Strategies for Closing the Gap: Predicting Student Performance in Economically Disadvantaged Schools

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In 2001, the No Child Left Behind Act placed even stronger responsibility on states to raise student performance. As a result of these accountability standards, states must now administer standardized tests to "measure adequate yearly progress" of all students. They face costly federal mandates and must submit comprehensive accountability plans. The federal law also focuses on narrowing the achievement gap between races. It requires that states monitor the performance of racial and economic subgroups and undertake corrective action in failing schools (Wong, in Gray and Hanson, 2004, p. 376).

Researchers examining student performance consistently find that one of the most important influences on student achievement is socioeconomic status (SES) of students. The more affluent the student's background, the better he or she will perform (Coleman, et. al., 1966; Jencks et. al., 1972). This research, often referred to as "status attainment research," generally concludes that other school and teacher characteristics as well as school policies and spending decisions have minimal consequences for student achievement. Later studies continue to support these conclusions (Hanushek, 1989, 1996). Okpala (2002, p. 907), in one of many studies that examines resource usage in public schools concludes, "Some of the major factors that are theoretically under the control of a school…have little if anything to do with student performance."

These findings give little comfort to educators in economically disadvantaged schools who are facing heavy pressure to improve performance and close the gap between minority and white students. Yet Verstegen and King (1998) claim that a growing body of research is using better databases and more sophisticated methodological strategies to provide evidence that school policies can make a positive difference in student outcomes. They also emphasize that resource patterns that optimize performance in one setting do not necessary work in others. Encouraged by this line of thinking, we investigate factors that may explain the differences in performances in schools that share a common socioeconomic context. That is, are there choices made by policymakers and administrators in economically disadvantaged schools that spark significant improvements in performance in these schools?

In this study, we assume the significance of SES or "input" factors in explaining achievement, and we consider the impact of other "process" variables, that is, factors over which schools have some control. Using the Texas Academic Excellence Indicator System (AEIS) data, we examine these variables to determine the elements that can impact success or failure of public school campuses. Our measure of performance is the standardized test given in 2001 to students in Texas public schools, the Texas Assessment of Academic Skills (TAAS). We focus our study on Texas schools that are predominantly populated by students who come from economically disadvantaged backgrounds. From this pool of poor school campuses we select two groups of very "high-performing" and very "poor-performing" school campuses. The central question of this study is to discover what factors contribute to the success of some and failure of other schools. We do acknowledge that factors that affect student achievement at the primary school level may not necessarily increase performance at the secondary level. Thus our study compares primary and secondary schools.

Impact of process variables

Although our statistical models include measures for SES (percent of economically disadvantaged students and percent white students), our focus is on process variables. The latter include those variables that school systems more or less control. We categorize these variables into three general areas: 1) school characteristics (school size, student/teacher ratio, and campus expenditures by function and program); 2) teacher characteristics (salary and experience levels); and 3) the global resource measure of per pupil expenditure (PPE).

One of the most important and controversial characteristics of schools is the size of school. Production function research on the effects of school size has been inconclusive, and both sides have their advocates. Supporters of small schools contend that students get more attention, school governance is simpler, and teachers and administrators are more accessible to parents. Noguera (2002) states that in high schools where the majority of low-income students of color are achieving at high levels, the one common characteristic is the small size of the schools. Lee and Burkam found that students are less likely to drop out of schools with fewer than 1,500 students (2003). However, others argue that large schools are able to offer students a wider range of educational offerings and services ("Still Stumped," 2002).

Recent research indicates that the effects of school size may depend on the SES of students. Findings show consistently that the relationship between achievement and socioeconomic status was substantially weaker in smaller schools than larger schools, that is, students from impoverished communities are much more likely to benefit from smaller schools. On the other hand, a positive relationship exists between larger schools and the output measures of affluent students (Lee and Smith, 1996; Howley and Bickel, 1999). Because our study examines the performance of economically disadvantaged students, we expect to find a negative relationship between school size and achievement scores. That is, the larger the school, the less likely students are to achieve on standardized tests.

The effect of class size on student achievement is another relationship that has been closely studied. In 2000, Congress allocated $1.3 billion for class size reduction as a provision of the Elementary and Secondary Education Act (ESEA) (Johnson, 2002). Most of the studies that examine the effect of class size on student performance have focused on primary schools. In the mid-1990s, findings from Tennessee's Student Achievement Ratio (STAR) study found that students from small classes had significantly higher scores on standardized tests in every subject tested (Mosteller, et.al., 1996; Finn and Achilles, 1999). However, Johnson (2000), citing a study at the Heritage Foundation examining National Assessment of Educational Progress (NAEP) reading data, asserted that the difference in reading assessment scores between students in small classes and students in large classes was insignificant. He criticized class size reduction programs citing California as example of how such programs exacerbate the problem of lack of qualified teachers to fill classrooms. His claim of the lack of association between class size and performance was consistent with Hanushek's conclusions (1999).

Studies of the effects of class size in secondary schools are much more rare and largely equivocal (Deutsch 2003; Grissmer 1999). Many of those who advocate for smaller class sizes at the secondary level argue that small classes positively impact the school environment, thus, improving performance indirectly. In her review of the literature of class size and secondary schools, Deutsch (2003) highlights studies that conclude small classes stimulate student engagement, allow more innovative instructional strategies, increase teacher-student interactions, reduce the amount of time teachers devote to discipline, improve teacher morale, and minimize feelings of isolation and alienation in adolescence that can come from anonymity.

In addition to school and class size, a critical characteristic of the school is the allocation of resources by function and program. Indeed, researchers generally conclude that the specific allocation of funds is as important as the total amount or per pupil expenditure (PPE) (Hedges, Laine, and Greenwald, 1994; Harter 1999). Harter's study is particularly interesting. She examined the effects of 17 different types of instructional expenditures in 2,800 elementary schools in Texas and found that the most significant correlates for achievement were money spent to reward highly rated teachers and for supplies and maintenance. These categories of expenditures were specifically effective in high-poverty schools.

In our study we examine the allocation of resources by function and by program. The former refers to spending for instruction rather than non-instructional purposes. Instruction refers to all activities dealing directly with the interaction between teachers and students, including instruction aided with computers. We also examine percent of funds spent on instructional leadership, i.e., managing, directing, supervising, and providing leadership for staff who provide instructional services. We anticipate that instructional leadership and support play a particularly significant role in improving the performance of students in impoverished communities.

Instruction by program applies to the areas defined by the Texas AEIS data, i.e., percentage spent on regular instruction, bilingual education, compensatory programs, gifted and talented programs, and career and technology programs for secondary students. In general, one would expect that spending on regular instruction would be positively correlated with student performance. However, predictions about the effects of spending on regular instruction are difficult to make with respect to economically disadvantaged schools. This is because the resources these schools put into other programs such as bilingual or compensatory education may help to improve the performance of students on standardized tests.[1]

Another important process variable we investigate encompasses teacher characteristics, namely, the level of teacher salaries and experience. As with the other factors in our model, conclusions about the effects of both on student performance has been mixed, but recent studies seem to point to more positive correlations, particularly teacher experience (Hedges, Lane, and Greenwald 1994). Although Hanushek (1989) originally found negligible effects between teacher salary and student achievement, this was not true for teacher experience. And, in a more recent review of research, he cites a positive correlation between teacher salary and student performance in 74 percent of the cases, and a positive correlation between teacher experience and student performance in 85 percent of the studies (Hanushek 1997, p. 144 as cited in Verstegen and King, 1998). In their review of production function research, Verstegen and King (1998) state that teacher experience was a significant predictor of student performance in 24 of 30 studies and teacher salary was significant in 17 or 19 studies.

Finally, we also examine the effects of global resources, that is, per pupil expenditure (PPE), on the impact of performance. In their review of production function research, Verstegen and King cite Hedges, Laine, and Greenwald's assertion (1994) that "Global resource variables such as PPE, show positive, strong, and consistent relations with achievement" (1995, 57-58). However, other studies fail to yield significant results (Chubb and Moe 1990; Okpala 2002). Tajalli, in his examination of the wealth equilization or “Robin Hood” program in Texas, found that the transfer of nearly $3.4 billion of dollars to poor school districts did not have a significant impact on the improvement of performance in these districts (Tajalli, 2003).

It may be that expenditures in general have an indirect effect that is not apparent when using PPE as a direct measure. In his study of school spending Wenglinsky (1997) develops a “path” in which he concludes a school’s economic resources are associated with academic achievement. He posits that per-pupil expenditures on instruction and central office administration are positively related to class size, i.e., more spending on smaller classes. Smaller teacher/student ratios contribute to a cohesive school environment, which enhances achievement.

Methodology and Data Analysis

Data: Data on finances, students, and school characteristics from over 7,600 Texas public school campuses were collected from the Texas Education Agency and merged for the purposes of this study. The resulting master file was screened to arrive at our final data set. We used several criteria for including a campus in our study. First, we eliminated campuses that had less than 50 students. Second, we selected only those school campuses where 50% or more of the students are recognized to be economically disadvantaged. We also eliminated those cases that did not seem to be appropriate for our study. For example, we deleted school campuses that did not have any regular expenditures, or had expenditures per pupil that were unrealistically low. The resulting data file provided us with 532 cases for the 4th grade data, 198 cases for the 8th grade campuses and 97 cases for the 10th grade schools.

Dependent Variables: Dependent variables of this study are three dichotomous variables each representing low-performing and high-performing school campuses. We used 2001 campus Texas Assessment of Academic Skills (TAAS) passing rates of 4th, 8th, and 10th graders for discerning high and low performing schools.[2] We defined high-performing schools as those with 90 percent or more TAAS passing rates, and low-performing schools as those that had 50 percent or lower TAAS passing rates. School campuses with TAAS passing rates between 50% and 90% were excluded from our study.

Independent Variables: Fourteen independent variables were considered for this study. Our regression models for 4th and 8th grade data did not include expenditure on “career and technology” since these campuses are not recipients of the revenue allocated for this expenditure. This variable was used only for the 10th grade model. The 10th grade regression did not include “Compensatory Expenditure” because it is highly correlated with the regular expenditure in this model. At the end, each regression model consisted of 13 independent variables. A list of all independent variables includes:

1. Campus size
2. Percentage of students economically disadvantaged.
3. Percentage of students White.
4. Percentage of expenditure on regular program.
5. Percentage of expenditure on bilingual program.
6. Percentage of expenditure on compensatory program.
7. Percentage of expenditure on gifted and talented program.
8. Percentage of expenditure on career and technology program.
9. Operating expenditure per pupil.
10. Percentage of expenditure on instruction.
11. Percentage of expenditure on instructional leadership.
12. Teacher-student ratio.
13. Average teacher base salary.
14. Average teachers' years of experience.

Procedure: Three separate forward logistic regressions were tested to determine which independent variables were predictors of school performance. These regressions were run on 4th, 8th and 10th grade high/low performing schools. The data was screened for outlier cases and the existence of multicollinearity among the independent variables. Neither of the two problems was detected for our 4th and 8th grade data. Independent variables for the 10th grade posed two new issues for our study. First, the results demonstrated a high correlation between school's "regular expenditure" and "compensatory expenditure." We decided to omit the later variable from our list of independent variables for this logistic regression in order to remove the problem of multicollinearity. Second, high schools in Texas receive additional revenue for career and technology. We included this variable into our 10th grade logistic regression.

For each of the three dependent variables tested, the forward logistic regression procedure produced a model with the best goodness-of-fit and independent variables that were statistically significant.

Findings

Forward logistic regression resulted in three models that constituted the best predictors of school performance. All three models resulted in four predictors in each. A list of the model predictors along with the regression coefficients for each model is provided in Table 1. Again, our models represent only those predictors (independent variables) that were statistically significant. Measures of the goodness-of-fit for each model are also presented in this table. The 4th grade model correctly classified 84.4 percent of the cases, while the 8th and 10th grade models correctly classified 91.4 percent and 81.4 percent of the cases respectively.

Wald statistics indicate that all independent variables in each model are significant predictors of school performance.

Table 1. Logistic Regression Results for High and Low Performing Schools

	4th Grade		8th Grade		10th Grade	
	B*	Odds Ratio	B*	Odds Ratio	B*	Odds Ratio
School Size						
% Econ Disadvantaged	-.065	.937	-.088	.916		
% White Students			.079	1.082	.028	1.028
% Regular Expediture					.054	1.056
% Bilingual Expenditure	.039	1.040			-.256	.767
% Compensatory Expenditure						
% Gifted and Talented						
Expenditure						
% Per Pupil Expenditure						
% Career and Tech. Expenditure						
% Instructional leadership Exp.	.392	1.480				
Teacher-student Ratio						
Average Teacher Salary/1000			.311	1.356		
Teacher Experience	.096	1.101			.248	1.281
Constant	4.927		-10.671		-6.291	
-2 Log Likelihood	395.50		71.51		76.83	
Chi-Square(df)	65.22 (4)		96.92 (3)		51.12 (3)	
Correctly Predicted by the Model	84.40%		91.40%		81.40%	
N--Low-performing campuses	83		168		36	
N--High-performing campuses	449		30		61	

*All coefficients are significant at $p<.05$.

In all three models, measures of SES were significant in the expected directions. The academic performance of 4th and 8th grade schools is adversely affected by the proportion of economically disadvantaged students in these schools. Our results show that, for each percent increase in the number of economically disadvantaged students in a campus, the odds of the campus being a high-performing case drops by 6.3% and 8.4% respectively for 4th and 8th grade campuses. Thus, even within the pool of economically disadvantaged schools, the extent of poverty matters. The findings, however, indicate that racial composition of schools gains importance as students move from elementary to middle and high schools. At the 10th grade level, percentage of white students is positively associated with performance scores.

Although SES remained a significant factor even within the context of economically disadvantaged schools, we discovered that some important process variables, i.e., those policy areas controlled by educators and administrators, were also significant. As expected these variables had different effects at different levels of instruction. For example, percentage of spending on bilingual education had a positive impact in the early stages of education. However, we found that middle schools do not benefit from this expenditure, and high school campuses are negatively affected by such spending. For each additional percent increase in the bilingual expenditure, the odds of a high school being a high-performing campus decreases by 23.3%. It should be noted that we are aware of the complexities of this particular variable. It may be that spending for bilingual education is an indicator rather than a cause of poor performance. Still, it appears that administrators in elementary schools are well served by spending on bilingual education while those in economically disadvantaged high schools may benefit by investing more in regular instructional expenditures.

Our results indicate that expenditures on instructional leadership had a positive impact at the elementary level but not at middle and high school levels. For each additional percent spending on instructional leadership, elementary schools are 1.48 times more likely to be classified as "high-performing" campuses.

An increase in teachers' salary is associated with high-performance only at middle level schools. Conversely, teachers' experience is important for the elementary and high school levels but not for middle level schools. For each additional $1000 increase in the teachers' salary, middle schools increase their chance of being high-performing campuses by 36.5%. Similarly, the likelihood of elementary and high schools becoming high-performing schools increases by 10.1% and 28.1% respectively for each extra year of teachers' experience.

Our models show no direct correlation between school performance and school size, class size, or per pupil expenditures. Though smaller schools may in fact benefit economically disadvantaged students, our models do not directly test this assumption since we do not compare different economic subsets of students. We find that within high poverty schools, there seems to be no advantage in attending smaller schools. The same can be said for class size. It may be that Wenglingsky's and others' assertion that expenditures have a positive indirect effect on performance through reductions of class size and improvements in the school's environment, but our analysis provides no direct support for this finding among economically disadvantaged schools.

Discussion

Our study finds that among educators and administrators of economically disadvantage schools, decisions matter. These policy-makers can make conscious choices that affect the performance of their students. While the socioeconomic context is still a critical predictor of success, process variables are also important. Perhaps the most consistent finding among all three levels of schools is that teacher characteristics can be an important element in improving performance. Teachers paid higher salaries and with more experience tend to improve the performance of students in poorer schools.

Among primary schools in economically disadvantaged settings in Texas, our findings imply that spending on bilingual programs can be an important resource for improving student achievement on standardized tests. This is not surprising since a large proportion of economically disadvantaged schools are located in the southern border areas of the state. Our study also confirms other findings from broader subsets of schools that demonstrate that spending on instruction and instructional leadership tends to raise test scores. While the global measure of resources (PPE) does not seem to have as direct effect on achievement, it could very well be, as Wenglinsky asserts, that it has an indirect effect on performance.

Our study addresses an important niche for educators in economically disadvantaged schools that are facing greater pressure to improve performance on standardized tests and to reduce the gap between poorer students and those from more affluent backgrounds. Further studies are crucial if reformers are going to influence the debate about the use of resources in an educational system with even greater pressures for accountability.

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[1]Compensatory education refers to federal dollars that are spent to supplement basic educational services. It is based on a formula relating to the number of economically

disadvantaged students in the district. It may be used for supplies or to pay personnel to work with designated children.

[2]Until it was replaced by another test, TAAS was the Texas statewide test of students' performance. Beginning with the class of 2003, TAAS was replaced by the Texas Assessment of Knowledge and Skills (TAKS).

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