resource teachers or other part-time arrangements; or whether it grants the principal the flexibility to hire a full-time teacher only after first observing in a part-time capacity.
Preschool	Extending preschool experiences to larger numbers of students in California, particularly to low-income students and students who will be attending low-performing schools, should be explored.
Year-Round Schools	Low-performing schools on year-round calendars that are not characterized by relatively short periods of instructional days alternating with relatively short periods of time off should be encouraged to adopt such schedules. A schedule such as this might be, for instance, 45 days on and 15 days off.
Magnet Schools	Though we have found that high-performing elementary schools are more likely to use the "magnet" approach in establishing their student enrollments, we do not advocate adopting selective admission criteria to raise the scores of low-performing schools. Low-performing students who did not meet such criteria would simply be passed onto another school, which would not resolve core performance issues.

[10] The Inglewood Unified School District appears to be an excellent source of principal trainers at the elementary level. Table 2 shows that 9 out of the 35 top-performing elementary schools, or 26 percent, were in this district alone.

Further Research

This study was intended to use the wealth of new and growing school-based data available at the state level, and some additional data developed specifically for this study, to identify statistically significant differences between high- and low-performing schools in California. Although more research is needed and possible, this study provides a framework that could be refined and expanded. As such, this study should be viewed as a beginning, not an end.

We conclude this article by stressing that this research will have served its purpose if it helps clarify the factors that can cause two schools sites -- with similar types of students, parent education levels, K-6 class sizes, and ratios of fully or emergency credentialed teachers -- to score either very well or very poorly on a measure of school-wide academic performance. Our hope is that these insights can translate into sharing with underperformers some of the tools that are working for high-performing schools.

One avenue of further research might directly focus on the factors at a school that drive changes in API score. Because the rewards and sanctions of California's PSAA are directly based upon these changes, it would be informative to know if the factors that affect change in API are the same that we found here to influence overall API level. Specifically, it would be very possible to include additional, important variables in the regression analysis to understand more about the factors driving student achievement, reduce omitted variable bias, and better identify high- and low-performing schools. Lastly, future studies could expand upon the sample sizes in this study. Most obviously, the focus on the top and bottom 5 percent of schools could be enlarged to include the top and bottom

10 percent, which would provide more robust sample sizes, especially for middle and high schools.

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