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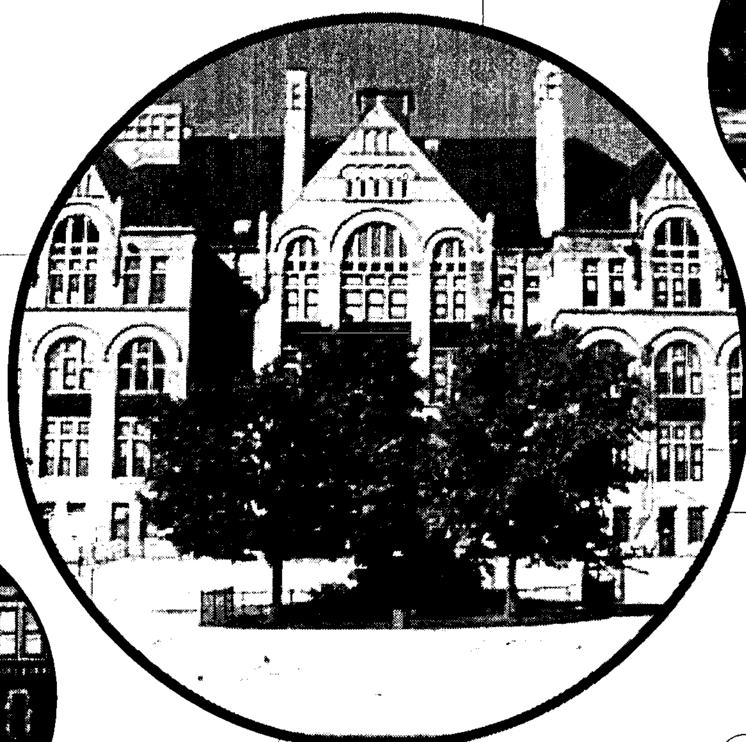
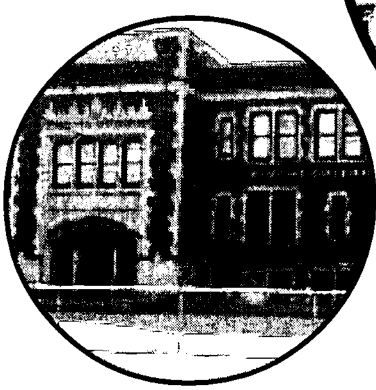
ABSTRACT

This study of 139 K-12 Milwaukee public schools examines the effect of building condition on student test scores compared to other influences such as family background, socioeconomic status, race/ethnicity, attendance, and student discipline. The study analyzed performance on the Wisconsin Student Assessment System Mathematics, Science, Language, and Social Studies tests of fourth, eighth, and tenth grades of each school in 1996, 1997, and 1998. Results show that student success is significantly related to facility condition. Facility condition was found to be a stronger predictor of academic achievement than many family background factors and socioeconomic conditions. An appendix contains the full regression tables for the analyses of the Wisconsin Student Assessment Tests. (Contains 13 references, 18 tables, 1 figure.) (GR)

FACILITY CONDITIONS AND STUDENT TEST PERFORMANCE IN THE MILWAUKEE PUBLIC SCHOOLS





DR. MORGAN LEWIS

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COUNCIL OF EDUCATIONAL FACILITY PLANNERS INTERNATIONAL

FACILITY CONDITIONS AND STUDENT TEST PERFORMANCE IN THE MILWAUKEE PUBLIC SCHOOLS

DR. MORGAN LEWIS

The relationship between the physical condition and educational adequacy of school buildings, student achievement and behavior has been examined from a variety of perspectives. Typically these studies have found a statistically significant relationship between the condition of a school and student achievement. However, most studies are unable to control all of the influences on learning, limiting the ability of the researchers to isolate the precise effect that the facility has on student learning.

In a study commissioned by the Council of Educational Facility Planners International, the effect of school facilities on student achievement was analyzed while controlling for a number of family background variables such as socio-economic status, race/ethnicity, attendance and student discipline. Utilizing data from Milwaukee Public Schools' facility condition and educational adequacy assessments of 1991, this study compared the student test scores in facilities of varied conditions.

The educational facility data for this study were collected on 139 schools of all grade levels by the Construction Control Corporation in 1991. The study analyzed the performance on the Wisconsin Student Assessment System Mathematics, Science, Language, and Social Studies tests of fourth, eighth, and tenth grades of each school in 1996, 1997, and 1998. The impact of school condition on student test scores was analyzed while controlling for differences in individual ability (as measured by Reading test scores), racial/ethnic group, attendance, truancy and suspension rates, mobility and the percent of students eligible for free or reduced-price lunches.

Student success was found to be significantly related to facility condition in 11 of the 36 estimates between 1996 and 1997—this is far higher than would be expected by chance. At the .05 probability level, only two relationships would be expected to be significant if occurring by chance. School conditions explained up to 16% of the variation in student mathematics scores in 1996. More precisely, a 10-point increase in a facility score was associated with a 1.6 increase in student math scores in 1996, thus indicating a powerful connection between the facility and student achievement.

Indeed, facility condition was found to be a stronger predictor of academic achievement than many family background factors and socio-economic condition. Out of 48 similar estimates of the relationship between measures of family background (mobility rates and eligibility for free/reduced-price lunches) and school attachment (attendance and suspension rates) with test performance, only 9 were found to be significant (as compared to 11 facility relationships). This finding suggests that a school's condition may impact student performance more readily than many social and economic variables.

The evidence–both in previous research and in this study–identifies that a direct relationship between school facility condition and student achievement does exist. The challenge remains to isolate this elusive relationship by controlling for the myriad of variables influencing student performance and behavior. Researchers must continue to chart the dimensions of the relationship of facilities and student achievement with future studies.

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INTRODUCTION

The relationship between the quality of school facilities and the learning of students has been a source of controversy since the mid-1960s. Prior to then, few questioned that the quality of the educational process influenced educational outcomes. Good schools, curriculum, and teachers were assumed to produce well-educated students. In 1966, James Coleman and others published *Equality of Educational Opportunity*. This classic study reported the surprising and controversial finding that traditional variables into the educational process had little impact on the academic performance of students. In the words of the report:

It appears that variations in the facilities and curriculums of the schools account for relatively little variation in pupil achievement insofar as this is measured by standard tests. (p. 22)

Since the Coleman report, the relationship between the physical condition of schools and student achievement has been examined from a variety of perspectives. Bowers and Burkett (1989) studied the effect of the age of school buildings. Berner (1993) asked parent volunteers (maintenance workers, engineers, architects) to evaluate the condition of their children's schools. Earthman, Cash, and Berkum (1995) collected standardized questionnaire data from school principals. After obtaining various measures of schools, each of these studies then compared achievement test scores from schools with better and worse conditions. Maxwell (1999) used a slightly different approach; she compared test scores before and after schools underwent renovation.

All of these studies have found a statistically significant positive relationship: better conditions are associated with higher achievement scores. In most cases, however, only a portion of the differences in scores can be attributed to the differences in facility conditions. When the complexity of learning and the number of factors that influence it are considered, the difficulty of estimating the effects of facilities is not surprising. Most studies are able to control only a few of the influences on learning, and, as a result, can explain relatively little of the total variability in test scores.

Three recent reviews have synthesized the available evidence. (Duke 1998, Earthman and Lemasters 1998, and Schrag 1999). Duke states: "... the studies that have been conducted suggest that there may be a relationship between the condition of facilities and learning," (p. 11). Earthman and Lemasters are more definitive: "As the condition of the facility improved, achievement test scores improved," (p. 10). Schrag reviewed the evidence but did not reach a summarizing conclusion. Overall, the literature suggests that school facilities do make a difference when it comes to student outcomes.

The present study examines the relationship between the condition of 139 facilities in the Milwaukee Public Schools and the test scores of students from these schools. The study includes direct or proxy measures of several of the factors that influence learning. All the data used in the study were provided by the Milwaukee Public Schools. The facility scores were produced by the Construction Control Corporation for a study conducted in 1991. The test scores are from students who were tested while they attended the fourth, eighth, and tenth grades in 1996, 1997, and 1998. The Milwaukee Schools also provided other information about the characteristics of the students who attend the 139 schools including enrollment by racial/ethnic group, attendance, truancy and suspension rates, mobility and the percent of students eligible for free or reduced price lunches.

The first step in the study was to match these separate data sets by school and to merge the data to be used in the analysis. The first critical decision in the analysis was to merge the data across grade level. We did this because there are only 18 middle and 15 high schools in the data set. We had a possibility of as many as 20 independent variables for use in multiple regression, and the ratio of schools to variables was too low. For multiple regression to produce reliable results, it is necessary to have at least three times the number of observations as there are independent variables. Combining the elementary, middle, and high schools yielded a total of 139 observations which greatly increased the power of the analysis and the chances of finding statistically significant relationships between the independent and dependent variables.

The report is organized as follows. First we describe the data provided by the Milwaukee Public Schools. We then present analyses conducted to examine the internal consistency of these data. Before conducting the multiple regression analyses, we wanted to determine if the data have the relationships that would be expected on the basis of existing knowledge. We then present the multiple regressions that tested the relationship between school facilities and student test scores, controlling for certain student characteristics.

DATA

Three separate kinds of data were provided by the Milwaukee Public Schools: facility condition and educational adequacy scores, student test scores by school level, and indicators of the characteristics of students in the 139 schools used in the analysis. We give most attention to the facility scores produced by the Construction Control Corporation. We then describe the Wisconsin Student Assessment System (WSAS), a battery of five standardized tests that are administered when students are in the fourth, eighth, and tenth grades. We also present the definitions of the student characteristics indicators.

These data provide some the best measures that have been used in analyses of this type. Unfortunately, they are not all from the same school year. There is a five-year gap between the facility study and the first year in which test scores were electronically available for all three grade levels. The student characteristic indicators are available for the 1994-95 and 1995-96 school years, one or two years before test scores were available. The multiple regression analyses presented below found most of the statistically significant relationships between facility and test scores for the tests administered in the 1996-97 school year, the one closest to the year in which the facility scores were produced. If all the measures had been available for the same school years, the findings across testing years may have been consistent.

FACILITY SCORES

Any study seeking to relate school facilities to academic achievement is critically dependent on the accuracy of the measures of the facilities. The Construction Control Corporation study, commissioned by the

Milwaukee Public Schools (MPS), was carefully conducted to yield valid and reliable measures. Four separate measures were produced: Existing Condition Total, Existing Condition Adjusted, Educational Adequacy Total, and Educational Adequacy Adjusted. The manner of producing each of these scores is described.

Existing Condition. The Existing Condition scores are based on direct examinations of the schools that were conducted by teams made up of MPS staff from the Department of Facilities and Maintenance Services and staff from the MPS Program Architect. The instructions given these teams are described as follows in the report of study:

The survey teams were charged with applying judgment factors which would assess the "general health" of the facility. Chronic problems and the typical, normal conditions of each component were to be rated, with emphasis on the functional integrity of the particular component being assessed. (Construction Control Corporation 1991, p. 5).

The teams were trained to use an evaluation form developed by the Construction Control Corporation, ensuring reliable data collection. This form called for ratings on a five-point scale defined as Poor, Marginal, Average, Good, and Excellent. These rating were then multiplied by weighing factors to calculate a total score for the facility. The weighting yielded scores that could range from 1,000 for the poorest school to 5,000 for an excellent school. These weighted scores were then adjusted according to the age of the facility. The rationale for this adjustment is explained in the report as follows:

At this point an overall score depressor was applied to reflect the statistical probability of chronic deficiencies due to age even when overall appearance merits a higher score. In the specific instance of MPS, facilities have been maintained in a condition which is exceptional for the age of the facility. Therefore, in order to reconcile the age effect among the facilities and account for age sensitive, depreciating components which would not otherwise be surveyed, an adjustment factor was applied to the raw score based on age category of the major portion of the facility. The adjustment was made by depressing the raw score of facilities as follows:

Age	*Deduct*
60+years	*1,000*
50-60	*750*
40-50	*500*
0-40	*0*

Construction Control Corporation 1991, pp. 5-6.

Results of the multiple regression analysis, to be presented below, indicate that this adjustment lowered the scores too much. While significant positive relationships were found between the Existing Conditions Total scores and WSAS test scores, significant negative relationships were found for the adjusted scores.

Educational Adequacy. The Educational Adequacy scores were produced in a similar manner but the teams that made the adequacy ratings were composed of teachers and curriculum specialists from the MPS faculty and staff. There were a total of five teams, one for the high schools, one for the middle schools and three for the elementary schools. The teams rated the schools using a form developed by Construction Control Corporation. The schools were rated on the degree to which they conformed to established design standards for each facility type (conformity), and their adequacy in accommodating current curricula, and their capability for alternative use (functional performance).

Conformity with established standards was rated as Inadequate, Below, Equal, Above, and Exceptional. Functional Performance was rated as Unacceptable, Inferior, Average, Good, and Excellent. These ratings were multiplied by weighting factors to yield scores from 1,000 to 5,000, the same range as the Existing Condition scores. These weighted scores were also adjusted. In this case, the size of the space and student/teacher ratios were used to adjust the Functional Performance scores.

Table 1 presents the mean facility scores for each educational level that were produced using the Construction Control Corporation method and standardized scores derived from the original scores. The standardized scores were calculated to make comparisons across the four measures easier. The standardized scores all have a mean of 100 and a standard deviation of 10. Any variable that is reported as a standardized score has a "Z" added as the final letter in its label.

The adjustment of the Educational Adequacy scores did not produce as much a change as the adjustment to the Existing Condition scores. Table 2 shows that the Existing Condition Total (EC Tot.) and Adjusted (EC Adj.) scores correlated at $r = .68$, and the Educational Adequacy Total (EA Tot.) and Adjusted (EA Adj.) correlated at $r = .89$. The strong effect of age on the Existing Condition Adjusted score is show by the negative correlation of -.88. The adjusted Existing Condition scores is, essentially, simply another measure of the age of the buildings: as the age of the building increases, the Existing Conditions Adjusted score declines.

When two measures are highly correlated, they should not both be entered into a multiple regression equation. In the regressions analyses that are presented below, age was not entered and the Existing Conditions Adjusted score served as the measure of age. For the same reason both the Educational Adequacy Total and Adjusted scores were not used. Because they correlate so highly, only the Total score was used.

Table 2 makes reference to "2-tail"in connection with the probability level. Tests of significant difference that are based on the normal probability curve are either 1-tail or 2-tail. The 1-tail test is appropriate if before the data are examined, the hypothesis being tested predicts the direction in which the results are expected to be different from chance. The overall hypothesis of this study is that as facility scores increase test scores will also increase. This hypothesis predicts the direction of the relationship and consequently a 1-tail test is appropriate and is used in this report. Any relationship that is labeled *statistically significant* refers to the .05 probability level of a 1-tail test.

WISCONSIN STUDENT ASSESSMENT SYSTEM SCORES

The WSAS consists of three sets of standardized tests that are administered to students when they are in the fourth, eighth, and tenth grades. The tests are designed to yield scores reflecting knowledge in reading, mathematics, language arts (including writing), science, and social studies.

The scores that were used for the 1996 analysis are somewhat different than those used in 1997 and 1998. The scores for 1996 are the percentile rankings of the schools on the national norms for the tests. For 1997 and 1998 the scores are the percent in each school that performed at or above the level defined as *proficient*. For each grade level and content area, the Office of Education Accountability of the Wisconsin Department of Public Instruction (1997) has established standards that define four different levels of performance: minimal, basic, proficient, and advanced. For each school in the state, the Department calculates the percentage of students who performed at or above the level defined as proficient. These percentages were reported for the 139 schools in the MPS for which facility data were available, and they constitute the student outcome data that were used in the analysis for the 1997 and 1998 school years.

As with the facility scores, the original data reported by the MPS were converted to standardized scores with a mean of 100 and a standard deviation of 10. The standardized score labels have a "Z" as their final letter.

INDICATORS OF STUDENT CHARACTERISTICS

In addition to the facility and test scores, the MPS provided data that reflect the characteristics of students attending the schools and the socioeconomic status of their families. These included attendance, truancy, suspension, mobility, and eligibility for free or reduced price lunches. These are the definitions for these indicators:

Attendance: Total days of attendance divided by total possible days of attendance.

For each of the following measures, the denominator is the total number of students enrolled on the third Friday of the school year:

Truancy: Number of students absent for either 10 or more consecutive days or 10 or more days during a semester.

Suspension: An unduplicated count of the number of students suspended from the school, (multiple suspensions for the same student are counted only once per school).

Table 1: Means for Original and Standardized Measures of School Facilities

Level		EC Tot.	EC Adj.	EA Tot.	EA Adj.
Elementary Original	Mean Number Stan. Dev.	3353.19 98 203.34	2850.64 98 591.22	2562.68 98 431.98	2514.21 98 519.20
Standardized	Mean Number Stan. Dev.	98.97 98 8.29	99.49 98 9.58	98.92 98 8.60	100.97 98 7.79
K-8 Original	Mean Number Stan. Dev.	3374.63 8 554.76	2530.88 8 890.42	2771.50 8 986.77	2677.75 8 1102.36
Standardized	Mean Number Stan. Dev.	99.84 8 22.61	94.31 8 14.42	103.08 8 19.65	103.42 8 16.54
Middle School Original	Mean Number Stan. Dev.	3402.00 18 166.13	3027.00 18 511.39	2629.83 18 504.75	2199.28 18 792.30
Standardized	Mean Number Stan. Dev.	100.96 18 6.77	102.35 18 8.2830	100.26 18 10.05	96.24 18 11.89
High School Original	Mean Number Stan. Dev.	3517.47 15 305.61	3100.80 15 682.63	2872.33 15 540.51	2205.67 15 967.10
Standardized	Mean Number Stan. Dev.	105.67 15 12.46	103.54 15 11.06	105.09 15 10.76	96.34 15 14.51
Total Original	Mean Number Stan. Dev.	3378.47 139 245.31	2882.07 139 617.40	2616.81 139 502.16	2449.55 139 666.30
Standardized	Mean Number Stan. Dev.	100.00 139 10.00	100.00 139 10.00	100.00 139 10.00	100.00 139 10.00

Table 2. Correlation of Age of Building with Facility and Adequacy Scores

	Age	EC Tot.	EC Adj.	EA Tot.	EA Adj.
Age	1.00				
EC Tot.	-.39	1.00			
EC Adj.	-.88	.68	1.00		
EA Tot.	-.48	.49	.54	1.00	
EA Adj.	-.36	.32	.40	.89	1.00

NOTE: All correlations are based on 139 schools and are significant at the 0.01 probability level or less (2-tail).

Mobility: Total students who entered or exited a school after the third Friday.

Free/reduced lunch: Total students receiving free or reduced price lunches.

All of these indicators were converted to standardized scores with a mean of 100 and a standard deviation of 10. Information was also provided on the racial/ethnic composition of the enrollment at each of the 139 schools for the 1995-96 school year.

The reader should note that the unit of analysis for this study was the individual school, not the individual student. Because the data were at the school level, there was the possibility that the scores for all schools could be quite similar. If students with varying levels of individual ability and diverse family backgrounds–the two primary determinants of test performance–were randomly distributed across schools, the percentage proficient at each school would be very close to the mean for all 139 schools.

The actual distributions of test scores and student characteristics were far from randomly distributed. Reading scores are the single most accurate indicators of the ability to do academic work. The percentages in each school that scored at the proficient level or above in Reading ranged from 12 to 98 percent. The mobility of enrollment and the percentage of students who received free or reduce price lunches ranged from 0 to 98 percent. The school-level variation in the characteristics of the students attending the 139 schools and in their performance on the separate tests spanned the full range of most of the measures.

INTERNAL CONSISTENCY OF THE DATA

This section of the report discusses the analyses we conducted to test the internal consistency of the data. We wanted to determine if the various measures had the kinds of relationships with one another that would be expected on the basis of existing knowledge. We expected, for example, that scores across the five tests in the WSAS would be highly correlated. Students in schools who scored well on one test would be expected to score well on the other tests, and students in schools that did poorly on one test would be expected to do poorly on the other tests. We further expected that the scores of students who took the tests in one year would correlate with the scores of students who took the tests in subsequent years. We expected this because the characteristics of students who attend a school usually do not change greatly from year to year. Elementary schools, in particular, tend to serve neighborhoods with similar socioeconomic characteristics that change fairly slowly from year to year. And elementary plus K-8 schools make up three-fourths of the schools in this study.

Table 3 shows that the expected relationships were found in the WSAS data. The first three sets of rows show the correlations of different tests for the same year. The bottom set of rows show the correlations of the same test for different years. The correlations across tests for the same years are quite high. This reflects a strong tendency for schools that scored highly on one content area to also score highly on the other areas.

The schools also tend to have similar scores on the same tests across years, but not to the degree they have similar scores the same year across tests. The correlations of the different tests for the same years indicate that students perform similarly on each of the tests. The correlations of the same tests across years reflect the tendency of schools to serve students who have similar levels of test performance in different years.

In addition to determining if the tests had the relationships expected, we examined the relationships among indicators that reflect the characteristics of students that attend the various schools. These variables are shown in Table 4. These indicators correlate highly across the years for which we have data. The three years of attendance data correlate at an average $r = .95$; the mobility data correlate $r = .89$, and the free/reduced lunch data correlate $r = .97$ across two years. Truancy rates are essentially the reverse of attendance, yielding high negative correlations. Suspension rates have a fairly high positive correlation with truancy and negative correlations of about the same magnitude with attendance. As attendance increases, suspension rates decrease. As the mobility of enrollments increases,

Table 3. Correlations of the Wisconsin Student Assessment System Scores for 1996, 1997, and 1998

	Reading	Mathematics	Language	Science	Social Studies
1996					
Reading	1.00				
Mathematics	.85	1.00			
Language	.94	.85	1.00		
Science	.84	.88	.84	1.00	
Social Studies	.89	.89	.87	.91	1.00
1997					
Reading	1.00				
Mathematics	.86	1.00			
Language	.91	.87	1.00		
Science	.84	.89	.83	1.00	
Social Studies	.73	.70	.70	.77	1.00
1998					
Reading	1.00				
Mathematics	.84	1.00			
Language	.95	.85	1.00		
Science	.80	.91	.80	1.00	
Social Studies	.91	.84	.90	.82	1.00
1996 with					
1997	.77	.70	.74	.71	.70
1998	.67	.48	.72	.53	.76
1997 with					
1998	.78	.75	.71	.68	.54

NOTE: All correlations are based on 139 schools and are significant at the 0.01 level or less (2-tailed).

attendance decreases and suspensions increase. The percentage of students eligible for free and reduced lunches, however, has no significant relationships with attendance, truancy, or suspension, but a fairly strong relationship with mobility. All of these relationships are consistent with prior expectations.

Our final test of the internal consistency of the data was to correlate the student characteristic indicators with the WSAS scores. These results are shown in Table 5. Once again, almost all of the relationships are significant and in the expected directions. The measures of truancy, suspension, mobility and the percentage of students eligible for free/reduced lunch have substantial negative relationships with almost all the tests. Attendance, in contrast, has a substantial positive correlation. These results are consistent over the three years of test data. The data provided by MPS have the internal consistency that existing research indicates they should have.

MULTIPLE REGRESSION ANALYSES

Having established that the test and student indicator data had substantial internal consistency, we were prepared to determine the relationship between test performance and the condition and educational adequacy of the schools the students attended at the times they took these tests. Multiple regression was used because it provides estimates of the effect of each independent variable upon the dependent variable while holding the effects of all other variables in the equation constant. This allows us to isolate the effect of facility condition on test performance, while controlling for other factors that might influence student test scores.

The equations were based, as far as possible, on Walberg's (1980) model of educational productivity. Although measures were not available for all the factors in the model, those that were used typically explained 80 to 90 percent of the variation in test performance across the 139 schools. This is a far larger percentage of explained variance than was found in the previous studies discussed in the Introduction section of this report.

Much of the strength of the model used in the analysis of the MPS data came from the inclusion of the WSAS Reading test as an *independent* variable that was regressed against the other WSAS tests as *dependent* variables. The decision to include Reading as an independent variable increased the explanatory power of the model and the probability of finding statistically significant relationships between the measures of school facilities and the percentage of students in the schools that

Table 4. Correlations of Indicators of Student Characteristics

	Attendance 1994	Attendance 1995	Attendance 1996	Truancy	Suspens.	Mobility Rate 1995	Mobility Rate 1996	Free/Red Lunch 1995	Free/Red Lunch 1996
Attend 94	1.00								
Attend 95	.97	1.00							
Prob.	.00								
Attend 96	.92	.96	1.00						
Prob.	.00	.00							
Truancy	-.88	-.87	-.87	1.00					
Prob.	.00	.00	.00						
Suspen.	-.59	-.67	-.65	.51	1.00				
Prob.	.00	.00	.00	.00					
Mobil 95	-.42	-.38	-.37	.31	.06	1.00			
Prob.	.00	.00	.00	.00	.46				
Mobil 96	-.40	-.37	-.36	.29	.10	.89	1.00		
Prob.	.00	.00	.00	.00	.24	.00			
Lunch 95	-.01	.02	-.02	-.13	.01	.41	.39	1.00	
Prob.	.90	.86	.85	.12	.94	.00	.00		
Lunch 96	.01	.02	-.01	-.14	.01	.39	.38	.97	1.00
Prob.	.95	.77	.88	.11	.88	.00	.00	.00	

Note: All correlations are based on 139 schools. The probabilities (Prob.) are for 2-tail tests.

Table 5. Indicators of Student Characteristics Correlated with WSAS Test Scores for 1996, 1997, and 1998

	Truant	Suspension	Attendance 1996	Mobility 1996	Free/Red Lunch 1996
Reading					
1996	-.27	-.26	.40	-.52	-.50
1997	-.41	-.38	.53	-.43	-.47
1998	-.44	-.42	.53	-.41	-.36
Mathematics					
1996	-.06	-.19	.23	-.44	-.56
1997	-.40	-.42	.52	-.38	-.42
1998	-.58	-.63	.67	-.29	-.14
Language					
1996	-.29	-.40	.46	-.45	-.49
1997	-.36	-.42	.50	-.40	-.47
1998	-.47	-.41	.56	-.42	-.35
Science					
1996	-.17	-.26	.29	-.44	-.61
1997	-.44	-.36	.52	-.43	-.43
1998	-.72	-.69	.78	-.27	-.12
Social Studies					
1996	-.31	-.28	.42	-.50	-.53
1997	-.04	.03	.17	-.44	-.63
1998	-.42	-.39	.52	-.42	-.35

*Note: All correlations are based on 139 schools. In contrast with the other tables in this report, the shaded cells are **not significant**. All others are significant at the .05 probability level (1-tail) or less, and most are significant at the .001 level.*

scored at the proficient level or above on the other four tests.

The increase in power from including Reading as an independent variable is shown in Table 6. This table compares the results from two multiple regression equations one of which included the 1996 Reading score and the identical model without this variable. The adjusted R Square is the percentage of variability in the dependent variable, 1996 Mathematics scores, that is explained by the independent variables. With Reading in the equation, the adjusted R Square is .805; without Reading it is .445, a drop of almost half.

Table 6 identifies the facility score variables with capital letters and all have "Z"s as their final letters, indicating that they are standardized scores. These are the same labels used in Appendix Tables A-1 through A-12: ECTOTZ is the label for Existing Conditions Total, ECADJZ is Existing Conditions Adjusted, and EATOTZ is Educational Adequacy Total. Educational Adequacy Adjusted was not included in the model because of its high correlation r=.89) with Educational Adequacy Total.

Table 7 presents a summary of the results of the school facility measures regressed against the three years of test data. The model shown in Table 6 with Reading included was run with the four other tests administered in the years 1996, 1997, and 1998 as the dependent variables. The facility measures used in all the regressions are the same, the scores produced in 1991 by the Construction Control Corporation. The results for the full regression model for each of the WSAS tests in each of these years are appended as Appendix Table A-1 through A-12.

The shaded cells indicate relationships that are significant at the .05 probability level or less. The coefficients are standardized and show the amount of change in the outcome measures that would be expected by a one-point (1.00) change in the standardized facility measures.

It is likely that most readers of this report will not be familiar with interpreting regression coefficients. Figure 1 may facilitate the understanding of these values.

The bars in Figure 1 represent the regression coefficients for the three facility measures that are presented in the upper, left-hand cell of Table 7 plus the regression coefficient for the Reading scores that were entered as an independent variable (Table 6). In the model, the reading score variable was used as a proxy for student ability. Reading scores were found to explain 82% of the variance in mathematics scores—a one-

Table 6. Regression Coefficients for Dependent Variable Mathematics 96Z with Reading96Z In and Out of the Equation

Independent Variables	With Reading Beta	With Reading t	With Reading Probability	Without Reading Beta	Without Reading t	Without Reading Probability
ECTOTZ	.15	2.39	.01	.23	2.11	.02
ECADJZ	-.16	-2.65	.00	-.18	-1.78	.04
EATOTZ	.09	1.90	.03	.09	1.09	.14
SuspensionZ	.00	.08	.45	-.12	-.98	.16
Attendance96Z	.10	1.04	.15	.42	2.53	.01
Mobility96Z	.05	.91	.18	-.17	-1.98	.02
F/R Lunch96Z	-.12	-1.55	.06	-.21	-1.68	.05
African American	1.28	1.72	.04	2.68	2.15	.02
Asian	.32	1.96	.02	.52	1.93	.03
Hispanic	1.04	2.09	.02	1.89	2.26	.01
White	.95	1.74	.04	2.17	2.39	.01
Elementary	-.25	-2.10	.02	-.46	-2.28	.01
Middle School	-.19	-2.39	.01	-.22	-1.66	.05
Reading96Z	.82	15.20	.00			

Model Summary

Model	R	R Square	Adjusted R Square	Standard Error
With Reading	.91	.82	.80	4.42
Without Reading	.70	.50	.44	7.45

Table 7. Regression Coefficients for Net Independent Effects of Facility Measures and Percentage of Students Eligible for Free or Reduced-Price Lunches on WSAS Scores for 1996, 1997, and 1998

Facility Measures	Mathematics Beta	Mathematics t	Language Beta	Language t	Science Beta	Science t	Social Studies Beta	Social Studies t
1996								
ECTOTZ	.15	2.39	.02	.51	.14	1.94	.07	1.24
ECADJZ	-.16	-2.65	-.01	-.27	-.06	-.95	-.08	-1.32
EATOTZ	.09	1.90	.00	.12	.03	.56	.09	1.96
1997								
ECTOTZ	.08	1.14	.07	1.13	.13	1.90	.12	1.79
ECADJZ	-.08	-1.27	-.15	-2.61	-.12	-1.93	-.14	-2.15
EATOTZ	.06	1.19	.03	.68	.13	2.59	.06	1.18
1998								
ECTOTZ	.08	1.52	.03	.64	.02	.44	.04	.74
ECADJZ	.02	.37	-.03	-.96	.04	.87	-.03	-.54
EATOTZ	-.04	-1.08	-.00	-.07	-.01	-.26	.03	.61
Free/Reduced Lunch96Z with								
1996 scores	-.12	-1.55	-.08	-1.74	-.28	-3.40	-.21	-3.00
1997 scores	-.16	-2.00	-.12	-1.73	-.12	-1.48	-.06	-.76
1998 scores	.08	1.25	.00	.02	.00	-.00	.06	.79

Note: All regressions are based on 139 schools. Shaded cells show coefficients that are significant at the .05 probability level or less, with a 1-tail test.

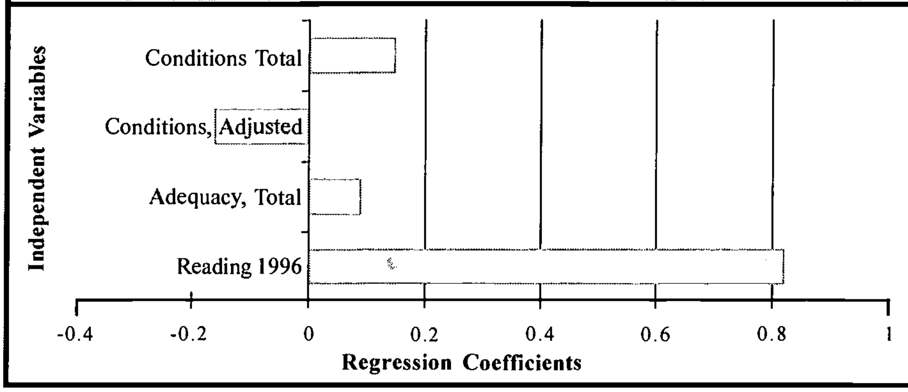
point (1.00) change in the student reading score was associated with a change of .82 in the mathematics score.

The facility scores are not as powerful as the Reading scores, but overall they do explain a significant proportion of the variability in the 1996 Mathematics scores. The Existing Conditions Total variable (ECTOTZ) explains 15 percent, Existing Conditions Adjusted (ECADJZ) 16 percent, and Educational Adequacy Total (EATOTZ) 9 percent of the variability in 1996 Mathematics scores across schools. In other words, a 10-point increase in a facility's existing condition score was associated with a 1.6 increase in student math scores in 1996.

The ECADJZ coefficient is negative: as these scores increase, Mathematics scores decrease. This reflects the strong effect of the adjustment made in the Existing Conditions Total score. It will be recalled, that the Construction Control Corporation study adjusted the Existing Conditions Total score by subtracting a specified number of points depending on the age of the building. This adjustment essentially made the Existing Condition Adjusted score a measure of the age of the building, with older school buildings assigned much lower scores based on age alone. Table 2 showed that the actual age of the buildings had a high negative correlation ($r = -.88$) with the Existing Conditions Adjusted score. As the age of the buildings increased, their Existing Condition Adjusted scores decreased. The adjustment made by Construction Control Corporation caused newer buildings to have higher Existing Condition Adjusted scores.

The negative coefficients for the Existing Conditions Adjusted score in Table 7 indicate that newer buildings tended to have lower test scores. This is counter to most previous findings. To test its validity, additional regressions were run that deleted the Existing Conditions Adjusted variable and replaced it with the actual age of the buildings. These regressions found age to have significant positive relationships. The Construction Control Corporation report (1991) noted that the age adjustment was made because "... MPS facilities have been maintained in a condition which is exceptional for the age of the facility." (p. 5) Perhaps it is this exceptional maintenance that is being reflected in the higher test scores from older buildings.

Figure 1. Net Change in 1996 Mathematics Score Associated with One-Point Change in Variables Listed



The percentages of explained variance for the facility measures are not additive. The percentages were suggested as a way of thinking about the meaning of the regression coefficients, but each of the coefficients cannot be converted to a percentage and summed. If this were done for all the variables, the percentage of explained variance would be more than 100.

In 1996, all three of the facility measures had statistically significant relationships with the Mathematics scores. Two other significant coefficients were also found between facility measures and test scores, one each with Science and Social Studies. The coefficients for these five significant relationships ranged from -.16 to .15. For these significant relationships, a 1.00 point change in a facility scores was associated with a -.16 to a .15 point change in the dependent variables. In 1997, there were six significant relationships and the coefficients were about of the same magnitude, a range of -.15 to .13. Only one of these significant 1997 coefficients, however, replicated a relationship found in 1996. The replicated one was for Existing Conditions Total measure and Science scores. The coefficients for these relationships were .14 in 1996 and .13 in 1997.

The limited replication of the 1996 results in 1997 is disappointing, but several significant coefficients still emerged. In 1998, however, none of the relationships between facility measure and test scores were significant. The failure to find any relationships in 1998 caused us to include the results for the free/reduced price lunch variable in Table 7 as a basis of comparison. This is the student characteristics variable that had the most significant relationships with test data. In 1996 and 1997, seven of the eight relationships between the percentages of students eligible for free or reduced-price lunches and test scores were significant or nearly so. In 1998, however, this variable, just like the facility measures, had no significant relationships with test scores.

It will be recalled that the school scores for 1996 are somewhat different than the scores for 1997 and 1998. In 1996, the scores are the schools' percentile rankings on the national norms for the tests that were administered. In 1997 and 1998, the scores indicate the percentage of students at the schools that scored at the levels defined as proficient or above for their grades. If any year were to have a different pattern of relationships among the variables, one would expect 1996 to be the year. The intercorrelations of the years in Table 3, however, show that 1996 scores correlated much the same with those from 1997 and 1998 as 1997 correlated with 1998. The average correlations of the five tests across the three years were as follows:

1996 with 1997, $r = .72$
1996 with 1998, $r = .63$
1997 with 1998, $r = .69$

Given the internal consistency of the Milwaukee data, we have no explanation for the failure to find significant relationships in 1998. The test data correlate in a similar manner across tests and across years. The 1998 data do not vary significantly from the other years. We could find no anomalies that would suggest why 1998 should yield no significant relationships, but this was true for almost all of the independent variables, not just the facility scores.

Although the facility measures are the major focus of this report, a brief discussion of the other variables in the full model, (See Appendix Tables), may be helpful.

- The most powerful independent variable in all of the equations was the Reading score. It was always highly significant, and a change of one point (1.00) in its standardized score was associated with a change of .54 to .90 in the dependent variables.

- In general, the student characteristics variables that had fairly strong one-to-one correlations with test data in Table 5 had few significant independent relationships in the regressions. When other factors associated with these student characteristics were held constant, indicators such as attendance, mobility, and suspension rates, had few independent relationships with the relative performance of the schools on the tests. The exception was the free/reduced price lunch variable, (See Table 7).

- The percentage of students in different racial/ethnic groups was often significant, especially in 1997. All of these coefficients were positive indicating that as the percentage in each of these groups increased, test scores increased. One of the technical requirements of multiple regression is that the sum of any set of variables cannot be a unity (100 percent). Because of this requirement, American Indians and students classified as Other were not included in the regressions.

- The variables Elementary and Middle School were entered to control for any systematic differences in the merged data sets from the fourth, eighth, and tenth grades. The schools were coded as dummy variables with the high school not entered in the equation because of the restriction on a set of variables adding to a unity. In some of the equations, the percentages scoring at the proficient level or above in the elementary and middle schools were found to differ significantly from these percentages in the high schools. These differences were in both directions, sometimes higher and sometimes lower.

In summary, student achievement was significantly related to facility condition in 11 of the 36 estimates between 1996 and 1998. This is far higher than would be expected by chance. At the .05 probability level, only two relationships would be expected to be significant by chance. No significant relationships were found in 1998, and there is no apparent reason why this year should be so different.

CONCLUSIONS

This study demonstrates a number of significant relationships between facility condition and student achievement. While findings were not always consistent over the number of years or areas of testing, the number of significant relationships observed were far greater than what would be expected by chance. Limitations in the data, due to the gap of time between the facility assessments and student test scores, may explain some of the inconsistency in the results.

One of the most interesting findings indicates that when differences in individual ability are controlled, facility condition may impact student performance more than many social and economic variables. A long history of educational research has demonstrated that family background has a strong impact on academic achievement: children from economically disadvantaged families perform more poorly than those from more favorable circumstances (*e.g.* Inoue 1999). Other research has demonstrated that school attachment, as reflected in attendance and suspensions, is essential to achievement (*e.g.*, ERIC Clearinghouse on Urban Education 1997). These are among the most established relationships in educational research. It is somewhat surprising, therefore, that when differences in the individual ability of students were controlled in this study, measures of school facilities explained as much of the differences in test performance across schools as indicators of family backgrounds and school attachment.

Out of 36 estimates of the net, independent relationships of measures of school facilities with performance on the WSAS tests, 11 were found to be significant. The significant relationships for facility measures typically explained about 10 to 15 percent of the differences in scores across schools when the influences of the other variables were statistically controlled. When simple one-to-one correlations were calculated between the facility measures and test scores, there were no significant relationships. Multiple regression was needed to detect relationships that were hidden by the effects of other variables.

Out of 48 similar estimates of the relationship between measures of family background (mobility rates and eligibility for free/reduced lunches) and school attachment (attendance and suspension rates) with test performance, 9 were found to be significant. Those that were significant explained between 8 and 28 percent of the differences in test scores across schools when other variables were controlled.

The evidence, however, is not fully consistent. Relationships that were found for one year of test data were not replicated in other years. Very few significant relationships, except for the Reading test, were found in 1998. Nevertheless, there are many more significant relationships than would be expected by chance, and the analyses of the internal consistency of the data found all the expected relationships. These analyses did not yield any results that would account for the low number of significant relationships in the 1998 data. One possible explanation is that as the time period between the facility measures and test data increases, conditions in the buildings change and the chances of finding significant relationships decrease. This may also be the case for the measures of family background and school attachment. If all the measures were from the same school year, a higher proportion of significant relationships might be found.

With the complexity of the learning process and the number of factors that can influence it, it may not be possible to produce a definitive estimate of the effect of facility conditions on student achievement. Overall, the evidence– both previous research and this study–strongly implies such a relationship exists. Researchers must continue to chart the dimensions of this relationship with future studies. ⌘

APPENDIX

FULL REGRESSION TABLES FOR THE ANALYSES OF THE WISCONSIN STUDENT ASSESSMENT TESTS

Appendix Table A-1. Dependent Variable: Mathematics 96Z

Coefficients

Independent Variables	Unstandardized Beta	Standard. Error	Standardized Beta	t	Probability
(Constant)	-39.946	34.512		-1.157	.124
ECTOTZ	.152	.064	.152	2.389	.009
ECADJZ	-.162	.061	-.162	-2.652	.004
EATOTZ	.093	.049	.093	1.901	.030
SuspensionZ	.005	.072	.005	.076	.450
Attendance96Z	.103	.099	.103	1.040	.150
Mobility96Z	.049	.054	.049	.909	.182
F/R Lunch96Z	-.116	.074	-.116	-1.551	.062
African American	.492	.286	1.283	1.721	.044
Asian	.603	.306	.317	1.961	.025
Hispanic	.603	.289	1.045	2.087	.020
White	.531	.304	.948	1.743	.042
Elementary	-5.890	2.802	-.252	-2.102	.019
Middle School	-5.584	2.336	-.188	-2.391	.009
Reading96Z	.821	.054	.820	15.205	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.908	.825	.805	4.4179

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	11380.545	14	812.896	41.649	.000
Residual	2420.188	124	19.518		
Total	13800.733	138			

Appendix Table A-2. Dependent Variable: Language 96Z

Coefficients

Independent Variables	Unstandardized Beta	Standard Error	Standardized Beta	t	Probability
(Constant)	-39.140	22.245		-1.760	.040
ECTOTZ	.021	.041	.021	.509	.305
ECADJZ	-.010	.039	-.010	-.266	.396
EATOTZ	.004	.032	.004	.119	.452
SuspensionZ	.012	.047	.012	.266	.395
Attendance96Z	.121	.064	.121	1.894	.061
Mobility96Z	.056	.035	.056	1.595	.056
F/R Lunch96Z	-.083	.048	-.083	-1.736	.042
African American	.395	.184	1.030	2.144	.017
Asian	.424	.196	.223	2.151	.017
Hispanic	.396	.186	.688	2.133	.018
White	.374	.196	.669	1.907	.030
Elementary	-.713	1.806	-.030	-.395	.347
Middle School	-5.674	1.505	-.191	-3.769	.000
Reading96Z	.902	.035	.901	25.920	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.963	.927	.919	2.8475

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	12805.091	14	914.649	112.803	.000
Residual	1005.440	124	8.108		
Total	13810.531	138			

Appendix Table A-3. Dependent Variable: Science 96Z

Coefficients

Independent Variables	Unstandardized Beta	Standard. Error	Standardized Beta	t	Probability
(Constant)	28.917	38.802		.745	.229
ECTOTZ	.139	.072	.139	1.938	.028
ECADJZ	-.065	.069	-.065	-.946	.173
EATOTZ	.031	.055	.031	.561	.288
SuspensionZ	-.042	.081	-.041	-.516	.304
Attendance96Z	-.045	.112	-.045	-.400	.345
Mobility96Z	.040	.061	.040	.650	.258
F/R Lunch96Z	-.285	.084	-.285	-3.403	.001
African American	.186	.322	.485	.578	.282
Asian	.217	.344	.114	.632	.264
Hispanic	.225	.325	.390	.693	.245
White	.197	.342	.354	.579	.282
Elementary	2.160	3.150	.092	.686	.247
Middle School	.126	2.626	.004	.048	.481
Reading96Z	.732	.061	.732	12.058	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.882	.778	.753	4.9670

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	10733.485	14	766.678	31.076	.000
Residual	3059.209	124	24.671		
Total	13792.694	138			

Appendix Table A-4. Dependent Variable: Social Studies 96Z

Coefficients

Independent Variables	Unstandardized Beta	Standard Error	Standardized Beta	t	Probability
(Constant)	5.703	32.005		.178	.430
ECTOTZ	.073	.059	.073	1.238	.209
ECADJZ	-.075	.057	-.075	-1.324	.094
EATOTZ	.089	.045	.089	1.960	.026
SuspensionZ	.006	.067	.007	.102	.460
Attendance96Z	-.040	.092	-.040	-.430	.334
Mobility96Z	-.001	.050	-.001	-.018	.488
F/R Lunch96Z	-.207	.069	-.207	-2.997	.002
African American	.231	.265	.601	.869	.193
Asian	.254	.284	.133	.894	.186
Hispanic	.296	.268	.512	1.103	.136
White	.250	.282	.447	.886	.189
Elementary	7.105	2.597	.303	2.735	.004
Middle School	4.777	2.166	.161	2.206	.014
Reading96Z	.797	.050	.797	15.951	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.922	.849	.832	4.0969

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	11726.854	14	837.632	49.904	.000
Residual	2081.338	124	16.785		
Total	13808.192	138			

Appendix Table A-5. Dependent Variable: Mathematics 97Z

Coefficients

Independent Variables	Unstandardized Beta	Standard. Error	Standardized Beta	t	Probability
(Constant)	-73.913	35.807		-2.064	.020
ECTOTZ	.075	.066	.075	1.141	.128
ECADJZ	-.080	.063	-.080	-1.269	.104
EATOTZ	.060	.050	.060	1.194	.118
SuspensionZ	-.091	.074	-.090	-1.227	.111
Attendance96Z	-.182	.102	-.183	-1.793	.038
Mobility96Z	-.034	.055	-.034	-.621	.268
F/R Lunch96Z	-.157	.078	-.157	-2.000	.024
African American	1.313	.292	3.427	4.496	.000
Asian	1.494	.314	.786	4.762	.000
Hispanic	1.372	.296	2.378	4.641	.000
White	1.354	.310	2.423	4.368	.000
Elementary	10.544	2.870	.451	3.674	.000
Middle School	7.101	2.404	.240	2.954	.002
Reading97Z	.756	.057	.777	13.359	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.902	.814	.793	4.5430

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	11196.112	14	799.794	38.751	.000
Residual	2559.251	124	20.639		
Total	13756.364	138			

Appendix Table A-6. Dependent Variable: Language 97Z

Coefficients

Independent Variables	Unstandardized Beta	Standard Error	Standardized Beta	t	Probability
(Constant)	-.723	31.904		-.023	.436
ECTOTZ	.066	.058	.066	1.127	.131
ECADJZ	-.147	.056	-.147	-2.609	.005
EATOTZ	.031	.045	.031	.681	.248
SuspensionZ	-.017	.066	-.017	-.262	.397
Attendance96Z	-.123	.091	-.123	-1.353	.090
Mobility96Z	-.053	.049	-.053	-1.091	.138
F/R Lunch96Z	-.121	.070	-.121	-1.734	.042
African American	.550	.260	1.434	2.115	.018
Asian	.583	.279	.307	2.087	.020
Hispanic	.554	.263	.960	2.105	.019
White	.584	.276	1.044	2.114	.019
Elementary	5.109	2.557	.218	1.997	.024
Middle School	.036	2.142	.001	.017	.488
Reading97Z	.784	.050	.805	15.554	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.923	.853	.836	4.0478

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	11764.431	14	840.317	51.286	.000
Residual	2031.725	124	16.385		
Total	13796.156	138			

Appendix Table A-7. Dependent Variable: Science 97Z

Coefficients

Independent Variables	Unstandardized Beta	Standard. Error	Standardized Beta	t	Probability
(Constant)	-73.470	36.620		-2.006	.024
ECTOTZ	.127	.067	.127	1.897	.030
ECADJZ	-.125	.065	-.125	-1.928	.028
EATOTZ	.133	.052	.133	2.575	.006
SuspensionZ	-.067	.076	-.066	-.890	.188
Attendance96Z	-.090	.104	-.090	-.865	.194
Mobility96Z	-.067	.056	-.067	-1.195	.117
F/R Lunch96Z	-.119	.080	-.119	-1.480	.070
African American	1.183	.299	3.083	3.960	.000
Asian	1.229	.321	.646	3.831	.000
Hispanic	1.258	.302	2.177	4.161	.000
White	1.296	.317	2.318	4.091	.000
Elementary	10.411	2.935	.445	3.547	.001
Middle School	9.231	2.458	.311	3.755	.000
Reading97Z	.661	.058	.678	11.421	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.897	.806	.784	4.6463

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	11118.480	14	794.177	36.788	.000
Residual	2676.888	124	21.588		
Total	13795.369	138			

Appendix Table A-8. Dependent Variable: Social Studies 97Z

Coefficients

Independent Variables	Unstandardized Beta	Standard Error	Standardized Beta	t	Probability
(Constant)	-61.593	35.961		-1.713	.044
ECTOTZ	.118	.066	.118	1.788	.038
ECADJZ	-.136	.063	-.136	-2.147	.017
EATOTZ	.060	.051	.060	1.177	.121
SuspensionZ	.037	.074	.036	.495	.310
Attendance96Z	.146	.102	.146	1.432	.078
Mobility96Z	-.014	.055	-.014	-.256	.385
F/R Lunch96Z	-.060	.079	-.060	-.759	.224
African American	.818	.293	2.132	2.788	.003
Asian	.885	.315	.465	2.810	.003
Hispanic	.876	.296	1.517	2.952	.002
White	.965	.311	1.742	3.131	.001
Elementary	-9.011	2.882	-.385	-3.126	.001
Middle School	2.089	2.414	.070	.865	.194
Reading97Z	.689	.057	.707	12.125	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.902	.813	.792	4.5626

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	11209.708	14	800.693	38.462	.000
Residual	2581.389	124	20.818		
Total	13791.096	138			

Appendix Table A-9. Dependent Variable: Mathematics 98Z

Coefficients

Independent Variables	Unstandardized Beta	Standard. Error	Standardized Beta	t	Probability
(Constant)	-16.729	28.836		-.580	.282
ECTOTZ	.079	.052	.079	1.517	.066
ECADJZ	.019	.050	.019	.369	.356
EATOTZ	-.044	.040	-.044	-1.082	.140
SuspensionZ	-.018	.060	-.018	-.300	.382
Attendance96Z	-.071	.081	-.071	-.883	.190
Mobility96Z	-.052	.044	-.052	-1.176	.121
F/R Lunch96Z	.077	.061	.077	1.251	.106
African American	.383	.234	.986	1.634	.052
Asian	.493	.252	.259	1.960	.026
Hispanic	.367	.237	.635	1.549	.062
White	.416	.248	.743	1.673	.048
Elementary	10.304	2.298	.440	4.482	.000
Middle School	-.781	1.926	-.026	-.405	.343
Reading98Z	.717	.044	.717	16.311	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.938	.881	.867	3.6443

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	12155.485	14	868.249	65.376	.000
Residual	1646.835	124	13.281		
Total	13802.320	138			

Appendix Table A-10. Dependent Variable: Language 98Z

Coefficients

Independent Variables	Unstandardized Beta	Standard Error	Standardized Beta	t	Probability
(Constant)	2.854	24.562		.116	.454
ECTOTZ	.030	.045	.030	.673	.251
ECADJZ	.027	.043	.027	.636	.263
EATOTZ	-.033	.034	-.033	-.965	.168
SuspensionZ	-.004	.051	-.004	-.073	.471
Attendance96Z	.040	.069	.040	.576	.282
Mobility96Z	-.023	.038	-.023	-.610	.272
F/R Lunch96Z	.001	.052	.001	.025	.485
African American	.022	.198	.057	.110	.461
Asian	.034	.214	.018	.160	.436
Hispanic	-.008	.202	-.014	-.039	.484
White	.040	.212	.072	.189	.426
Elementary	1.618	1.958	.069	.826	.205
Middle School	1.855	1.641	.063	1.131	.130
Reading98Z	.896	.037	.897	23.929	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.956	.913	.903	3.1041

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	12538.041	14	895.574	92.944	.000
Residual	1194.821	124	9.636		
Total	13732.863	138			

Appendix Table A-11. Dependent Variable: Science 98Z

Coefficients

Independent Variables	Unstandardized Beta	Standard. Error	Standardized Beta	t	Probability
(Constant)	26.062	24.196		1.077	.142
ECTOTZ	.019	.044	.019	.443	.329
ECADJZ	.037	.042	.037	.870	.193
EATOTZ	-.009	.034	-.009	-.260	.398
SuspensionZ	-.088	.050	-.086	-1.750	.042
Attendance96Z	-.010	.068	-.010	-.146	.442
Mobility96Z	-.020	.037	-.020	-.526	.299
F/R Lunch96Z	-.000	.051	.000	-.004	.493
African American	.141	.196	.367	.716	.238
Asian	.215	.211	.113	1.016	.156
Hispanic	.136	.198	.236	.685	.248
White	.183	.208	.328	.880	.190
Elementary	14.673	1.929	.627	7.607	.000
Middle School	4.342	1.616	.146	2.686	.004
Reading98Z	.542	.037	.542	14.710	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.957	.916	.906	3.0580

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	12641.433	14	902.959	96.559	.000
Residual	1159.570	124	9.351		
Total	13801.003	138			

Appendix Table A-12. Dependent Variable: Social Studies 98Z

Coefficients

Independent Variables	Unstandardized Beta	Standard Error	Standardized Beta	t	Probability
(Constant)	-11.093	33.331		-.333	.370
ECTOTZ	.045	.061	.045	.738	.231
ECADJZ	-.032	.058	-.032	-.544	.294
EATOTZ	.028	.047	.028	.610	.272
SuspensionZ	.001	.069	.000	.007	.492
Attendance96Z	.043	.093	.043	.457	.324
Mobility96Z	-.057	.051	-.057	-1.110	.134
F/R Lunch96Z	.056	.071	.056	.790	.216
African American	.165	.271	.429	.608	.272
Asian	.292	.291	.153	1.003	.109
Hispanic	.149	.274	.259	.546	.293
White	.233	.287	.416	.811	.220
Elementary	.412	2.657	.018	.155	.438
Middle School	.172	2.226	.006	.077	.470
Reading98Z	.844	.051	.844	16.622	.000

Model Summary

R	R Square	Adjusted R Square	Standard Error of the Estimate
.917	.841	.823	4.2124

ANOVA

	Sum of Squares	df	Mean Square	F	Probability
Regression	11597.251	14	828.447	46.688	.000
Residual	2200.277	124	17.744		
Total	13797.528	138			

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ABOUT THE COUNCIL

Founded in 1921 as The National Council on Schoolhouse Construction, The Council of Educational Facility Planners International (CEFPI) is recognized internationally for its leadership in planning, designing, constructing, equipping and maintaining educational facilities. CEFPI is a non-profit organization supporting its members' professional efforts to create world class educational facilities by fostering and disseminating best practices in school planning.

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CEFPI is the primary advocate and resource for planning effective educational facilities. We serve those who use, plan, design, construct, maintain, equip, and operate educational facilities.

CEFPI believes that:

- facilities impact the learning, development and behavior of the facility user;
- the planning process is essential for quality facilities;
- sharing and networking improves the planning process; and
- there is a standard by which to measure.

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