Do School Types Matter in Student Achievement in Urban High Schools?

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1. Descriptive Analysis

This study uses a subset of NELS students enrolled in urban schools. The primary reason why we focus on students at urban schools is that most private schools are located in those areas. 65.3 percent of 1,441 NELS individuals enrolled in private schools are present in municipal areas.[1] 80.8 percent of Catholic school students reside in urban places.[2] Moreover, private schools aside, public magnet schools are also more prevalent in urban regions. 57.5 percent of magnet school students are drawn from urban institutions. The over-representation of private and public magnet schools in urban areas may reflect the fact that educators and policy-makers have concerns about the disturbed state of public education in those areas. To improve the quality of urban education, many government agencies have attempted to provide their students with the opportunity to choose schools, whether by establishing varied types of public schools with special missions or by implementing school voucher programs applied to private schools.

Another reason is that minority youth are disproportionately located in urban areas. Increasing gaps in educational attainment between racial/ethnic groups has been one of the most pressing education policy challenges facing the United States today. Provision of urban education with high quality may play a significant role in reducing the gaps. Table 1 compares demographic characteristics of the entire NELS and urban samples. 21.2 percent of students enrolled in urban schools were Hispanic while the equivalent number is only 12.8 percent for the

[1] To put it differently, 28.4 percent of 3,319 students in urban areas were attending private schools while the equivalent number was only 11.9 percent for the entire NELS sample (N=12,144).
[2] More specifically, the equivalent numbers are 74.4 percent for Catholic Diocesan schools, 93.9 percent for Catholic Parish schools, and 89.6 percent for Catholic Religious Order schools.

total sample. African American students comprise 13.6 percent of the urban sample while making up only 9.1 percent of the entire sample. But, there seem to be fewer differences in gender, prior achievement, and socio-economic status between the two samples.

Table 2 presents descriptive statistics of the urban sample by school type. School types include 1) public comprehensive; 2) public magnet; 3) school of choice, public; 4) Catholic Diocesan; 5) Catholic Parish; 6) Catholic Religious Order; 7) other private, religious affiliation; and 8) private school, no religious affiliation.[3] As shown in the top rows of Table 2, there are systematic differences in demographic characteristics of students among school types. Compared to public comprehensive, females appear to be relatively over-represented in Catholic Diocesan, Catholic Parish, and other religious private schools; whereas they are under-represented in Catholic Religious Order and other non-religious private schools. In contrast, there seem to be fewer gender differences among public school types. Moreover, Table 2 demonstrates racial/ethnic differences among school types. Minority students, Hispanic or African American, are significantly less prevalent in most private schools. The racial/ethnic differences are even more dramatic for the last two private school types. Only 2.6 percent and 1.3 percent of students at other religious private and 2.4 percent and 2.0 percent of students at non-religious private schools are Hispanic and African American, respectively, in comparison to 23.8 percent and 12.2 percent for public comprehensive. On the contrary, public magnet and public schools of choice tend to serve those minority students at a higher rate than public comprehensive schools.

[3] In 1992, school administrators were asked *which of these characterizes your school? Public comprehensive; public magnet; school of choice, public; Catholic Diocesan; Catholic Parish; Catholic Religious Order; other private, religious affiliation; private school, no religious affiliation, and so on*. They were supposed to choose one of the first three 'exclusive' categories regarding public schools. Nevertheless, there are multiple responses. For example, 229 students were enrolled in both public comprehensive and public magnet schools. Additionally, 291 individuals were attending public comprehensive and choice schools. For the analytic purpose, those observations are treated as students who were enrolled in public magnet and choice schools, respectively.

Table 2 also demonstrates that there are substantial differences in prior achievement and socio-economic status. Importantly, high achievers tend to attend private schools rather than public schools. Catholic Diocesan, Catholic Religious Order, other religious private, and non-religious private schools are having higher-achieving students on the 8th grade cognitive tests. But, there seem to be fewer differences in the test scores among public school types and between Catholic Parish and public comprehensive. Similarly, Table 2 shows that there are considerable differences in socio-economic status[4] among school types. Students enrolled in all types of private schools tend to be from higher socio-economic backgrounds than those in public comprehensive schools. But, there exist fewer differences in the socio-economic composite scores among public school types.

It is important to note that the existence of systematic differences in student demographics by school types suggests 'non-random' assignment of students into school types. This not only suggests that one should account for the systematic differences in observed demographics of students when comparing academic achievement of students at different types of schools. But, it also indicates that one must address an essential issue of sample selection on the basis of unobserved characteristics of students. There may be also sizeable differences in unobservables, such as motivation, among school types. Highly motivated students may be more likely to attend private schools where there are high quality teachers and privileged peers. To put it differently, there could exist unobserved factors that are correlated with a student's decision on which type of school to attend and the student's academic achievement.

Moreover, different types of schools seem to have different characteristics of the student body. Private schools tend to serve the even smaller number of 12th graders than public

[4] SES composite is computed based on the non-missing values of five components: father's and mother's educational levels, father's and mother's occupations, and family income (Curtin, Ingels, Wu, & Heuer, 2002).

comprehensive schools. As shown in Table 2, 12th grade enrollments at public comprehensive schools are approximately four times those of private schools. Students at private schools tend to have higher ability peers in terms of 8th grade test scores. In addition, they are more likely to have classmates from high socio-economic backgrounds. Private schools have significantly lower proportions of Hispanic or African American and economically disadvantaged students. These existing differences in peer characteristics should be taken into account when comparing individual performances of students in different types of schools. Students at schools having 'better-off' peers may show higher student achievement simply because they are exposed to a 'peer effect' (McEwan, 2000; Levin, 1998).

The bottom rows of Table 2 present educational outcomes, whether short- or long-run, by school type. Not surprisingly, students at private schools show much better performances than those at public schools. As for the short-run outcomes, there seem to be 5 to 10 point differences in 12th grade test scores between public and private schools. Students at private schools tend to score from 10 to 100 points higher on the SAT test than those at public schools. Similarly, as for the long-term outcome, private school enrollees tend to attain a bachelor's degree at twice the rate of those at public schools. In addition, students at private schools showed a higher level of civic-mindedness than public school students. In contrast, there are fewer differences in student outcomes among public schools.

Then, a major question is whether these differences in student performances between public and private schools are attributable to a 'pure' private school effect. As noted, some of the differences may be explained by differences in student demographics. Others may be simply reflecting differences in characteristics of peers. Moreover, sample selection on unobservables may account for, at least in part, the gaps in student achievement between public and private

schools. The goal of this study is to examine if there are any significant differences in student achievement among school types, once adjusting for observed characteristics of students and their peers as well as sample selectivity.

2. Multivariate Analysis

A private school effect can be explained in three ways (McEwan, 2000). A first explanation is that students at private schools do academically better because they are exposed to 'privileged' students. Many studies have shown the existence of a "peer effect," meaning that characteristics of peers are significantly related to the academic achievement of an individual student (e.g. Zimmer & Toma, 2000; Hoxby, 2000; Hanushek, Kain, Markman, & Rivkin; 2001). A second explanation is that private schools utilize a different set of school inputs and different education policies and practices. A final explanation is that private schools allocate more efficiently resources and provide better incentives for teaching and management. The first regarding a peer effect can be separated from other explanations in that it is not related to the issue of what and how differently private schools educate their students. Although it is difficult to disentangle it from others, this study attempts to address a peer effect by introducing peer characteristics into the analysis of a private school effect.

2.1. Adjusting for observed characteristics of students and their peers

As noted, there are substantial differences in characteristics of individual students as well as their peers among school types. Those differences may explain, at least in part, differences in student achievement among school types. To approach it, this study enters as explanatory variables demographic characteristics of individual students and their peers into the Ordinary

Least Squares (OLS) regression of student performances. Individual student variables include gender, race/ethnicity, prior achievement, and socio-economic status. Peer variables contain the number of peers, their mean test scores, and percentages of minorities, Hispanic or African American, and economically disadvantaged students. One statistical concern over the OLS estimates is that standard errors may not be precise due to the fact that observations are clustered within schools and thereby correlated with each other. Clusters of schools may reduce OLS standard errors and therefore overestimate the precision of a school-level variable effect. This study addresses this clustering issue by using a cluster option of statistical package software that corrects properly OLS standard errors[5].

12th grade Academic Achievement:

Tables 3A and 3B present the results of OLS regressions of 12th grade academic achievement in subjects such as reading, math, science, and history. Our base-line model is specified in two ways: 1) without controls and 2) with controls. The results from the first specification indicate raw differences in educational outcomes among school types. Those from the second demonstrate achievement differences that are adjusted for characteristics of individual students and their peers. The first two columns of Table 3A report the results of regressions on reading achievement. The results indicate that students at Catholic Diocesan, Catholic Religious Order, and other religious private schools score 5 to 6 points higher than their counterparts at public comprehensive schools while those at Catholic Parish schools score lower by 5.8 points. However, once adjusting for characteristics of students and their peers, the differences in reading achievement are significantly reduced toward zeros. The results indicate that achievement

[5] Many studies have approached the clustering issue by introducing Hierarchical Linear Modeling analysis (for example, see Gamoran, 1996). For simplicity, this study relies on a 'cluster' command of STATA that adjust OLS standard errors for clusters of schools.

advantages of Catholic Diocesan, Catholic Religious Order, and other religious private schools decrease to 1.4, 2.8, and 1.5 points, respectively. Similarly, the difference between Catholic Parish and public comprehensive schools falls to 1.8 points. It is important to note that most of the adjusted differences are not statistically different from zeros at the significance level of 5 percent. In other words, the results suggest that there are few differences in student achievement in reading among school types, after controlling for individual student demographics and peer characteristics. There is one exception; there remains a positive and significant advantage of Catholic Religious Order schools on reading achievement over public comprehensive.

The last two columns of Table 3A suggest that the considerable part of raw differences in math achievement among school types is also explained by student demographics and peer characteristics. The results indicate that achievement differences significantly decrease from 4.1 to 2.4 points for Catholic Diocesan, from 6.9 to 3.4 points for Catholic Religious Order, and from 7.0 to 1.3 points for non-religious private. Among them, the difference between non-religious private and public comprehensive is not statistically significant at the 5 percent level. Nonetheless, there seem to remain significant and positive advantages of Catholic Diocesan and Catholic Religious Order schools on 12th grade math test scores. The results show that students at Catholic Diocesan and Catholic Religious Order schools outscore public comprehensive schools by 2.4 and 3.4 points, respectively.

Table 3B also demonstrates that adjusting student achievement in science and history for characteristics of students and their peers significantly decreases raw differences among school types toward zeros. The results indicate that advantages of Catholic Diocesan, Catholic Parish, and Catholic Religious Order schools are reduced from 3.3, -6.3, and 6.2 points to 1.6, -1.0, and 2.0 points, respectively, for science and from 3.5, -5.0, and 6.1 points to 0.5, -0.7, and 2.2 points,

respectively, for history. Most of the adjusted differences are not statistically different from zeros at the 5 percent level. One exception is that students at Catholic Religious Order schools still show significantly better performances on the science and history tests than their counterparts at public comprehensive schools.

What other factors affect student performances on the 12th grade cognitive tests? Obviously, socio-economic status and prior achievement are the most powerful predictors of 12th grade achievement regardless of subjects. Even after controlling for previous achievement and socioeconomic background, gender and race/ethnicity variables are significantly related to 12th grade achievement. The results indicate that girls score 0.9 to 1.8 points lower on the math and science tests than boys. African American students are shown to score 2.3 points lower than their white counterparts. Student demographics aside, the results suggest that characteristics of peers, such as ability and socio-economic backgrounds, are significantly related to student performance on the 12th grade tests. For example, peer ability measured by mean 8th grade test scores seems to have an independent positive impact on science achievement. On the contrary, the proportion of minority students, Hispanic or African American, in school is negatively related to individual student achievement on science and history.

SAT test scores:

Next, the study examines whether school types are related to student performances on the SAT test. The main reason why we choose SAT scores as one of outcomes is that the test serves as a good standardized metric of student performance in secondary education across the nation. In addition, a student's SAT scores are commonly shown as the most powerful predictor of the student's postsecondary enrollment as well as performance in college (e.g. Rothstein, 2004). However, one disadvantage of the use of SAT scores is that not all students take the SAT test.

Only 36.8 percent of NELS 12th graders sat for the exam. More importantly, there seem to be substantial variations of the proportion of SAT test-takers in the student population among different types of schools. 57.1 percent of Catholic Diocesan, 22.6 percent of Catholic Parish, 71.1 percent of Catholic Religious Order, 63.0 percent of other religious private, and 90.5 percent of non-religious private school students took the SAT test while the equivalent number is only 32.4 percent for public comprehensive schools. The differences in student participation in the SAT test may simply reflect the fact that college-bound students are disproportionately distributed across school types. Or they may be related to different education practices or policies related to the SAT test among different types of schools. In the latter case, it is important to note that the failure to account for the variations of SAT-taking rates would lead to an omitted variable bias. [6] For example, suppose two schools have similar distributions of student ability. But, the schools have different practices or polices related to the SAT test: 1) school A requires all students to take the test, 2) school B discourages low ability students from doing it. Then, mean SAT test scores are differently calculated for the schools simply due to their practices or polices. School B appears to obtain higher mean SAT scores because low ability students are removed from the sample.

To approach this concern, this study introduces a control function approach that exploits the fraction of SAT takers to the student population in school, following Card and Payne (2002). Let SAT^*_{ist} denotes a potential SAT test score of ith individual in a school s with type t. Then,

$$SAT^*_{ist} = \alpha + X_{ist}\beta + \varepsilon_{ist}$$

where X_{ist} denotes individual student demographics and peer characteristics and ε_{ist} is an error term.

[6] In the first case, we have already included peer ability as measured by the school mean of 8th grade test scores in our analytic framework. In other words, the peer ability variable would account for variations of student ability distributions across different types of schools.

However, SAT test scores are not always observed for all students; in other words, we do observe SAT scores, SAT_{ist}, only for those who sat for the exam. Assume that the probability of the ith individual's taking the test depends upon s school's practices or policies and that the fraction of SAT takers to the population in a school s with type t, P_{st}, can serve as a proxy. We enter a control function, $f_s(P_{st})$, as a right-hand side variable to control for school practices or policies related to the SAT test.

$$SAT_{ist} = \alpha + X_{ist}\beta + f_s(P_{st}) + v_{ist}$$

where $f_s(P_{st}) = -\delta \frac{\phi(P_{st})}{\Phi(P_{st})}$, so-called the inverse Mill's ratio function and v_{ist} denotes a stochastic term that is jointly normally distributed with ε_{ist}.

Table 4 reports the results of OLS regressions of SAT test scores on student demographics, peer characteristics, and the control function. The first column of Table 4 demonstrates that there are large raw differences in SAT math scores among different types of schools. The results indicate that students at Catholic Religious Order and other religious private schools scored 66.5 and 82.2 points higher on the SAT math test than their counterparts at public comprehensive schools. But, once introducing individual student- and peer-level variables into the regression, we see that the differences in the SAT math scores substantially decrease to 33.3 and 16.1 points for Catholic Religious Order and other religious private, respectively. The difference between other religious private and public comprehensive is not statistically different from zero at the 5 percent level. But, there remain significant advantages for Catholic Religious Order schools. The last two columns of Table 4 also suggest that the raw differences in the SAT verbal scores among school types are significantly reduced toward zeros, after adjusting for individual student demographics and peer characteristics. The SAT verbal score gap between other religious private and public comprehensive schools is not statistically significant at the level of 0.05. But, students

at Catholic Religious Order schools still show significantly better performances on the test than their counterparts at public comprehensive schools. Interestingly, adjusting SAT test scores for characteristics of students and their peers makes the coefficients on some of school type dummies, such as Catholic Parish, non-religious private, and public school of choice, statistically significant. The changes in the significance seem to be due to smaller standard errors, not increases in the coefficients. Actually, the coefficients commonly decrease after controlling for student and peer variables as expected. It may be because introducing additional variables into the regression accounts for and thereby reduces variations in the dependent variable by school type. Decreasing standard errors are commonly observed in tables 3A, 3B, and 4.

Among student and peer variables, a student's prior achievement and socio-economic status seem to play the most powerful roles in predicting the student's SAT test scores. However, once controlling for previous achievement and socio-economic backgrounds, race/ethnicity variables are no longer a good predictor of SAT scores. There appears to be a gender difference in SAT math scores. The results indicate that girls scored 47.8 points lower than boys. The results also suggest that peer characteristics, such as percentages of minorities, Hispanic or African American, and economically disadvantaged students, are significantly related to SAT test scores. For example, a one percent increase in the proportion of minority students is related to a 0.5 point decrease in the SAT math score. In addition, a one percent increase in the proportion of students eligible for free/reduced lunch programs induces a 0.3 point decrease in the SAT verbal score.

College degree attainment and Civic-mindedness:

Are there any effects of types of secondary schools on longer-term outcomes, such as a bachelor's degree attainment and civic-mindedness? A bachelor's degree is worthy of examining

as a long-run outcome since it serves as a good indicator of a student's economic welfare in the future. It is well documented that labor market outcomes, such as employment and earnings, are strongly affected by college degrees. Moreover, civic socialization is another essential outcome of secondary education. Well-socialized, democratically active citizens are considered as important as cognitive skills and knowledge for a democratic society. This study created a measure of civic socialization as a composite variable, 'civic-mindedness,' from three variables, civic community volunteering, youth organization volunteering, and voting in elections, all drawn from the fourth follow-up student survey[7].

The first two columns show the results of logit regressions of bachelor's degree attainment on school types, individual student demographics, and peer characteristics. For the purpose of interpretation, the marginal effect of each independent variable is presented instead of the coefficient. The results in the first column demonstrate that there are significant differences in college degree attainment among school types. Students at Catholic Diocesan, Catholic Religious Order, other religious private, and non-religious private schools tend to obtain a bachelor's degree at a higher rate by 22.0, 39.9, 30.9, and 36.5 percent, respectively. But, after introducing student and peer variables into the regression, the differences in the probability of obtaining a college degree substantially decrease to 13.7, 34.6, 16.4, and 19.6 percent, respectively. Most of the differences are not statistically significant at the level of 5 percent. One exception is again given to Catholic Religious Order schools. Among student-level variables, a student's prior achievement and socio-economic background serve again as the most powerful predictors of the student's degree attainment. Once controlling for previous achievement and socio-economic status, race/ethnicity variables are not statistically significant. Girls are 7.6 percent more likely to

[7] A newly created variable, civic-mindedness, is a dummy variable indicating whether a student involved in any of these activities (civic community volunteering, youth organization volunteering, and voting in elections).

receive a bachelor's degree than boys. In contrast to student demographics, peer characteristics do not seem to have any relationship with degree attainment.

The last two columns of Table 5 present the marginal effects of explanatory variables on civic-mindedness. The results from the regression without controls indicate that only students at Catholic Diocesan schools tend to have civic-mindedness at an 8.9 percent higher rate. However, this advantage of Catholic Diocesan schools seems to disappear after including control variables in the regression. The results suggest that there are few differences in a student's civic-mindedness among different types of schools. Among student variables, prior achievement is the most powerful predictor of civic mindedness. African American students are 13.9 percent more likely to have civic-mindedness while other students are 14.3 percent less likely. There seems to be no gender difference. As for the peer variables, peer ability is significantly related to an individual student's civic-mindedness. Other peer characteristics do not seem to have any relationship.

In sum, there tend to be large raw differences in all outcomes, whether short- or long-run, among school types. The results show that students at private schools perform significantly better than their counterparts at public schools. However, most private school advantages seem to decrease noticeably toward zeros, once adjusting for individual student demographics and peer characteristics. In other words, observed differences in student achievement among different types simply reflects differences in characteristics of students and their peers. Nonetheless, there are some exceptions to these findings. For example, the results indicate that students at Catholic Religious Order schools show consistently better performances than their public comprehensive counterparts. Then, the following question is whether the differences in student performances

between Catholic Religious Order and public comprehensive schools are attributable to a school-type effect or simply reflect differences in unobserved characteristics of students enrolled.

2.2. Adjusting for sample selection based on unobservables

A combination of the results from descriptive and multiple regression analyses above indicates that students are not randomly assigned into the various types of schools. The existence of systematic differences in student demographics and peer characteristics among different types suggests the possibility of sample selection on the basis of observables as well as unobservables. For example, highly motivated students may be more likely to attend private schools. What if a level of motivation is positively correlated with student achievement? In such cases, estimated private school effects adjusted for observed characteristics of students remain potentially over-estimated due to an omitted variable bias that occurs from ignoring unmeasured motivation.

Many existing studies have approached this sample selection problem by using such statistical techniques as the two-step selection correction. For instance, Gamoran (1996) first modeled and estimated a school-type selection process through a multinomial logit analysis. From the estimation, he computed the predicted probability of attending each type of school for each individual. Then, the inverse Mill's ratios based on the predicted probabilities were multiplied by school type dummies and were included as separate regressors along with the school type dummies already in the regression. Each selection correction term was intended to account for the covariance between unobserved characteristics of students and educational outcomes for each school type. Fundamentally, this strategy relies on the identification of instrumental variables that should be correlated with choice of school type, but uncorrelated with student outcomes. In his study, parent's Catholic religious status was used as one of the instrumental variables for school-type choice. However, Catholic religious status is documented

not to pass the test of exogeneity (Murnane, Newstead, & Olsen, 1985). It has been shown to be correlated with educational outcomes, even after controlling for student demographics (Sander and Krautmann, 1995). Moreover, one selection correction term for one school type should identify itself from another in the regression. In other words, there should be at least one instrumental variable for each treatment, namely each type of school. Otherwise, not all correction terms would capture the covariance between unobservables and outcomes due to collinearity of the regressors[8].

Rather, this study utilizes the propensity score matching method that does not require the assumptions underlying the two-step selection correction method. Rosenbaum and Rubin (1983, 1984) proposed an alternative approach that adjusts for pre-treatment variables on the so-called propensity score. Basically, the propensity score, defined as the conditional probability of assignment to the treatment group, attempts to control for systematic differences between the treatment and control groups. In practice, the propensity score can be obtained from a probit or logit regression of treatment assignment on pre-treatment variables. Then, one can match pairs of observations in the treatment and control groups based on the propensity score and compare outcomes of the matched observations. Differences in educational outcomes between the treatment and matched control groups can be interpreted as average treatment effects under the assumption of *strong ignorability of treatment assignment,* that the distribution of the actual treatment is independent of potential outcomes[9] conditional on the observed covariates (Rosenbaum & Rubin, 1983). The main advantage of propensity score matching is that there is no need to specify the multi-dimensional relationship between outcomes and covariates. As a matter of fact, a multiple regression analysis is vulnerable to misspecification error. Alternatively,

[8] In this study, we need at least seven instrumental variables because of eight different types of schools. It is not very feasible to find an instrument for each type of school.
[9] Potential outcomes are defined as outcomes that would have happened if an individual were exposed to treatments.

one has to specify the probit/logit regression model to obtain the propensity score balancing the groups. Balance diagnostics can be run across the groups to test whether there are any misspecifications. Nevertheless, simulation studies document that estimated treatment effects are shown to be fairly robust to misspecification of the propensity scores (e.g. Drake, 1993).

This study implements the propensity score matching to examine whether there are any significant differences in student achievement between school types, once adjustment is made for sample selectivity. Public comprehensive schools are used as a control group again. See Appendix for detailed description of the matching procedure.

Table 6 presents the results of the propensity score matching analysis for Catholic Religious Order versus public comprehensive schools. The previous section consistently shows that there are still advantages for Catholic Religious Order schools on student achievement, even after controlling for characteristics of students and their peers. The multiple regression analysis is repeated for the sub-sample that consists of observations only in the two types of schools. For the purpose of comparison, the results are reported in the first column of Table 6. The second column presents differences in means of educational outcomes between the two types only for the matched sample. The results suggest that matching individuals significantly decreases all differences in student outcomes between Catholic Religious Order and public comprehensive schools. For example, the differences adjusted for characteristics of students and their peers are reduced by 2.02 points in 12th grade reading score, 2.16 in 12th grade math score, 27.0 in SAT verbal score, and 31.8 percent in the probability of obtaining a bachelor's degree to 1.39 points, 0.53 points, 21.44 points, and 21.6 percent, respectively. The differences in all outcomes but degree attainment are not statistically different from zeros at the level of 5 percent. This study used a boostrap with 1,000 replications to compute robust standard errors for the differences in

the outcomes for hypothesis testing. This suggests that most advantages of Catholic Religious Order schools simply reflect differences in unobserved characteristics of students between the two types of schools. Nevertheless, there remains a significant difference in a bachelor's degree attainment between the two types, even after matching individuals. Students from Catholic Religious Order schools tend to obtain a bachelor's degree at a 21.6 percent higher rate than their counterparts from public comprehensive schools.

Table 7 reports the results of the propensity score matching analyses for other types versus public comprehensive. The first two columns of Table 7 suggest that there are few differences in student achievement between public comprehensive and the other two types of public schools, magnet and school of choice. All differences are not statistically significant at the level of 5 percent. But, the next column indicates that there remain significant differences in a couple of educational outcomes between Catholic Diocesan and public comprehensive schools. Students enrolled in Catholic Diocesan schools appear to show by 2.14 points better performances on the 12th grade math test and obtain a bachelor's degree at a 13.1 percent higher rate than their counterparts in public comprehensive schools. But, the differences in the other six outcomes are reported to be statistically nonsignificant at the 5 percent level. Moreover, the next two columns demonstrate that there are few advantages of Catholic Parish and other religious private schools on student achievement. All differences are shown to be tiny and statistically nonsignificant. The last column of Table 7 also shows that achievement differences in all outcomes but SAT verbal scores between non-religious private and public comprehensive schools are also not statistically different from zeros at the 5 percent level. One exception is that students at non-religious private schools scored 40 points higher than their counterparts at public comprehensive schools.

To summarize, the results of the propensity score matching analysis suggests that there exist few effects of school types on student achievement, whether short- or long-run. The achievement differences adjusted for observed characteristics of students and their peers tend to be significantly reduced toward zeros after matching observations. This indicates that adjusting for observables alone produces still positively biased estimates of school-type effects. Nonetheless, there are some exceptions--there remain significant advantages of three school types over public comprehensive on some outcomes. For example, students from Catholic Religious Order and Catholic Diocesan schools tend to attain 4-year college degree at 21.6 percent and 13.1 percent higher rates than their counterparts from public comprehensive schools. This may reflect the fact that Catholic schools focus more on a common academic core (Bryk, Lee, & Holland, 1993). The effects of school types on student achievement are summarized in Table 8.

Appendix: Propensity Score Matching

The first step of the propensity score matching is to estimate the propensity score. Any dichotomous outcome model, such as probit and logit, can be used. It is important to note that the propensity score plays a role in reducing the multi-dimension of pre-treatment covariates. This study utilizes the probit model as follows.

$$\Pr(y_i = 1 \mid X_i) = \Phi(X_i \beta)$$

where y_i denotes a school-type dummy, X_i denotes pre-treatment variables, such as individual student demographics and $\Phi(\cdot)$ denotes the standard cumulative normal distribution.

The sample is first divided into 7 groups: 1) public comprehensive and magnet, 2) public comprehensive and public school of choice, 3) public comprehensive and Catholic Diocesan, 4) public comprehensive and Catholic Parish, 5) public comprehensive and Catholic Religious Order, 6) public comprehensive and other religious private, and 7) public comprehensive and non-religious private. Then, each probit regression is separately run for each sub-sample.

Table A1 presents the results of probit regressions on pre-treatment variables[10]. The results confirm the findings from the descriptive analysis that there are significant differences in student characteristics among school types. More specifically, high-performing students and those from high socio-economic backgrounds tend be enrolled in private schools. Minority youth are less likely to be enrolled in private schools. In contrast, African American and Hispanic students are more likely to attend magnet schools and public schools of choice than their white counterparts. High achievers also tend to attend magnet schools.

[10] As pre-treatment variables, student demographics include gender, race/ethnicity, 8th grade test composite score, and socio-economic status composite score.

Based on the propensity score from the probit regression, we matched pairs of observations with replacement by using statistical software[11]. Then, in order to check the balance between the treatment and control groups, we ran balancing diagnostics for each sub-sample. For example, Table A2 presents balancing diagnostics for the sub-sample of Catholic Religious Order and public comprehensive. Before matching, we see significant differences in pre-treatment variables between the two groups. A standard t-test suggests that there are significant differences in gender, race/ethnicity (Hispanic), prior achievement, and socio-economic backgrounds. However, after matching, none of the differences are statistically different from zeros at the 5 percent. This indicates that the matched sample has, on average, few differences in student demographics between Catholic Religious Order and public comprehensive. Balancing diagnostics for other sub-samples shows that all student demographic variables are balanced across the treatment and control groups.

[11] Statistical software STATA provides a 'psmatch2' command to perform the propensity score matching analysis.

Appendix Tables:

Table A1. Probit Regressions: Public Comprehensive as a Control Group

Variables	Public		Private				
	Magnet	Of Choice	Catholic Dio.	Catholic Par.	Catholic R.O.	Other Religious	No religious
Female	0.027	0.026	0.135	0.323*	-0.400**	0.166	-0.229*
	(0.074)	(0.076)	(0.090)	(0.136)	(0.092)	(0.150)	(0.109)
Hispanic	0.591**	0.355**	-0.353**	-0.136	-0.137	-	-0.677**
	(0.103)	(0.101)	(0.131)	(0.187)	(0.134)	-	(0.237)
African American	1.106**	0.508**	-0.118	0.570**	0.084	-0.968	-0.476
	(0.109)	(0.119)	(0.156)	(0.175)	(0.162)	(0.564)	(0.287)
Other	0.769**	0.187	-0.848**	-0.551	-0.291	0.263	-0.482*
	(0.108)	(0.120)	(0.194)	(0.301)	(0.156)	(0.191)	(0.190)
8th grade score	0.016**	0.006	0.011*	-0.006	0.018**	0.019*	0.039**
	(0.004)	(0.004)	(0.005)	(0.008)	(0.005)	(0.008)	(0.006)
Socioeconomic status	-0.027	0.043	0.354**	0.206*	0.640**	0.977**	1.214**
	(0.054)	(0.055)	(0.070)	(0.097)	(0.073)	(0.139)	(0.099)
Constant	-1.848**	-1.150**	-1.275**	-1.474**	-1.708**	-2.936**	-3.405**
	(0.239)	(0.241)	(0.295)	(0.425)	(0.290)	(0.479)	(0.361)
Pseudo R-squared	0.077	0.015	0.085	0.067	0.161	0.247	0.431
Observations	1,367	1,301	1,044	1,017	1,193	804	1,201

Note: Standard errors are in parentheses. Observations are not weighted with NELS design weights * Significant at the 5 percent and ** significant at the 1 percent.

Table A2. Balancing Diagnostics: Public Comprehensive vs. Catholic Religious Order

Variables	Sample	Treat (School type)	Control (Comprehensive)	Treat - Control Differences	t-test
Female	Unmatched	0.338	0.534	-0.196	-5.14**
	Matched	0.338	0.357	-0.019	-0.41
Hispanic	Unmatched	0.122	0.238	-0.116	-3.68**
	Matched	0.122	0.122	0	0
African American	Unmatched	0.085	0.106	-0.021	-0.93
	Matched	0.085	0.099	-0.014	-0.50
Other	Unmatched	0.094	0.125	-0.031	-1.25
	Matched	0.094	0.094	0	0
8th grade score	Unmatched	56.69	51.11	5.58	7.60**
	Matched	56.69	57.79	-1.10	-1.20
Socioeconomic status	Unmatched	0.533	-0.146	0.679	11.96**
	Matched	0.533	0.516	0.017	0.31

Note: * Significant at the 5 percent and ** significant at the 1 percent.

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Table 1. Demographics of the Sample: All NELS Students versus Urban Students

Variables	All NELS Sample	Urban Sample
Student Characteristics		
Female	53.0 %	52.6 %
Hispanic	12.8 %	21.2 %
African American	9.1 %	13.6 %
Other	8.0 %	11.4 %
8th grade reading test score	51.42 (10.07)	51.97 (10.32)
8th grade math test score	51.62 (10.23)	52.22 (10.70)
8th grade science test score	51.38 (10.06)	51.17 (10.23)
8th grade history test score	51.26 (10.04)	51.62 (10.32)
Socioeconomic status	-0.084 (0.787)	-0.005 (0.853)
Observations	12,127	3,319

Note: Standard deviations for continuous variables are in parentheses. Observations are not weighted with NELS design weights.

Table 2. Descriptive Statistics by School Types

	Public schools[1]			Private schools[2]				
Variables	Type (1)	Type (2)	Type (3)	Type (1)	Type (2)	Type (3)	Type (4)	Type (5)
Student Demographics								
Female	53.0%	54.4%	54.3%	58.5%	68.3%	36.1%	58.2%	47.8%
Hispanic	23.8%	26.5%	29.9%	11.3%	15.0%	11.8%	2.6%	2.4%
African American	12.2%	28.6%	18.2%	8.4%	31.7%	8.0%	1.3%	2.0%
Other	12.3%	20.4%	12.3%	3.3%	3.3%	9.2%	16.7%	8.5%
8th grade reading score	50.25	51.00	50.69	55.06	50.49	56.37	59.01	60.07
	(9.82)	(10.38)	(10.36)	(8.89)	(9.60)	(8.95)	(9.35)	(8.66)
8th grade math score	50.18	51.45	50.93	53.56	49.70	55.72	59.64	63.59
	(9.71)	(10.90)	(10.83)	(8.49)	(7.76)	(9.08)	(9.53)	(8.70)
8th grade science score	50.17	49.50	50.20	52.64	48.87	55.07	56.64	60.11
	(9.71)	(9.97)	(10.00)	(8.79)	(8.74)	(9.32)	(10.33)	(9.75)
8th grade history score	50.07	49.77	49.08	54.83	49.86	56.69	57.76	60.57
	(9.91)	(10.05)	(9.55)	(8.45)	(7.92)	(8.88)	(10.72)	(8.88)
Socioeconomic status	-0.158	-0.249	-0.182	0.235	0.029	0.527	0.824	1.024
	(0.780)	(0.781)	(0.856)	(0.658)	(0.711)	(0.593)	(0.520)	(0.485)
Peer Characteristics								
# of 12th graders in school	420.0	394.8	386.8	160.0	133.6	151.8	69.3	91.1
	(152.3)	(207.1)	(184.6)	(102.8)	(120.9)	(76.9)	(37.8)	(64.2)
School mean of 8th grade test scores	50.55	51.45	50.76	54.74	50.24	56.49	59.97	62.8
	(6.23)	(7.67)	(6.48)	(3.88)	(4.54)	(4.64)	(6.29)	(5.97)
% of African American or Hispanic pupils	41.03	61.03	53.14	19.08	30.03	20.51	6.85	6.96
	(31.44)	(30.75)	(37.36)	(24.11)	(37.11)	(22.93)	(9.01)	(6.67)
% of free/red. Lunch program students	30.08	30.91	27.59	3.39	16.19	5.35	0.37	1.07
	(22.74)	(23.86)	(24.28)	(7.38)	(17.13)	(19.58)	(1.90)	(3.16)
Educational Outcomes								
12th grade reading score	50.51	50.46	50.44	54.86	49.32	56.83	57.74	59.94
	(9.62)	(10.29)	(9.87)	(8.16)	(9.57)	(7.58)	(8.48)	(7.50)
12th grade math score	50.54	50.13	50.33	55.19	50.65	57.26	57.76	62.36
	(9.67)	(10.41)	(10.43)	(8.22)	(9.88)	(7.76)	(9.13)	(6.35)
12th grade science score	49.83	48.42	49.42	53.24	48.29	55.67	56.81	60.29
	(9.84)	(10.45)	(10.18)	(8.34)	(9.71)	(8.67)	(8.26)	(6.91)
12th grade history score	50.80	50.51	50.53	54.67	50.10	57.90	57.43	60.62
	(9.59)	(9.90)	(9.80)	(8.42)	(9.74)	(7.83)	(8.51)	(7.35)
SAT math score	473.5	485.0	471.3	485.8	428.6	533.0	570.2	598.5
	(119.8)	(135.4)	(140.9)	(107.5)	(138.0)	(109.5)	(104.2)	(95.3)
SAT verbal score	415.5	430.6	409.0	436.1	363.6	487.7	524.3	548.8
	(110.7)	(119.4)	(112.8)	(96.6)	(107.7)	(93.6)	(97.6)	(92.7)
Bachelor's degree attainment	37.4%	41.7%	37.8%	62.2%	48.3%	75.6%	76.3%	87.7%
Civic-Mindedness	57.4%	58.6%	58.8%	64.4%	61.3%	68.2%	70.0%	68.9%
Observations	1,107[3]	482	389	285	62	242	81	253

Note: Standard deviations for continuous variables are in parentheses. [1] Types of public schools indicate (1) comprehensive, (2) Magnet, and (3) School of choice, respectively. [2] Types of private schools refer to (1) Catholic Diocesan, (2) Catholic Parish, (3) Catholic Religious Order, (4) Other private, religious affiliation, and (5) Private school, no religious affiliation, respectively. [3] 520 observations coupled with multiple responses in the second follow-up school survey are excluded from the group of public comprehensive. Among them, 229 individuals are treated as those who were enrolled in public magnet schools while 291 students in public choice schools.

Table 3A. 12th Grade Academic Achievement on Reading and Math

	Reading		Math	
Variables	Model 1	Model 2	Model 1	Model 2
Public magnet school	-0.423	2.076	-1.133	1.250
	(1.752)	(1.394)	(1.637)	(1.097)
Public school of choice	0.401	0.049	0.146	-0.336
	(1.379)	(0.538)	(1.576)	(0.535)
Catholic Diocesan	4.785**	1.397	4.102**	2.441**
	(0.921)	(0.749)	(1.120)	(0.692)
Catholic Parish	-5.827**	-1.818	-4.302	-0.539
	(1.904)	(1.654)	(2.357)	(1.351)
Catholic Religious order	6.214**	2.834**	6.930**	3.412**
	(0.854)	(0.918)	(0.938)	(0.795)
Other private, religious affiliation	5.638*	0.277	3.110	-0.538
	(2.293)	(0.937)	(3.247)	(1.538)
Private school, no religious affiliation	4.574	1.466	6.966**	1.311
	(3.289)	(2.278)	(2.634)	(0.890)
Student Demographics[1]	No	Yes	No	Yes
Peer Characteristics[2]	No	Yes	No	Yes
Constant	50.33**	18.32**	50.60**	17.76**
	(0.667)	(6.947)	(0.638)	(5.416)
R-squared	0.068	0.598	0.078	0.721
Observations	2,045	1,846	2,048	1,854

Note: Robust standard errors adjusted for clusters of schools are in parentheses. Observations are weighted with NELS design weights. * Significant at the 5 percent and ** significant at the 1 percent. [1] Student characteristics include gender, race/ethnicity, prior achievement, and socioeconomic status. [2] Peer characteristics contain the number of 12th graders in school, school mean 8th grade reading-math composite test score, percentage of African American or Hispanic students in school, and percentage of free/reduced lunch students.

Table 3B. 12th Grade Academic Achievement on Science and History

	Science		History	
Variables	Model 1	Model 2	Model 1	Model 2
Public magnet school	-2.445	0.709	-1.283	1.953
	(1.503)	(0.912)	(1.541)	(1.633)
Public school of choice	0.831	0.229	0.456	0.535
	(1.454)	(0.616)	(1.396)	(0.751)
Catholic Diocesan	3.349**	0.601	3.460**	0.523
	(0.951)	(0.679)	(1.170)	(0.952)
Catholic Parish	-6.270*	-1.017	-5.008*	-0.694
	(2.487)	(1.262)	(2.205)	(1.642)
Catholic Religious order	6.178**	1.954*	6.436**	2.159*
	(0.946)	(0.807)	(0.845)	(1.106)
Other private, religious affiliation	3.274	-0.421	3.826	-1.259
	(2.423)	(0.851)	(2.705)	(1.202)
Private school, no religious affiliation	5.283	-0.832	3.668	-2.158
	(3.100)	(1.947)	(3.166)	(1.898)
Student Demographics[1]	No	Yes	No	Yes
Peer Characteristics[2]	No	Yes	No	Yes
Constant	49.90**	15.09**	51.06**	24.67**
	(0.605)	(4.156)	(0.618)	(8.356)
R-squared	0.072	0.611	0.062	0.516
Observations	2,033	1,835	2,026	1,819

Note: Robust standard errors adjusted for clusters of schools are in parentheses. Observations are weighted with NELS design weights. * Significant at the 5 percent and ** significant at the 1 percent. [1] Student characteristics include gender, race/ethnicity, prior achievement, and socioeconomic status. [2] Peer characteristics contain the number of 12th graders in school, school mean 8th grade reading-math composite test score, percentage of African American or Hispanic students in school, and percentage of free/reduced lunch students.

Table 4. Student Performances on the SAT Test

	SAT Math		SAT Verbal	
Variables	Model 1	Model 2	Model 1	Model 2
Public magnet school	-15.760	12.920	-10.684	8.075
	(28.668)	(10.406)	(21.702)	(10.017)
Public school of choice	-8.823	-0.514	-26.020	-17.439*
	(26.753)	(9.559)	(20.936)	(7.185)
Catholic Diocesan	-2.440	-3.148	5.477	-2.524
	(20.237)	(11.496)	(16.038)	(12.318)
Catholic Parish	-63.422	29.680*	-75.413*	-11.454
	(35.193)	(11.992)	(30.168)	(18.058)
Catholic Religious order	66.479**	33.336**	76.229**	46.503**
	(19.709)	(11.528)	(17.229)	(12.343)
Other private, religious affiliation	82.234**	16.087	93.036**	26.374
	(29.484)	(17.430)	(28.437)	(16.876)
Private school, no religious affiliation	57.311	19.927	73.159	34.846*
	(49.153)	(17.003)	(42.171)	(16.078)
Student Demographics[1]	No	Yes	No	Yes
Peer Characteristics[2]	No	Yes	No	Yes
SAT participation adjusted[3]	Yes	Yes	Yes	Yes
Constant	485.42**	-35.674	428.64**	-37.991
	(47.712)	(51.958)	(35.814)	(39.260)
R-squared	0.068	0.695	0.119	0.691
Observations	1,126	1,023	1,126	1,023

Note: Robust standard errors adjusted for clusters of schools are in parentheses. Observations are weighted with NELS design weights. * Significant at the 5 percent and ** significant at the 1 percent. [1] Student characteristics include gender, race/ethnicity, prior achievement, and socioeconomic status. [2] Peer characteristics contain the number of 12th graders in school, school mean 8th grade reading-math composite test score, percentage of African American or Hispanic students in school, and percentage of free/reduced lunch students.

Table 5. Long-term Outcomes: Bachelor's Degree Attainment and Civic-Mindedness

Variables	Bachelor's Degree Attainment		Civic-Mindedness	
	Model 1 (=*dy/dx*)	Model 2 (=*dy/dx*)	Model 1 (=*dy/dx*)	Model 2 (=*dy/dx*)
Public magnet school	0.020	0.079	0.050	0.011
	(0.064)	(0.070)	(0.059)	(0.056)
Public school of choice	-0.009	-0.229	0.035	0.058
	(0.064)	(0.066)	(0.051)	(0.048)
Catholic Diocesan	0.220**	0.137	0.089*	0.060
	(0.060)	(0.078)	(0.042)	(0.055)
Catholic Parish	-0.089	0.053	-0.078	-0.031
	(0.167)	(0.174)	(0.087)	(0.084)
Catholic Religious order	0.399**	0.346**	0.080	0.052
	(0.046)	(0.071)	(0.043)	(0.057)
Other private, religious affiliation	0.309**	0.164	0.150	0.113
	(0.080)	(0.092)	(0.078)	(0.118)
Private school, no religious affiliation	0.365**	0.196	-0.096	-0.132
	(0.087)	(0.153)	(0.108)	(0.102)
Student Demographics[1]	No	Yes	No	Yes
Peer Characteristics[2]	No	Yes	No	Yes
Base-line probability	0.450	0.416	0.618	0.631
Pseudo R-squared	0.073	0.256	0.008	0.045
Observations	2,132	1,917	2,368	2,146

Note: Robust standard errors adjusted for clusters of schools are in parentheses. Observations are weighted with NELS design weights. * Significant at the 5 percent and ** significant at the 1 percent. [1] Student characteristics include gender, race/ethnicity, prior achievement, and socioeconomic status. [2] Peer characteristics contain the number of 12th graders in school, school mean 8th grade reading-math composite test score, percentage of African American or Hispanic students in school, and percentage of free/reduced lunch students.

Table 6. Propensity Score Matching: Public Comprehensive vs. Catholic Religious Order

Outcomes	Pooled Sample *Multiple Regression*[1] (*=dy/dx*)	Matched Sample[2] *Differences in means*[3]
12th grade Reading test scores	2.021* (0.898)	1.391 (1.002)
12th grade Math test scores	2.163** (0.681)	0.525 (0.983)
12th grade Science test scores	1.172 (0.758)	-0.447 (1.018)
12th grade History test scores	1.012 (0.876)	0.453 (1.005)
SAT Math scores	22.04 (12.88)	-4.910 (15.63)
SAT Verbal scores	27.00* (11.83)	21.44 (14.30)
BA degree attainment	0.318** (0.077)	0.216** (0.057)
Civic-mindedness	0.094 (0.056)	0.043 (0.060)

Note: Observations are not weighted with NELS design weights * Significant at the 5 percent and ** significant at the 1 percent. [1] Control variables include student demographics, such as gender, race/ethnicity, prior achievement, and socioeconomic status, and peer characteristics, such as the number of 12th graders in school, school mean 8th grade reading-math composite test score, percentage of African American or Hispanic students in school, and percentage of free/reduced lunch students. Robust standard errors adjusted for clusters of schools are in parentheses. [2] See Appendix for details. [3] Standard errors for differences in means are computed using a bootstrap with 1000 replications.

Table 7. Propensity Score Matching: Public Comprehensive vs. Other Types of Schools

	Public		Private			
Outcomes	Magnet	Of Choice	Catholic Dio.	Catholic Par.	Other Religious	No religious
12th grade Reading test scores	-0.309	-0.321	0.825	-1.966	1.165	1.221
	(0.954)	(0.884)	(0.863)	(2.072)	(1.431)	(0.895)
12th grade Math test scores	-0.296	-0.337	2.144*	-0.308	0.621	0.944
	(0.915)	(0.852)	(0.883)	(1.987)	(1.518)	(0.960)
12th grade Science test scores	-1.445	0.618	-0.649	-1.168	0.018	0.868
	(0.933)	(0.901)	(0.983)	(2.124)	(1.753)	(1.055)
12th grade History test scores	1.216	-0.496	0.479	0.392	0.662	0.161
	(0.965)	(1.941)	(0.904)	(2.069)	(1.552)	(0.934)
SAT Math scores	20.13	8.474	0.629	-5.385	0.638	29.73
	(17.45)	(17.47)	(15.23)	(41.32)	(23.72)	(16.40)
SAT Verbal scores	8.224	-1.017	9.720	-73.08	37.66	40.00*
	(17.20)	(15.88)	(14.09)	(41.41)	(22.87)	(16.04)
BA degree attainment	0.078	0.007	0.131*	0.089	0.085	0.074
	(0.051)	(0.051)	(0.054)	(0.115)	(0.086)	(0.055)
Civic-mindedness	-0.002	0.027	0.039	0.133	0.014	-0.025
	(0.046)	(0.048)	(0.055)	(0.106)	(0.105)	(0.068)

Note: * Significant at the 5 percent and ** significant at the 1 percent. Standard errors for differences in means are computed using a bootstrap with 1000 replications.

Table 8. Summary of School-type Effects on Student Achievement

Outcomes	Multiple Regression Analysis		Propensity Score Matching Analysis [2]
	Unadjusted	Adjusted [1]	
12th grade test scores: Reading	Catholic Dio.: 4.8 Catholic Par.: -5.8 Catholic Rel. Order: 6.2 Other Rel. Priv.: 5.6	Catholic Rel. Order: 2.8	
Math	Catholic Dio.: 4.4 Catholic Rel. Order: 6.9 Non-rel. Priv.: 7.0	Catholic Dio.: 2.4 Catholic Rel. Order: 3.4	Catholic Dio.: 2.1
Science	Catholic Dio.: 3.3 Catholic Par.: -6.3 Catholic Rel. Order: 6.2	Catholic Rel. Order: 2.0	
History	Catholic Dio.: 3.5 Catholic Par.: -5.0 Catholic Rel. Order: 6.4	Catholic Rel. Order: 2.2	
SAT Math scores	Catholic Rel. Order: 66.5 Other Rel. Priv.: 82.2	Catholic Par.: 29.7 Catholic Rel. Order: 33.3	
SAT Verbal scores	Catholic Par.: -75.4 Catholic Rel. Order: 76.2 Other Rel. Priv.: 93.0	Pub. sch.of choice: -17.4 Catholic Rel. Order: 46.5 Non-rel. Priv.: 34.8	Non-rel. Priv.: 40.0
Bachelor's degree attainment	Catholic Dio.: 22% Catholic Rel. Order: 40% Other Rel. Priv.: 31% Non-rel. Priv.: 37%	Catholic Rel. Order: 35%	Catholic Dio.: 13% Catholic Rel. Order: 22%
Civic-mindedness	Catholic Dio.: 9%		

Note: All numbers are statistically significant at the level of 5 percent. [1] Outcomes are adjusted for student demographics, such as gender, race/ethnicity, prior achievement, and socioeconomic status, and peer characteristics, such as the number of 12th graders in school, school mean 8th grade reading-math composite test score, percentage of African American or Hispanic students in school, and percentage of free/reduced lunch students. [2] The propensity score is based on pre-treatment variables, such as gender, race/ethnicity, prior achievement, and socioeconomic status.