Race, Income, And Test Scores: A Structural Model of the Determinants of Test Scores in Toledo Elementary Schools

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ABSTRACT

In this study, we build a structural model for explaining variations in test scores among elementary schools in Toledo, Ohio. In the process of constructing this model we examine the assumptions underlying theories of the determinants of test scores, notably the family background, inequality, concentrated poverty, subculture, and racial theses. Using Census Tract and public school data for the city of Toledo, we test these assumptions and reach a number of conclusions. First, percapita income is the strongest variable associated with test scores. Second, although concentrated poverty negatively correlates with test scores, income is a stronger explanatory variable. Third, schools located in low-income neighborhoods are more likely to have teachers with less experience and less than a master's degree. Fourth, these teacher characteristics make a small difference in test scores. Finally, race is not a factor in test scores when we control for poverty. The broader implication is that low income is the most serious problem with low-test scores.

Scholars have long observed an association between poverty and low-test scores. However, they have debated explanations for this association. Four major position have dominated this debate:

1) The family background perspective,
2) The unequal educational resources view,
3) The concentrated poverty and social dislocation thesis, and
4) The culture of poverty theory,

In this study, we reexamine some of the aspects of the debate and the underlying assumptions of these views and positions.

Our primary purpose in this study is to construct a structural model for explaining The determinants of tests scores in Toledo public schools. Before building the model, we briefly reexamine some of the assumptions under girding the debate over the determinants of test scores. Our goal is not to provide comprehensive overview of this debate but simply to situate our study within the context of the broader literature. We identify a few of assumptions and test them. However, our goal is to create a structural model.

In developing our model, we use census tract data for the city of Toledo and Toledo public school reports. Our model includes four factors: community, teacher profile, student profile, and test scores. Each factor consists of several variables, the households, and percapita income. Teacher profile variables involve teacher experience and teacher education. Student profile variables are the proportion of students entering and leaving the school and the percentage of students on the federal school lunch program. We use these data to test come of the assumptions arising from the debate over the determinants of test scores. Our ultimate goal is to develop a structural model explaining these determinants.

We focus on the Toledo area because of its convenience, as we are located in Toledo, and because of its demographics. Its population of 332,943 to a large extent mirrors the nation. It has a poverty rate of 15.4 and mean income of $24,819, both equivalent to national figures. It has a black population of 65,659 or 19.7 percent of the city's population, slightly above the national proportion of just above 12 percent.

We proceed as follows: First, we briefly discuss these four major positions in the debate. Second, we develop four testable assumptions from our discussion. Third, we construct our model. Finally we test our assumption as we complete our model.

THEORETICAL ISSUES

The Family Background Perspective:

The family background perspective attributes variations in test scores to differences in family background. This perspective de-emphasizes school resources and underscores the importance of a student's family resources in explaining student performance on state sponsored tests. According to this perspective, student's test scores are not determined by the size of their classrooms the physical condition of their school buildings, the number of volumes in their school libraries or the amount of money their school districts spend per pupil. Rather, these scores are more strongly associated with

the occupations, incomes, and levels of education of their parents and with the number of books and magazines in their homes.

This perspective emerged primarily from the research conducted by James Coleman (1990). In the late 1960s, Coleman conducted a massive national study of 4,000 elementary and secondary schools, examining both family background and school resource factors. Coleman concluded:

> When the relative importance of school factors for achievement was assessed, achievement for each racial group separately was regressed upon various school factors after family background characteristics were controlled. This control was carried out so that those school factors most highly correlated with family background would not spuriously show a high relation to achievement. In carrying out this control however, the analysis showed what had already been well known: the powerful relation of the child's own family background characteristic to his achievement, a relation stronger than that of any school factor (Coleman 1990,73).

This conclusion ignited a bonfire of criticism. Critics argued that this conclusion implied that schools did not matter, that the amount of resources allocated to a school had little effect on student performance, and that it made little sense to attempt to equalize educational resources.

Because we do not have direct data on the families of students in the Toledo public schools, we cannot re-test Coleman's thesis. However, we can and do use our model to examine the association between community variables and the test scores of neighbor schools. We call this association, assumption one. Restated, it is as follows: There is an association between test scores and the family background variables: family structure, level of education, and income.

<u>The Unequal Education Resources View</u>

The unequal educational resources view offers an alternative to the family background perspective. This unequal resources view maintains that children from low-income families tend to live in poor areas, go to poor schools, and receive inadequate education; and that children from will to do families tent to live in more affluent areas, go to will endowed schools, and obtain a good education. Proponents of this view attribute the higher test scores of students in affluent areas to better schools and living conditions, and the lower test scores of students living in high poverty areas to debilitating neighborhood environments and to inadequately endowed schools.

Jonathan Kozol (1991) presents on of the most passionate discussions of this view in his book <u>Savage Inequalities: Children in America's Schools</u>. He identifies two forms of inequality in public education: inequality between school districts and inequality within the same district. In one of his many examples of inequality between districts, Kozol (1991) contrasts two high schools, one located in suburb of Chicago and the other in Chicago. The suburban high school, New Tier, is located on 27 acre of land. It has a custodial staff of 48. Its science labs have superior lab equipment and up to date technology. It has seven gyms along with a fencing room, wrestling room, and dance

studio. New Trier offers courses in aeronautics, computer language, philosophy, Latin and six other languages. Each freshman is assigned to a faculty advisor who is given time off to advise 24 students. Over 90 percent of New Trier graduating seniors go to college. Many of them are admitted to universities like Harvard, Princeton, Yale, and Berkeley.

New Trier contrasts sharply with Du Sable, a typical Chicago high school. Du Sable is located on a crowded block. Its science labs have makeshift equipment. One guidance counselor is assigned to over 400 students. It has a graduation rate of 25 percent. Only 17 percent of its seniors are in college preparatory programs. Over 60 percent are in vocational programs (Kozol 1991).

To illustrate inequality within the same school district, Kozol draws examples from Chicago, Detroit, and New York. He shows how these school districts have manipulated school attendance boundaries and have used the concept of magnet schools to create special schools for select students, usually from middle class and more affluent families. These special schools are more endowed with experienced teachers, smaller classes, cutting edge educational material, and challenging curricula. Kozol demonstrates that even within the same central city school district like Detroit, Chicago or New York, children from low-income families go to poorer schools and children from middle class families attend the better schools.

Kozol (1991) maintains that inequality in the distribution of educational resources is largely responsible for the school failure of children from poor families. In countless cases, these children are trapped in schools with deteriorating structures overcrowded classrooms, inexperienced teachers, outdated text books, obsolete or nonexistent learning material. Of course, Kozol cites environmental factors which obstruct the educational development of poor children—neighborhoods with high crime rates, lead poison hazards, inadequate recreation facilities, high rates of infant mortality, infants with low birth weights and other problems.

Other studies have found inequalities both between rich and poor districts and between rich and poor neighborhoods within the same district. Because public school systems are financed primarily by local property taxes, an affluent district can raise more money per pupil with a small tax than a poor district can with a heavy tax (Cochran and Malone 1995).

The urban administration literature has documented problems of unequal resource distribution within the same district. For example, in their study of Oakland California, Levy, Melstner and Wildavsky (1974) find that schools in poorer neighborhoods were disadvantaged in two ways. First, teachers were more likely to transfer out of the schools located in a poor area and transfer to schools located in middle class areas. Hence, more experienced teachers with more seniority were more likely to be found in schools in the middle class area and less experienced teachers were more likely found in the schools in the poor neighborhoods. Second, parent organizations in middle class neighborhood school were more active in raising money for special programs and additional school equipment, such as computers, than parent organizations in low-income neighborhood schools. They conclude that schools in middle class neighborhood ended up with the better teachers and more school resources (Levy, Melstner, and Wildavsky1974). From the unequal resources thesis we develop assumption two: Schools in poor neighborhoods

are likely to have teachers with less experience and less education than those in middle class neighborhood and these teachers characteristics make a difference in test scores.

The Concentrated Poverty and Social Dislocation Thesis

The concentrated poverty and social dislocation thesis attributes school failure to the special and debilitating effects of concentrated poverty—areas with census tracts with poverty rates of over forty percent. William Julius Wilson (1987), a proponent of this thesis, sees school failure as part of a larger problem, a tangle of pathology, generated by concentrated poverty. Wilson describes this problem as follows:

> In short, the communities of the underclass are plagued by massive joblessness, Flagrant and open lawlessness, and low achieving schools, and therefore tend to be avoided by outsider. Consequently, the residents of these areas, have become increasingly socially isolated from mainstream patterns of behavior, whether women and children of welfare families or aggressive street criminals.
>
> If I had to use one term to capture the differences in the experiences of low-income families who live in inner-city areas from the experiences of those who live in other areas in the central city today, that term would be concentration effects. The social transformation of the inner city has resulted in a disproportionate concentration of the most disadvantaged segments of the urban black population, creating a social milieu significantly different from the environment that existed in these communities several decades ago (Wilson 1987,58).

For William J. Wilson, school failure—schools with drop-out rates of over 50 percent, with large proportions of students unable to pass proficiency tests, and with few graduating high school students capable of doing college work—is not caused by inadequately funded schools or by family background factors per se'. Rather, it is one of the many pathological effects of concentrated poverty. Wilson argues that concentrated poverty means two things. First, it means the absence of middle class families; that is, the absence of families that are likely to have two parents, that offer positive role models of adults with steady jobs, that contribute to community organizations, that become part of supportive social networks and that participate in parent-teacher organizations, and that support local schools. Second, concentrated poverty means the concentration of the problems associated with poverty--crime, welfare dependency, low aspirations, and drug-addiction (Massey and Denton 1993). From the concentrated poverty thesis emerges assumption three: Concentrated poverty has a much more devastating impact on school test score than any other single variable.

Other School Failures Themes

The concentrated poverty and school failure thesis is related to other sub-themes associated with issues of culture and race. One sub-theme is the culture of poverty thesis. According to this thesis, school failure is a function of a debilitating subculture, not to economic deprivation or inequality in the distribution of school resources. This subculture may include attitudes and values that place less importance on education and

more importance on immediate gratification or economic rewards (Banfield 1974; Auletta 1982; Gilder 1981; Murray 1984). This subculture may also refer to poor or African American students having learning styles different from middle class students or possessing language patterns which hinder standard educational development and speaks to cultural biases in standardized tests (Hale 1981; Smitherman 1978).

Murray and Hernstein (1994) argue that African Americans on average score below the norm on standardized tests. They insist that low-test scores among African Americans are a function of a genetic factor. Murray and Hernstein (1994) maintain that the high proportion of blacks in concentrated poverty areas and the high proportion of blacks failing school are functions of the same genetic factors. The testable assumption here (assumption four) is as follows: Even if we control for poverty, Blacks will have test scores significantly below the norm.

Methodology: Testing Hypotheses and Building a Structural Model

The testable assumptions, which emerge from this discussion, are as follows:

1. There is an association between test scores and the following community variables: family structure, level of education, and income.
2. Schools in poor neighborhoods are likely to have teachers with less experience and less education than those in middle class neighborhood and these teacher characteristics make a difference in test scores.
3. Concentrated poverty has a much more devastating impact on schools test scores than any other single variable.
4. Even if we control for poverty, blacks will have test scores significantly below the norm.

These assumptions also provide a basis for developing a model for examining the determinants of test scores in the Toledo school sys tem. In developing this model, we focus on three factors, each with different sets and levels of variables: community, school, and test scores. Each factor contains several variables derived from a number of sources.

Factors and Variables

Community Factors:

The community factor involves five variables: poverty, female-headed households, unemployment, education, and income. These variables are obtained from census tract reports for the Toledo area. For our measure of poverty we use the percentage of families with income below the poverty line. Female-headed household is the percentage of families headed by women. The level of education variable is the percentage of individuals 25 years and older who have at least a four year college degree.

For employment we obtain the proportion of individuals in the civilian labor force, 16 years and older, unemployed but actively seeking employment. We used percapita income for our income variable.

Concentrated Poverty Measure:

To measure the special effects of concentrated poverty, we use a concentrated poverty index. We calculate this variable by assigning a number, 1-6, to an area based on its proportion of poor families: 0 to 10% = 1, 10+ to 20% = 2, ... 50+ to 60% = 6. We square each number to obtain a figure, which measures the geometric effects of higher concentrations of poverty.

For each one of all 43 Toledo Public elementary schools, we match the school's attendance boundaries with its corresponding census tracts. Through this method, we are able to use census tract data to measure community variable for each elementary school. Hence, we can associate elementary schools' community variables with school variables and test scores.

Dependent Variable: Test Scores

For our dependent variables we use two sources of data: the Ohio Proficiency Test and the Metropolitan Achievement Test. Two tests provide more sensitive measures of student performance than a single test. This point has been emphasized in the research on the Head Start Program (Fisher1993).

The Proficiency Test has four skills areas: writing, reading, mathematics, and civics. Our variable is the percentage of students passing all four areas. The Metropolitan Achievement Test has three major areas: reading, mathematics, and language. We use the school mean for reading section of this test. Because of the possibility of independent variables correlation with some skills, but not with others, we see the Proficiency test, which accounts for a wider range of skills, as the more sensitive dependent variable.

Data for student and teacher body factor come from the Toledo school district reports. Student profile variables include measures of the level of poverty among students and the stability of the student population. To measure poverty, we use the percentage of students on the federal school lunch program. This figure gives us a more direct measure of poverty among the students than the percent of poverty within the community, although there is a strong association between community and school poverty. To measure the stability of the student population we used the percentage of students who have transferred either into or out of the school during the past year.

Teacher profile variables include the level of experience and education of the teachers within each elementary school. We measure their level of experience by using the average (mean) number of years taught by the teachers in each elementary school. We use the percentage of teachers with the master degree to measure their level of education.

We are confident in our use of multiple data sets. We are careful to keep our discussion on the aggregate level. We are not talking about individuals. We are discussing groups and trends. We associate neighborhood demographic characteristics

with the characteristics of neighborhood schools. Correlating census tract data with school data is the best way of making this association.

With this data we can construct a structural model designed to do two things: 1) we can attempt to explain variations in test scores; and 2) we can test our four assumptions.

Construction the Model

Our structural model connects these three factors—community variables, student is illustrated below in figure one:

FIGURE ONE ABOUT HERE

With the use of regression methods we develop a path analysis to measure direct and indirect associations and to control for possible spurious variables. This method allows us to trace lines of association either directly from community factors to test scores, teacher factors to test scores, or student factors to test scores or indirectly from community factors to teacher and student body factors to test performance.

We analyze our data in parts. We begin with community variables and test scores, proceed with teacher and student profile variables, and end with the race issue.

Findings I: Community Variables and Test Scores

The association between individual community variables and test scores appears strong. The correlation between female-headed households and test scores is - .82. The correlation between poverty and test scores is -.76. The correlation between per capita income and test scores is .84. The correlation between unemployment and test scores is .72. The correlation between education and test scores is .71. The correlation between concentrated poverty and test scores is -.62. All correlations are statistically significant at the .01 level. This pattern holds when we substitute the Metropolitan Achievement Test for the Proficiency Test.

TABLE ONE ABOUT HERE

Because of the problem of multicollinearity, we are cautious about using all of these community variables in a regression formula. Most of these variables are highly correlated with each other, with a correlation coefficient well above .8 (see table one).

Nevertheless we need to test the independent effects of education and family structure on test scores. Thus, we use partial correlations. Correlating female-headed households with tests scores, while holding poverty rates constant, we get a correlation of- .52, with a .001 level of significance. When we correlate education with test scores, while holding poverty rates constant, we get a correlation of .43, with a .004 level of significance.

Percapita income emerges as the strongest of the five community variables correlated with test scores. This variable is probably a more sensitive measure of the level of material deprivation than poverty, concentrated poverty, or unemployment. With adequate unemployment insurance, the temporarily unemployed may not necessarily be poor. Measures of income or poverty are better measures of material deprivation than unemployment. Poverty rates tell us whether family income falls below a certain figure, say $14,763 for a family of four. Percapita income tells us how far below this poverty line income falls, per person. When income falls 20, 25, 30, or more percentage points below the poverty line, per capita income measures theses varying degrees of poverty, poverty rates do not. Concentrated poverty tells us whether the percentage of poor families exceeds a certain threshold--30 or 40 percent. Percapita income tells how poor these families really are.

We can now make some conclusions about two of our testable assumptions, one and three. Assumption one reads as follows: There is an association between test scores and the following community variables: family structure, level of education, and income. Our conclusion is the affirmative. More precisely, percapita income is clearly the strongest variable associated with these scores. Followed by family structure and education. However, when we control for poverty, the correlation between female-headed household and tests cores declines from -.82 to .52.

Assumption three reads as follows: Concentrated poverty has more devastating impact on schools than any other single variable. Our conclusion is in the negative. With a correlation .84, percapita income is by far the strongest variable correlating with test scores followed by poverty and concentrated poverty, with correlations vicariate correlations of -.76 and -.62.

Findings II: Teacher and Student Profile and Test Scored

TABLE TWO ABOUT HERE

We examine the effect of teacher characteristics and student profile, our independent variables, on test scores by using a regression analysis. Several note worthy patterns emerge from the results of this analysis. First, there is a strong association between the percentage of students on the federal school lunch program and test scores, as indicated by a standardized beta of -.692 with a .0001 level of significance. That is, test scores are likely to decrease as the percentage of students on the school lunch program increases.

The second noteworthy pattern found in our analysis is that the percentage of students entering and leaving a school has no effect on student test performance. This point is demonstrated by a standardized beta of .109 with a .462 level of significance for this variable as indicated in table four. That is, an unstable student population does not appear to have an impact on school test scores.

The third pattern is that teacher profile variables have a small effect on student performance on proficiency tests. The standardized beta weights for teacher experience and teacher education age .27 and .18 respectively. Whereas these figures appear negligible, they are statistically significant at the .01 and .05 levels, respectively.

Finding III: Percapita Income, Teacher Profile, Student Profile and Test Scores

We expand our model by adding percapita income, our most significant and potent community variable, to student and teacher profile variables. Clearly, there is a strong, negative association between the level of percapita income in a community and the percentage of its public school students on the federal school lunch program and the proportion of students entering and leaving a school. That is, the lower the percapita income within a community, the greater will be both the proportion of students on the school lunch program in the neighborhood school and the proportion of students entering and leaving that school.

Also, data indicate that there is a strong positive association between percapita income and teacher experience/teacher education. That is, as percapita income within a community declines (or as poverty as a measure of low income increases) the average years of teacher experience decreases and the proportion of teachers with the master's degree declines. In other words, teachers with more experience and with the master degrees are more likely to be found in public schools in higher income neighborhoods and less likely to be found in public schools in low income areas.

Just as there is an association between community variables and teacher profile variables, there is an association between student profile and teacher profile variables. That is, teachers with more experience and with masters degrees are more likely to be found in public schools with fewer students on the federal school lunch program.

FIGURE TWO HERE

With the standardized beta coefficients for these variables—percapita income, teacher/student profile variables, and the test score variable—we are able to construct a structural model illustrating these patterns of association. This model, shown in figure two, demonstrates the strong association between percapita income and the teacher/student profile factors and the strong association between the proportion of students on the school lunch program and both teacher experience and teacher education. The model also illustrates the strong association between the proportion of low-income students, as measured by the percentage of students on the school lunch program, and test

scores and the small but statistically significant association between teacher experience and teacher education and test scores.

We can now reach a conclusion about assumption two: Schools in poor neighborhoods are likely to have teachers with less experience and less education than those in middle class neighborhoods and that these teacher characteristics make a difference in test scores. Our data provide some support for this assumption. Teachers with more years of seniority and with masters degrees are more likely to be found in schools located in middle class neighborhoods than in schools located in low income neighborhood.

FIGURE THREE ABOUT HERE

Finding IV: The Race Factor

When we examine race and test scores while controlling for teacher experience and student poverty, four points emerge. First, there is absolutely no association between race and test scores. Race is clearly a spurious factor. This point is consistent with a larger body of research that indicates that race washes out whenever a researcher controls for social class, or poverty in examining the determinants of test scores (Green 1981;Gould 1981; Kamin 1995; Jacoby and Glauberman1995). Gould (1981) provides a good history on research on race and standardized testing. Green summarizes some of the more recent studies that control for social class. Kamin (1995) and Jacoby and Glauberman (1995) provide a solid refutation of Herrnstein and Murray's (1994) book The Bell Curve.

Second, these findings also challenge the black sub-culture view. If black/white differences disappear when we control for poverty, then so do the educational hampering effects of a black subculture.

Third, there is a negative association between race and teacher profile variables. That is, even after controlling for poverty, there is a negative association between the percentage of black students in a school and the average years of experience of the teachers and the proportion of teachers with master degrees. More experienced and more educated teachers are likely to avoid schools with higher proportions of black students and higher proportions of indigent students.

Summary

Now that we have completed the construction of the model, we can summarize our conclusions about the four assumptions. Our data provide strong support for assumption one, that there is a correlation between the demographic characteristics of a neighborhood and the test scores of students in the neighborhood school. Mean test scores tend to be lower for schools located in low income, high poverty neighborhoods with high percentages of female headed households and low percentages of adults with college degrees.

Our data offer some support for assumption two. Schools located in low income neighborhoods are more likely to have teachers with less experience and with less than a masters degree. These teacher characteristics are weakly associated with test scores, although this association is statistically significant.

We reject assumptions three and four. Although we found a negative correlation between concentrated poverty and test scores, percapita income was more strongly associated with test scores than was concentrated poverty. Finally, the race factor washes out when we control for poverty. When the race variable disappears, so too do the other related issues: genetics, and racial subcultures. The broader implications of this study, is that low-income--not concentrated poverty, Ebonics, a racial subculture, nor race-is the most serious problem with school performance.

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TABLE ONE
Correlation Matrices for Community Variables

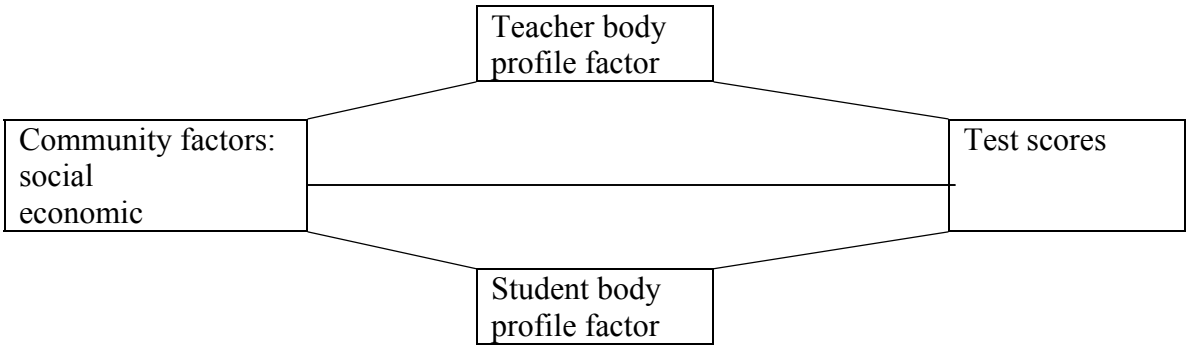
	Poverty	unemployment	percap-inco.	Femaleheaded	BA degree
Poverty	____	.848	-.938	.851	-.651
Unemploym	____	___	___	.732	-.741
Percap-inco	____	____	___	-.853	.756
Femalehead	____	____	___	____	.672
BA degree	____	____	___	____	____

TABLE TWO

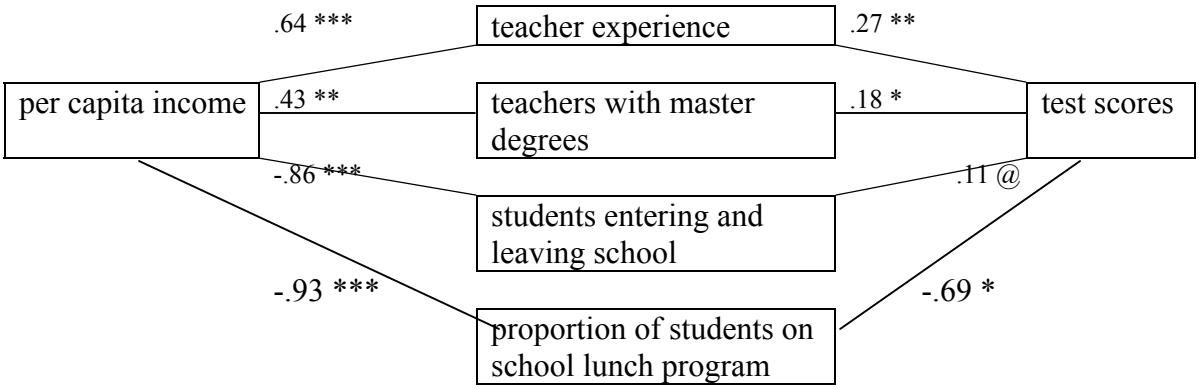
Regression Equation for Proficiency Tests and Teacher/Student Profile Independent Variables

Variables	B	SE	Standardized Beta	Significance
Teacher Experience	1.345	.495	.270	.009
Teacher Education	.255	.117	.177	.035
Students on School Lunch Program	-.526	.115	-.692	.0001
Students Leaving & Entering School	.179	.242	.109	.462

R = .9
R squared = .817
Adjusted R squared = .79

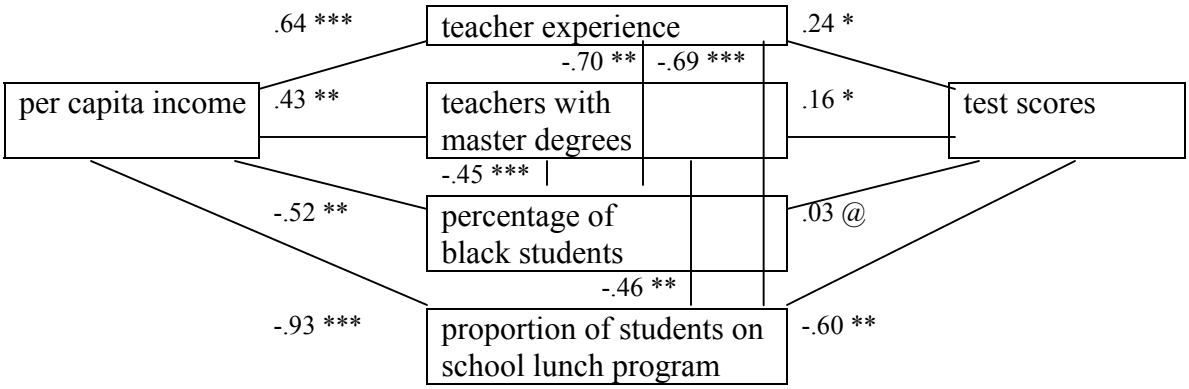


Structural Model of Test Score Determinants
Figure One



@	not significant
*	significant at the .05 level
**	significant at the .01 level
***	significant at the .001 level

Community, Teacher Profile, Student Profile, and Test Scores
Figure Two



@	not significant
*	significant at the .05 level
**	significant at the .01 level
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Community, Teacher Profile, Student Profile, and Test Scores
Figure Three