Classmates Count

A study of the interrelationship between socioeconomic background and standardized test scores of 4th grade pupils in the Madison-Dane County public schools

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CLASSMATES COUNT
Executive Summary

Since sociologist James Coleman's path-breaking *Equality of Educational Opportunity* (1966), educational researchers have examined the relationship between socioeconomic status and academic achievement.

Covering 4th graders in the 60 elementary schools in 16 school districts of Madison-Dane County, Wisconsin for the 1998-99, 1999-00, and 2000-01 school years, this new, cross-sectional analysis confirms the common findings of such research.

1. **The socioeconomic status of a school's pupil population was the primary factor that was related to academic performance as measured by standardized tests.** In the Madison-Dane County public schools, the percentage of each of the 60 schools' 4th grade test takers that were low income (that is, qualified for subsidized school meals) was highly correlated with the variation in school-by-school 4th grade passage rates at the Advanced and Proficient levels (that this study will characterize hereafter as "test scores"). Specifically, socioeconomic status accounted for

* 73% of the variation in reading scores;

* 64% of the variation in language scores;

* 71% of the variation in math scores;

* 76% of the variation in science scores; and

* 77% of the variation in social studies scores.

Measured at the level of the 16 school districts, variations in school inputs (educational expenditures per pupil, pupil-teacher ratios, federal revenues per pupil) were not statistically related to test scores. While not statistically significant because of the small number of observations (16 highly divergent school districts), the finding is confirmed by other research.

2. **The test scores of low-income pupils improved significantly the more they were surrounded by middle class classmates.** For every 1% increase in middle class classmates, the average low-income 4th grade pupil's test scores improved

* 0.64 percentage point in reading;

* 0.50 percentage point in language;

* 0.72 percentage point in math;

* 0.80 percentage point in science; and

* 0.74 percentage point in social studies.

In other words, the difference between a low income pupil's attending a school with 45% middle class classmates (e.g. Lincoln and Mendota Elementary Schools) and that pupil's attending a school with 85% middle class classmates (e.g. Crestwood and Northside Elementary Schools) would typically be *a 20 to 32 percentage point improvement in that low-income pupil's test scores.*

3. **A school's socioeconomic context matters far more for low-income pupils than for their middle class counterparts.** The statistical analysis did show a slight decline of middle class pupils' test scores as the percentage of low-income classmates increased. The rate of decline for middle class pupils was less than half the rate of improvement for low-income pupils.

However, that apparent decline in middle class pupils' performance most probably reflected the changing composition of the "middle class" in schools with increasingly higher percentages of low-income classmates. "Middle class" schools with very few low-income pupils had higher percentages of children from the highest income, largely professional households. In "middle class" schools with much larger numbers of low-income pupils, children from more modest "blue collar" households predominated. That was most likely the primary contributing factor to the apparent slow decline in middle class test scores and not any directly adverse effect of having more low-income classmates. Local performance levels never dropped below 70-75% of middle class pupils' achieving advanced and proficient levels under any socioeconomic circumstances in Madison-Dane County (which had *no* very high-poverty schools).

Summing up: Who the kids are is the key underlying condition influencing a school's academic performance level. Undoubtedly, given two schools with equal socioeconomic profiles, the children in the school with more resources (such as better trained, more experienced teachers;

smaller class sizes; an inspired principal; special services and enriched curricula, etc.) will outperform the children in a school with less resources. However, within the modest variations in resources in Madison-Dane County, what school boards provided was overwhelmed by differences in whom the neighborhoods sent to school.[1]

By contrast with most states, Wisconsin's school-by-school report cards distinguish between academic performance of low-income children and academic performance of middle class children within the same school. This study has shown that *classmates count.* Having low-income children attend school with higher numbers of middle class children substantially boosts low-income children's scores.

Overall, Madison-Dane County was less racially and economically segregated than most USA metropolitan areas and benefited from a strong economy – facts that were reflected in the enrollment patterns of its public schools. There were no elementary schools that enrolled more than 60% low-income children in 1998-99, 1999-00, and 2000-01.[2]

On the other hand, Madison's post-war suburbanization (even within its expanding city limits) has followed the typical pattern of new subdivisions targeted to narrowly defined income groups. Economic segregation has increased.

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[1] In Madison-Dane County, there was only a 28% differential in educational expenditures per pupil between the highest (Madison Metropolitan: $9,151) and the lowest (Mount Horeb: $6,594) and only a 19% differential in pupil-teacher ratios between the lowest (Madison Metropolitan: 10.9 to 1) and the highest (Mount Horeb: 13.5 to 1). Significantly increasing resources for disadvantaged children, however, may make little difference. The Dutch educational system spends 90% more money per pupil for disadvantaged immigrant children (mostly Turkish, Moroccan, and Surinamese) than it spends on middle class, ethnic Dutch children. After two decades, the Dutch Board of Audit concluded that there was no evidence that the extra spending had any appreciable impact on the generally low academic performance of disadvantaged minority children when they were isolated in majority minority schools.

[2] By contrast, of the 100 elementary schools in Milwaukee Public Schools, there were only 15 schools with fewer low-income pupils than Madison Metropolitan's most poverty-impacted school (Lincoln Elementary with an enrollment of 56.5% low-income pupils). District-wide, Milwaukee had 67% low-income pupils compared with Madison Metropolitan's 30% low-income pupils.

Housing policy *is* school policy. Where a child lives largely shapes a child's educational opportunities – not, as this study has demonstrated once again, in terms of how much money is spent but in terms of who the child's classmates (and playmates) are.

Economically segregated suburbs and city neighborhoods produce economically segregated neighborhood schools. Mixed-income neighborhoods produce mixed-income neighborhood schools.

To achieve more mixed-income neighborhoods, Madison-Dane County needs to change the "rules of the game" that govern the region's housing market. Inclusionary zoning is a proven policy tool elsewhere for achieving greater economic diversity within a region's neighborhoods. Optimally, such a policy should be in effect countywide. However, about half of the region's new housing starts each year occur within the expanding boundaries of the city of Madison. For the mayor and city council to adopt an inclusionary zoning ordinance (combined with continued annexations) would be a major step forward in creating a more socially just community with a more economically competitive future labor force.

INTRODUCTION

In 1966, sociologist James Coleman released his path-breaking study, *Equality of Educational Opportunity*. Sponsored by the then-US Office of Education, Coleman and his research team examined pupil, family, and school characteristics for over a million public school children in search of factors that were associated with academic success.

The Coleman Report concluded that the socioeconomic characteristics of a child and of the child's classmates (measured principally by family income and parental education) were the overwhelming factors that accounted for academic success. Nothing else – expenditures per pupil, pupil-teacher ratios, teacher experience, instructional materials, age of school buildings, etc. – came close. "The educational resources provided by a child's fellow students," Coleman summarized, "are more important for his achievement than are the resources provided by the school board." So important are fellow students, the report found, that "the social composition of the student body is more highly related to achievement, independent of the student's own social background, than is any school factor."[3]

For over three decades, educational researchers, including Coleman, have revisited, refined, and debated Coleman's original findings. There has been no more consistent finding of educational research that the paramount importance of a school's socioeconomic makeup on academic achievement. Summarizing the enormous body of research, the Century Foundation's Richard D. Kahlenberg writes

> "What makes a school good or bad is not so much the physical plant and facilities as the people involved in it – the students, the parents, and the teachers. The portrait of the nation's high poverty schools is not just a racist or classist stereotype: high-poverty schools are often marked by students who have less motivation and are often subject to negative peer influences; parents who are generally less active, exert less clout in school affairs, and garner fewer financial resources for the school; and teachers who tend to be less qualified, to have

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[3] Quoted in Richard D. Kahlenberg. *All Together Now: Creating Middle-Class Schools through Public School Choice.* Brookings Institution Press: Washington, DC. (2001), page 28. Kahlenberg's 33 pages of footnotes to chapters 3 and 4 catalogue most major studies on the effects of racial and economic school integration.

> lower expectations, and to teach a watered-down curriculum. Giving all students access to schools with a core of middle class students and parents will significantly raise the overall quality of schooling in America."[4]

I highlighted the interrelationship of housing patterns, economically segregated schools, and academic performance in my address to the "Nolen in the New Century" conference, focused largely on land use issues, held in Madison last September.[5] My remarks included my finding that for the 29 elementary schools in the Madison Metropolitan School District "one fact – the percentage of each school's pupils that qualify for subsidized lunches – accounts for 73% of the variation in fourth grade reading scores."

"I have no doubt that similar findings would apply to math, science, social studies and, above all, language skills," I continued. "And I believe that the relationship would be even stronger after factoring in suburban elementary schools."

Stimulated by these observations, the sponsors of last fall's land use conference commissioned this more complete analysis of public schools in Madison-Dane County. They were particularly intrigued by my comments that "educational researchers also consistently find that poor children learn best in middle class schools. And middle class children do well no matter how many low-income classmates they have until a school begins to approach having a majority of low income children." Would this indeed be the case in Madison-Dane County?

Admittedly, I undertook this study with an already publicly expressed point of view and a policy reform – inclusionary zoning – that I had already proposed. To bring greater expertise and objectivity to bear, I have invited Duncan Chaplin to be my collaborator. Duncan is Senior Research Methodologist for the Education Policy Center of The Urban Institute, the highly respected, Washington, DC-based think tank. He has reviewed and refined, where needed, my analysis.

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[4] *Op. cit.*, page 47.

[5] See my article, "The Key to Good Schools? Housing Policy" in *Isthmus*, November 25, 2001, pages 8-9, that was based on my conference remarks.

Part I: Background

a. Regional Profile

Madison-Dane County has a lot going for it. It is Wisconsin's state capital and home to the 40,000-student University of Wisconsin. State capitals and college towns have done well over the past fifty years. Madison, of course, is both.

From 1950 to 1990, the Madison metro area (Dane County) grew 117% in population, exceeding the 90% growth rate of the USA's 320 metro areas. During those same years, real family incomes (adjusted for inflation) grew 135% for Madison-Dane County, exceeding the national metropolitan growth rate of 128% in real family income. Indeed, among 92 metropolitan areas in what I call the "Industrial Heartland," Madison-Dane County ranked 12th in real family income growth, edging out Minneapolis-St. Paul (134%), the Midwestern pacesetter, and only falling behind five other college towns, another state capital, two Twin Cities outliers, and Owensboro, KY (145%), Wausau, WI (147%), and Bloomington-Normal, IL (149%).[6]

During the 1990s, Madison-Dane County's population grew another 16.2% – again bettering the 13.9% growth rate for all metro areas and far outstripping the state of Wisconsin's population growth rate (9.6%). Median family income for Madison-Dane County rose from $41,529 in 1989 to $62,964 in 1999 – after adjusting for a decade's inflation, a solid 12.7% real increase compared with the USA's 5.6% real increase. Median family income in metro Madison was almost 26% higher than the USA's median family income ($50,046).

The Madison region's more rapid growth in real income reflected vigorous growth in jobs and a very tight job market by the end of the decade. The region's job supply expanded from 262,439 in 1989 to 341,551 in 1999 – a robust 30% increase compared to a 19% national growth rate. By 1999, the local unemployment rate had fallen to an incredibly low 1.4%!

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[6] The college towns were Columbia (University of Missouri – 185%), Lexington-Fayette (University of Kentucky – 175%), Iowa City, IA (Iowa State – 166%), Lawrence (University of Kansas – 165%), and State College (Penn State – 144%). The state capital was Springfield, MO (141%). (Real family income grew 137% in state capital regions as a group.) Rochester, MN (Mayo Clinic – 171%) and St. Cloud, MN (143%) were outlying satellites of the Twin Cities.

At the heart of the region's growth, of course, was the city of Madison. Fifty years ago the city itself virtually was the region. With 96,000 residents in 1950, the city may have been only 57% of the total county's population, but it was 87% of the so-called "urbanized population." The city limits (15 square miles) took in 60% of the "urbanized area" (25 square miles). City median family income was 9% higher than the countywide median (despite the presence already of substantial numbers of lower-income university students). In short, in 1950 Madison was a relatively compact city (6,237 persons per square mile) and a relatively well-off city located in the midst of rural county.

During the 1950s, the Madison area exploded outward as did everywhere else in America. Urbanized population grew 43%, but urbanized land area more than doubled (125%) to 55 square miles. Throughout succeeding decades, low-density sub-divisions, shopping centers and malls, and office parks continued to be the dominant growth mode. By 1990, though urbanized population had more than doubled (122%), the amount of land urbanized had almost quadrupled (299%).

Census 2000 has not yet released data on urbanized areas in order to assess the degree of sprawl during the 1990s. However, during the 1990s Dane County grew by about 60,000 more residents, but it lost about 57,000 acres of farmland. That's about one acre for each new resident – about three times the amount of land consumed for each additional resident during the previous four decades.

In many circumstances, such sprawling development would have doomed the core city, especially in a region like Dane County that is divided into many "little box" governments (24 municipalities and 34 townships besides the "Big Box" city of Madison).

However, three factors allowed the city to be "elastic" – that is, to annex much of the new growth: 1) Madison was not totally surrounded by incorporated suburban municipalities (unlike Milwaukee by the 1960s onward); 2) townships in Wisconsin were relatively weak politically and hence legally (by contrast with townships in Michigan and Pennsylvania); and, as a result, 3) Wisconsin's annexation procedures were relatively liberal and workable (unlike all of New England, New Jersey, New York, and Pennsylvania where altering municipal boundaries was impossible).[7]

Thus, through steady annexation, Madison expanded its municipal territory from 15 square miles in 1950 to 69 square miles today. The city captured over 70% of the net growth of the urbanized population, expanded its tax base, and maintained relative income parity with its suburbs. (The city's median family income was 95% of the county's median family income in 1990.) Madison maintains a blue-chip, AAA credit rating.

By any measure, Madison is a strong city, a desirable place to live, and the heart of a region with many economic advantages and successes.

And yet Madison-Dane County has not been exempt from divisions by race and class that have been the scourge of American society. Race was virtually a theoretical issue at mid-century; Dane County's "non-whites" constituted a minute six-tenths of one percent (0.6%) of the total population. The county's minorities grew steadily, however, drawn, in part, by a great university. Table 1 summarizes Madison-Dane County's racial and ethnic profile by 2000. Madison-Dane County (13%) was still less diverse than either metro Milwaukee (26%) or the typical USA metro area (25%).

Table 1
Racial Composition of Madison-Dane County in 2000

	Madison	Milwaukee	metro USA*
Black	**4.6%**	**16.0%**	**10.9%**
Hispanic	**3.4%**	**6.3%**	**9.9%**
Asian	**3.9%**	**2.4%**	**2.9%**
AmerIndian	**0.8%**	**0.9%**	**1.2%**

*** Non-weighted mean of 330 metro areas**

Source: Census 2000

Somewhat to my surprise, I found that in past decades Dane County's very small black population (still only 1.1% in 1970) was highly segregated. On a scale of 0 to 100 (with 100 = total apartheid), Madison-Dane County's segregation index was 85 in 1970. Almost one-quarter of the county's

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[7] See the author's *Cities without Suburbs*. Woodrow Wilson Center/Johns Hopkins University Press: Washington, DC and Baltimore (2nd ed., 1995) for a full discussion of urban "elasticity," comparing elastic" Madison and "inelastic" Harrisburg (pp 5-48).

African Americans lived in the Badger Road-Bram's Addition section. During the 1970s, however, the Civil Rights Act of 1968 and the city's fair housing ordinance, one of the USA's earliest, began having an impact. The black middle class scattered rapidly across a wider range of Madison neighborhoods, in a decade dropping the segregation index below 50. As Table 2 shows, however, it has not improved much since.

Table 2
Racial Segregation Indices for Madison-Dane County in 2000
(Scale: 0 to 100; 100 = total racial apartheid)

	Madison	Milwaukee	metro USA*
Black	**46**	**82**	**51**
Hispanic	**38**	**60**	**39**
Asian	**44**	**41**	**36**
AmerIndian	**na**	**na**	**na**

*** Non-weighted mean of 330 metro areas**

Source: Mumford Center at SUNY-Albany, based on Census 2000

However, if housing barriers based on race have been going down everywhere, barriers based on income have been going up. Jim Crow by income is replacing Jim Crow by race.

Table 3 shows the relative degree to which poor persons live "clumped together," set apart from the middle class. Using the same scale, Madison-Dane County's economic segregation jumped from 28 to 43 over a twenty-year period. (With so many temporarily poor college students,

Table 3
Economic Segregation Indices for Madison-Dane County 1970-90
(Scale: 0 to 100; 100 = total apartheid)

	Madison	Milwaukee	metro USA*
1970	**28**	**39**	**33**
1980	**na**	**46**	**35**
1990	**43**	**55**	**36**
2000	**na**	**na**	**na**

*** Non-weighted mean of 100 large metro areas**

Source: Alan Abramson et al. in* Housing Policy Debate. *Fannie Mae: Vol. 6:1 (1995)

the Madison index is based on segregation of poor families.) By comparison, the highest level of economic segregation in the USA was found in metropolitan Milwaukee-Waukesha (55).

What was the trend in the past decade? Until the release of income and poverty data from Census 2000 this summer, we cannot know for sure. One proxy, however, is school enrollment trends. Since my visit to Madison last fall, I completed a study of racial and economic trends in all the USA's public elementary schools.[8] It was based on data provided by the National Center for Educational Statistics that are, in turn, submitted annually by most (but not all) state education agencies. As such, the data were invariably subject to reporting errors, omissions, and inconsistencies. Nevertheless, averaging data over three-year periods generally yields reliable indications of trends.

Table 4 shows that the percentage of minority pupils in local public elementary schools grew steadily from 11% in 1989-91 to 21% in 1997-99. Blacks, Hispanics, and Asians all almost doubled their proportion of public school enrollments during the decade. This tracked the national trend. Not only was the USA becoming more diverse, but birth rates among whites continued to fall much faster than among minority families.[9] It is also noteworthy that, despite the Madison region's economic prosperity, the

Table 4
Socioeconomic Percentages for Madison-Dane County Elementary Schools

	1989-91	**1993-5**	**1997-99**
Black	**6.0%**	**8.5%**	**11.4%**
Hispanic	**1.8%**	**2.5%**	**3.4%**
Asian	**3.0%**	**4.2%**	**5.7%**
AmerIndian	**0.4%**	**0.5%**	**0.6%**
White	**88.8%**	**84.3%**	**78.9%**
Low-Income	**10.4%**	**11.6%**	**14.1%**

Source: author's study from data provided by National Center for Education Statistics

[8] The Century Foundation Task Force on the Common School. *One Nation: Economic and Racial Integration Today, Tomorrow, and Forever – The Neglected Core of the Education Debate.* The Century Foundation: New York, NY (forthcoming).

[9] By decade's end California, Texas, New Mexico, Mississippi, and Hawaii were majority minority at the elementary school level.

percentage of low income pupils increased steadily throughout the 1990s.

Table 5 summarizes the segregation indices for Madison-Dane County's elementary schools. Segregation declined steadily for blacks (primarily African Americans, but undoubtedly including some black immigrants from the Caribbean, Central America, and Africa). The indices rose slightly for Hispanics, reflecting an initial tendency for immigrants to bond together. The indices for Asians, though stable, were quite high – a function perhaps of the large number of Hmongs from Laos among Madison's Asian population.

Table 5
Segregation Indices for Madison-Dane County Elementary Schools
(Scale: 0 to 100; 100 = total apartheid)

	1989-91	1993-5	1997-99
Black	**55.8**	**53.5**	**49.4**
Hispanic	**38.8**	**40.8**	**42.0**
Asian	**56.0**	**52.0**	**54.4**
AmerIndian	**47.2**	**44.1**	**35.5**
Low-Income	**34.8**	**33.0**	**31.6**

Source: author's study from data provided by National Center for Education Statistics

Most encouraging, however, is the slight downward trend indicated for economic segregation. If accurate, that may portend a leveling off or even downturn in the region's general trend toward greater economic segregation in its regional housing market.

b. School Profile

As is the case for local government, responsibility for public education in Madison-Dane County is divided among one "Big Box" (Madison Metropolitan School District) and 15 suburban and rural "little boxes."

Madison Metropolitan, of course, is not truly "metropolitan" in scope.[10] Though not all of the city of Madison lies within the school district, Madison Metropolitan also serves portions of Madison township and the city of Fitchburg, and the villages of Maple Bluffs and Shoreham Hills

[10] Only unified, countywide school districts in single county metropolitan areas, such as Miami-Dade County, Florida, are truly metropolitan school districts.

that are surrounded by the city. However, Madison Metropolitan is "metropolitan" in the sense that, in Webster's definition, it "knows, or has the characteristic attitudes and manners of a metropolis" – that is, it is diverse and varied.

Table 6 characterizes the distribution of students by different characteristics based on 4th graders who took the battery of standardized state tests in 2000-01. Enrolling only 35% of the county's pupils, Madison Metropolitan had more than twice its proportionate share of blacks, Hispanics, Asians, and pupils with Limited English Proficiency. In addition, Madison Metropolitan had more than twice its proportionate share of low income pupils (72%) although the 15 suburban and rural schools districts had substantial numbers as well. Only in the distribution of pupils with disabilities did Madison Metropolitan and the 15 other districts approach their proportionate shares.

Table 6
Distribution of 4th Graders* among Madison-Dane County Elementary Schools by Different Characteristics in 2000-01

	Total	Madison	All Others
Total	**5,057**	**35%**	**65%**
Minority	**844**	**78%**	**22%**
Black	**409**	**81%**	**19%**
Hispanic	**184**	**71%**	**29%**
Asian	**225**	**81%**	**19%**
AmerIndian	**26**	**46%**	**54%**
with disabilities	**719**	**44%**	**56%**
Limited English Proficiency	**194**	**87%**	**13%**
Low Income	**796**	**72%**	**28%**

Note: * Based on those who took 4th grade state test battery

Source: author's study from school district report cards on Internet

Table 7 characterizes the mix of 4th graders in a "typical" school (that is, based on district-wide enrollment figures). By contrast with the typical suburban/rural school, a typical 4th grade classroom in Madison Metropolitan would appear to be very diverse both ethnically (62% white, 19% black, 7% Hispanic and 10% Asian, leading to 10% LEP pupils) and economically (67% middle class, 33% low income).

In reality, of course, the distributions were somewhat more skewed within Madison Metropolitan's 29 elementary schools. In 2000-01 nine schools were "majority minority" (Allis, Glendale, Hawthorne, Lake View, Lincoln, Lindburgh, Midvale, Mendota, and Shorewood Hills), while five had less than 20% low income pupils (Elvehjem, Gompers, Kennedy, Orchard Ridge, and Van Hise).

Table 7
Composition of a Typical 4th Grade*
in Madison-Dane County in 2000-01

	Madison	**All Others**
White	**62%**	**94%**
Minority	**38%**	**6%**
Black	**19%**	**2%**
Hispanic	**7%**	**2%**
Asian	**10%**	**1%**
AmerIndian	**1%**	**1%**
with disabilities	**18%**	**17%**
Limited English Proficiency	**10%**	**1%**
Low Income	**33%**	**9%**

*** Based on those who took 4th grade state test battery**

Source: author's study from school district report cards on Internet

Overall, however, Madison Metropolitan was comparatively balanced in the distribution of its pupils. *Most remarkably, there was no school with more than 60% low income pupils – a circumstance I have not encountered in a dozen other similar studies.*[11]

[11] By contrast, only 21 of Milwaukee Public Schools' 100 regular elementary schools had *less* than 60% low income pupils.

Part II: Study Methodology

a. School Report Cards

Under the WINSS program (Wisconsin Successful Schools), the Wisconsin Department of Public Instruction publishes of Public Instruction publishes annual “report cards” for every public school on the Internet annual “report cards” for every public school. They are treasure troves of information. They are available to any parent, student, or member of the public, and I have relied on these reports exclusively for this study. However, though data are summarized at the state and individual school district levels, compiling the data for a multi-school study like this one requires considerable dedication and patience. Unlike the state of Connecticut’s school report card system, one cannot simply order up customized spreadsheets over the Internet.[12]

Most states now issue annual school report cards. Wisconsin’s data, however, offer a rare opportunity for researchers. In addition to providing overall test scores for each school’s pupil population, WINSS data break down results by different categories of pupil characteristics – by gender, by race and ethnicity, by disability status, by Limited English Proficiency (LEP), and, most importantly for this study, by general economic status.

Out of all the potential information, I culled out what I believed to be the most insightful items for this inquiry. The study goals were three-fold:

1) to analyze the relationship between pupils’ socio-economic status (as measured by eligibility for subsidized school meals) and standardized test scores and compare this relationship with other possible factors influencing pupil academic achievement;

2) to analyze the impact of different percentages of middle class classmates on test scores of low income pupils; and

3) to analyze the impact of different percentages of low income classmates on test scores of middle class pupils.

The study had the following parameters:

[12] For this report, I hand copied from web pages and entered onto spreadsheets over 11,000 data items.

1) The study focused on 4th grade standardized test scores. Standardized tests were also given at the middle school (8th grade) and high school (10th grade) levels. However, I excluded middle school and high school results for two reasons. First, there would be many fewer middle and high schools than elementary schools, reducing the statistical reliability of any findings at the secondary school level. Second, though the proportion of pupils applying for subsidized meals in middle schools usually tracks eligibility at the elementary school level, across the USA the proportion of high school students receiving subsidized meals drops off sharply. Some analysts have speculated that many parents may have progressed to higher income levels by the time their children reach high school. I believe the reasons are simpler. Many teenagers hate cafeteria food and, with some money in their pockets (often from after-school jobs) and with the option of going to a nearby MacDonald's, they pass up subsidized lunches. Also, many may not want to be stigmatized as being poor in the eyes of their peers.

2) What I referred to as test "scores" were, to be precise, the percentage of test takers who met the minimum standards for achieving "advanced" and "proficient" status. Under WINSS, "advanced" and "proficient" were deemed acceptable levels, while "basic" and "minimal" were judged unacceptable, requiring remedial action. Publicly available WINSS data did not allow determining by how much the average student exceeded the minimum threshold for each level. In that sense, these "test scores" differed from scores on SAT and ACT college entrance exams or on other nationally standardized tests like the Comprehensive Test of Basic Skills (CTBS) or the Iowa Test of Basic Skills (ITBS) that provide more fine-tuned academic assessments.

3) The study was limited to tests taken in February 1999, February 2000, and February 2001. Though a fourth set of scores was available for 1997, those tests were taken in September, shortly after pupils returned from summer vacation. The 1997 scores were from 7 to 28 points below

the three-year averages of 1999-2001.[13] Thus, for lack of comparability, I excluded the 1997 data.

4) I calculated averages for the three years of data both for test scores and for matching pupil characteristics. Test scores (particularly among young children) are notorious for their wide variations from year to year and from subject matter to subject matter.[14] Averaging smoothed out some of the variations. Thus, this study did not evaluate short-term trends over a three-year period but used the averages of three years of data for cross-sectional analysis.

5) Though I analyzed pupil characteristics for all elementary schools for all grades, the study categorizes school populations solely by the characteristics of those 4th graders who took the battery of tests in a given year. (There was a 0.89 correlation, for example, between the school-wide percentage of low income pupils and the percentage of low income pupils among 4th grade test takers.)

6) "Averages" were non-weighted means (e.g. three years of test scores added together and divided by three). Late in the study, I ran samples of weighted means for reading scores (e.g. weighted by the number of test takers each year) and essentially found that weighted means had minimal impact on statistical outcomes. Thus, I did not try to derive weighted means for all data and to redo dozens of calculations.

7) In order to maintain the confidentiality of results for individual pupils, it was WINSS policy to suppress test score results when the number of pupils in a given category was five or less. This was certainly an understandable and defensible policy, but it meant that for 4th grades with very small numbers of black or disabled or low-income, etc. test takers, test results were unavailable both for the small

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[13] The gaps were: reading (1997: 75%; 1999-01: 82%); language (1997: 44%; 1999-01: 72%); math (1997: 60%; 1999-01: 76%); science (1997: 73%; 1999-01: 85%); and social studies (1997: 68%; 1999-01: 85%) .

[14] For example, in 1994-95, the Urban Institute and I studied the relationship between economic status and test scores for 1,108 children from public housing households in the Albuquerque Public Schools. There was only a 0.51 correlation between a typical public housing child's 3rd grade reading scores and the same child's 5th grade reading scores.

> minority *and for the large majority*. Thus, one of the study's central hypotheses – that low-income pupils learn best in middle class schools – was somewhat hampered by the unavailability of data for a "best-case" scenario (when low-income pupils were typically less than 10 percent of 4^{th} grade test takers).

Finally, there were two notable data shortcomings of WINSS report cards. First, and most important, they did not allow cross-tabulating pupil characteristics. For example, WINSS reported what percentage of pupils were white and what percentage of pupils were low income, but one could not derive what percentage of pupils were low income whites.

Second, data on school inputs (as contrasted with pupil characteristics) were presented only at the school district level. Thus, I could analyze the relationship of expenditures per pupil, pupil-teacher ratios, etc. only at the level of the 16 school districts – such a small and over-generalized data set as to be statistically unreliable.

b. Statistical Method

Except as otherwise noted, the primary statistical method used was linear, least-squares regression analysis. Linear regression measures to what degree a dependent (or *y*) variable was related to an independent (or *x*) variable. Relating a dependent variable to multiple independent variables is termed "multi-variate analysis;" each of the independent variables acts as a "control" for the others.

The strength of the relationship is measured by the *adjusted r-square*. If the value of the adjusted r-square is 1.00, that means that changes in the independent variable (*x*) will always produce the same proportional changes in the dependent (*y*) variable. In simple terms, the closer the adjusted r-square approaches 1.00, the more the independent variable "explains," "accounts for," or "is correlated with" the dependent variable. For example, the adjusted r-square between the average (*non-weighted* percentage of low income 4^{th} graders in 113 Milwaukee elementary schools and the average (*weighted*) percentage of 4^{th} graders in 113 Milwaukee elementary schools was .997; variations in one produced almost identical variations in the other.

At the other extreme, if the adjusted r-square is 0.00, that means that there is no relationship between changes in *x* and changes in *y* – the two variables have no relationship to each other. There is no "correlation."

If one depicts an array of data on a two-axis scatter plot and there is a measurable degree of correlation, the data points will tend to group around an imaginary straight line running through the data points that can be drawn based on least-squares linear regression. If the data points are grouped closely above and below the line, there is a high degree of correlation. If they are scattered widely above and below the line, the correlation is low.

The *coefficient estimate* measures the degree to which a unit change in *x* (the independent variable) produces a change in the value of *y* (the independent variable). Suppose, for example, that *x* is a school's percentage of low income 4th graders and *y* is the school's average 4th grade reading score (that is, the percentage of 4th graders that achieve proficient or advanced levels). If the coefficient estimate of *x* is -0.59, then every 1% increase in the percentage of low income 4th graders will be associated, on average, with a 0.59 percentage point decline in the school's reading score.

A positive sign for the coefficient estimate means that changes in the *x* variable are related to changes in the *y* variable in the same direction: a higher *x* produces a higher *y* – a lower *x* produces a lower *y*. A negative sign for the coefficient means that changes in *x* are associated with changes in *y* in the opposite direction: a higher *x* means a lower *y* – a lower *x* means a higher *y*.

The *standard error* of a coefficient estimate can be used to calculate a confidence region around the coefficient estimate. The commonly sought 95% confidence region, for example, is the region within 1.96 standard errors of the coefficient estimate. Roughly speaking, the confidence region is the area within which the true coefficient is likely to lie with 95% confidence. (The exact definition is far more complicated.)

Good researchers normally focus their discussion of results on coefficient estimates that are statistically significant. These are coefficient estimates that have t-statistics (the coefficient estimate divided by the standard error) that are more than 1.96. Focusing on coefficient estimates this large reduces (in reverse English) the probability of incorrectly saying that there is an effect of x on y to less than 5%. Focusing on even larger coefficient estimates (say, with t-stats over 2.57) reduces this probability to less than 1%. Looking at smaller coefficient estimates (those with t-stats as low as 1.64) increases the probability to 10%. In the tables presented, we denote t-stats over 1.64 with *; over 1.96 with **; and over 2.57 with ***.

The standard error reflects both the number of observations (*n*) and the degree to which the data points are scattered tightly or loosely around the regression line. In general, the more tightly the data points are packed around the regression line and the larger the number of observations, the smaller is the standard error. The more widely the data points diverge from the regression line and the smaller the number of observations, the larger is the standard error. The standard error, in effect, expresses mathematically what can otherwise be seen graphically in a scatter plot.

The next section analyzes data for only 16 school districts (that is, *n* equals 16). *These results are statistically suspect.* Later sections deal with observations from 60 and 55 elementary schools in Madison-Dane County (that is *n* equals 60 or 55). Those results will be much more reliable.

Part III: Pupil Factors or School Factors?

Key Factors at the School District Level

Analyzing data summarized at school district level is more statistically dubious than the proverbial comparison of apples and oranges. The mix of Madison-Dane County's 16 school districts ranged from a watermelon (Madison Metropolitan: 1,719 4^{th} graders) to a peach (Middleton-Cross Plains: 351 4^{th} graders) to a grape (Deerfield Community: 58 4^{th} graders). Yet all must be given equal weight because data on what might be called "school board inputs" were only provided at school district rather than at individual building level.

The WINSS report cards provided both totals and "per member" (that is, per pupil) information about school board inputs on:

Cost: current education cost; transportation and facilities cost; food and community services cost; and total cost for three years (1998-99 to 2000-01)

Staff: administration; aides/support/other; licensed staff; and total staff for five years (1996-97 to 2000-01)

Revenues: state; federal; local property taxes; local other revenues; and total revenues for three years (1998-99 to 2000-01).

In addition, the report cards provided a wealth of information about attendance and truancy; student participation in extra-curricular activities; student behavior (suspensions and expulsions, their causes, etc.); and dropout rates (that would have been relevant for assessing high school, but not elementary school, outcomes).

From this menu, I analyzed the relationship between 4^{th} grade test scores and those factors that were most clearly related to classroom activity (three-year averages were calculated in all cases). These were:

- current education cost per pupil as those costs most relevant to teaching (as contrasted with transportation and cafeteria expenditures);

- licensed full-time equivalent (FTE) staff per pupil as the closest data available to pupil-teacher ratios, though licensed staff included others such as superintendents, principals, librarians, counselors, and school nurses; and,

- federal revenues per pupil in order to verify that federal Chapter 1 funds were indeed targeted on low-income pupils and to see if they had any discernible impact on test scores.

In addition, I used district level data as a preliminary screen of the potential impact of "classmate inputs" dealing with the characteristics of a child's classmates (that is, disability, minority, and low-income status).[15]

Table 8 summarizes multi-variate regression analyses relating five dependent (*y*) variables to the six independent (*x*) variables. The five dependent variables were the three-year averages of 4th grade test scores in five subject areas.

Overall, though the number of observations (16 school districts) was low, *diminishing the statistical reliability of the findings*, the explanatory value of the six independent variables combined was quite high for four out of five cases. Adjusted r-squares ranged from a solid 0.588 for language scores to a very high 0.851 for science scores. Only the adjusted r-square for math scores (0.246) was quite low.

What were the relative contributions of the six independent variables?

School Board Inputs: On average, none of the three school board inputs came close to making a statistically significant contribution to explaining variations in the five test scores among the 16 school districts.

The coefficient estimates for education expenditures per pupil and federal revenues per pupil were minimal across the board. At the level of the 6 school districts there was no relationship whatsoever between these two variables and test results with one exception. Increasing per pupil expenditures by $1,000 had a statistically significant (but microscopic) effect of lowering science scores by 0.034 percentage points.

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[15] Analyzing 4th grade test scores by six different racial and ethnic groups, for example, would have required compiling an additional 6,000 data points on top of the 11,000 already gathered for this study. It was important to get a rough idea of what might be relevant factors to explore before making such a commitment of time and energy.

The average number of pupils per licensed staff (the "pupil-teacher ratio") was significantly related only to science and social studies scores (at 5% and 1% significance levels, respectively). All signs for the coefficient estimates, however, were in the right direction (that is, all negative). In layman's terms, the lower the pupil-teacher ratio, the higher the test scores. However, the impact on science and social studies test scores was insignificant. Lowering the pupil-teacher ratio from 12:1 to 11:1, for example, produced 0.029 and 0.021 percentage point improvements in science and social studies scores.

It should be noted that the variations in school board inputs among the 16 school districts fell within a relatively narrow range. There was only a 28% differential in educational expenditures per pupil between the highest (Madison Metropolitan: $9,151) and the lowest (Mount Horeb: $6,594) and only a 19% differential in pupil-teacher ratios between the lowest (Madison Metropolitan: 10.9 to 1) and the highest (Mount Horeb: 13.5 to 1).

The variation in federal revenues per pupil was much greater with the highest (Madison Metropolitan: $420 per pupil) being than three times as much as the lowest (Waunakee Community: $143 per pupil). Between Chapter I grants from the US Department of Education and school meal subsidies from the US Department of Agriculture, federal school aid was indeed targeted on needy pupils. There was a .73 correlation between FARM rates and federal revenues per pupil.

However, the dollar impact was small – amounting to barely 5% of total revenues even for Madison Metropolitan, the largest recipient of federal aid. As stated above, there was no significant statistical relationship between federal aid and test scores.[16]

These are not results that parents, school administrators, teachers unions, and business groups campaigning for higher spending on public schools want to hear. As I have noted repeatedly, based on only 16 observations (16 school districts of greatly unequal sizes), these results are

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[16] Significantly increasing resources for disadvantaged children may make little difference. The Dutch educational system spends 90% more money per pupil for disadvantaged immigrant children (mostly Turkish, Moroccan, and Surinamese) than it spends on middle-class, ethnic Dutch children. After two decades, the Dutch Board of Audit concluded that there was no evidence that the extra spending had any appreciable impact on the generally low academic performance of disadvantaged minority children.

statistically suspect. However, these findings generally conform to findings regarding impact on test scores from studies with much larger databases.[17]

Classmate Inputs: I have characterized three categories of enrollment characteristics as "classmate inputs."

Controlling for income and disability status, there was no correlation between minority status and test scores except in the case of the language scores (very weak – at the 10% significance level). Curiously, that sign was positive (that is, the higher the percentage of minorities, the higher the language test scores) – a result that was completely counter-intuitive. (I grouped all minorities together because many of the suburban and rural school districts had so few members from specific groups – blacks, Hispanics, etc. – that no scores would be recorded.)

Coefficient estimates for the impact of varying percentages of pupils with disabilities also fell well below the statistically significant level with the exception of a weak correlation with reading scores (-0.593 at the 10% significance level) and a stronger correlation with language scores (-0.989 at the 5% significance level). However, all signs were negative as would be expected (that is, the higher the percentage of 4th grade test takers with disabilities, the lower the district's test scores).

It was only when analyzing the impact of the percentage of low income pupils (FARM, or Free And Reduced price Meals-eligible) that we entered the realm of more consistently statistically significant relationships. With the exception of math scores (already mentioned above), the coefficient estimates for the other four subject matters were all statistically significant at the 1% significance level and all signs were negative as expected. In other words, the higher the percentage of low income test takers, the lower a school's 4th grade test scores.

Of the six independent variables, the only one that consistently had any explanatory power for district-by-district variations in test scores was the percentage of low income pupils.

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[17] Readers who would like general summaries of such studies may turn to a recent book, Gary Burtless, ed. *Does Money Matter*? *The Effect of School Resources on Student Achievement and Adult Success*. Brookings Institution Press: Washington, DC (1996).

Revisiting Pupil Characteristics

Before moving on to a closer examination of the income-test score relationship, we should take a further overview of the average test scores associated with various pupil characteristics.

Table 9 summarizes these results solely for Madison Metropolitan School District, which was the only district with significant numbers of 4th grade pupils in all categories (see table 6 on page 9). By contrast with the statistically suspect, district-level analysis above, Table 9 conforms to our more common perceptions and expectations.

Focusing just on the mean test battery scores, we find that little girls tested three points better than little boys. (I'll leave the explanation of that to mothers and teachers.)

Pupils with disabilities scored much lower (39%) than pupils without disabilities (79%). A similar gap existed between economically dis-advantaged pupils (45%) and non-economically disadvantaged pupils (83%).

As a group, white pupils had the highest pass rates (84%) with the different groups of minority pupils falling far below. Having Limited English Proficiency (score: 32% – the lowest of all categories) undoubtedly contributed to the low scores for Asians (55%) and Hispanics (49%). Blacks had the lowest pass rates of all (45%).

Poverty was certainly more prevalent among minority pupils. Though WINSS data prevented cross-tabulation, the 1990 census reported that the regional poverty rate among black children ages 5 to 17 was 45%; among Asian children, 36%; among Hispanic children, 15%; and among white children, only 4%.

Minority children were less than 9% of all children between the ages of 5 and 17 in 1990, but minority children were 45% of all poor children. The stunningly high poverty rates among black and Asian children, in particular, should be a matter of great concern to Madison-Dane County public officials and citizens.

Low income parents also typically have a higher proportion of children with disabilities because of inadequate pre-natal care, fetal damage (from drug and alcohol abuse), low birth weight, and inadequate pediatric care. Also, school districts are known to diagnose children whose problems are essentially cultural and behavioral improperly as “disabled” – sometimes in a well-intentioned effort to secure extra help for them.

All such factors – much greater poverty, a higher incidence of disabilities, limited English proficiency – must be borne in mind when assessing the test score gap between minority pupils and white pupils.[18]

We will now look at race, income, and disability status in more detail.

Correlation of Race, Income, and Disability and Test Scores

Analyzing pupil characteristics and test scores in 60 elementary schools rather than in 16 school districts greatly increases statistical reliability. Furthermore, though the WINSS data precluded cross-tabulating specific pupil characteristics (e.g. identifying low income white pupils, etc.), we could establish general correlations among different characteristics.

Table 10 demonstrates that, as foreshadowed by the preceding paragraphs, there was a very high correlation (0.828) between the percentage of minorities and the percentage of low income pupils in the 60 elementary schools. The correlations between low income and disability status (0.295) and minority and disability status (0.191) were much lower but still at highly statistically significant levels.

Table 10
Correlations among Low Income (FARM), Minority, and Disabled Pupils in 60 Madison-Dane County Elementary Schools

	***Y* = FARM *X* = Minority**	***Y* = Disabled *X* = FARM**	***Y* = Disabled *X* = Minority**
Adjusted r-square	**0.828**	**0.295**	**0.191**
Coefficient estimate	**0.083*** **	**0.220*** **	**0.158*** **
Standard Error	**0.059**	**0.047**	**0.050**

* = <0.10% level of significance ** = <0.05% level of significance *** = <0.01% level of significance

[18] Nationally, controlling for income, there is still a significant test score gap between African Americans and European Americans. For a discussion of the complex socio-cultural factors that seem to create this gap, see Christopher Jencks and Meredith Phillips, *The Black-White Test Score Gap*. Brookings Institution Press: Washington, DC (1998).

Table 11 disaggregates the relationship between minority and low income status into the different racial groupings.[19] Just as black children had the highest poverty rate (45%) in the 1990 census, among all minority groups there was the highest correlation between percentage of black 4th graders and percentage of low income 4th graders (0.745). With lower poverty rates among Asian children (36%) and Hispanic children (15%), the correlations between Asian and Hispanic 4th graders and low income 4th graders was correspondingly lower (0.339 and 0.366, respectively).

Finally, white children had a very low poverty rate (4%). With white pupils constituting 85% of all 4th graders, the correlation between percentage of white 4th graders and percentage of low income 4th graders was the highest of all (0.828) – *but inverse*. The higher the percentage of white 4th graders, the lower the percentage of low income 4th graders.

It is notable that a 1% increase in minority pupils from each category (black, Asian, Hispanic) produced a *more than* 1% increase in percentage of low income pupils. That indicates that minority pupils are clumped together in the same schools across racial groups – as indeed they are (that is, most are in certain Madison Metropolitan schools). Thus, a 1% increase in black pupils will typically be associated with increased percentages of Asian and Hispanic pupils as well, leading to a cumulatively greater increase in low income pupils. (The converse is true in the overwhelmingly white suburban and rural schools.)

Table 12 relates the basic categorization of 4th graders to their average test scores. The three factors (poverty status, disability status, and minority status) had a highly explanatory power across all five tests. Correlations between pupil characteristics and test scores ranged from 0.756 for the language test to 0.856 for the social studies test. Both the percentage of low income 4th graders and the percentage of 4th graders with disabilities were strongly – and negatively – correlated across all five tests.

However, Table 12 indicates that minority status was *not* correlated with test scores in reading, language, and math when outcomes were controlled for income and disability status as well. As we saw in the district-level analysis, there were correlations between minority status and

[19] I have omitted any further discussion of American Indians in the report because there were only 24 American Indian 4th graders among all 60 elementary schools.

science scores (coefficient estimate: -0.199**) and (weaker) between minority status and social studies scores (coefficient estimate: -0.134*).

What could be happening is that, since schools with high percentages of minorities also have high percentages of both low income pupils and Limited English Proficiency pupils, teachers are devoting more classroom time to basic reading, language, and math skills and correspondingly less to science and social studies. Thus, being exposed substantially less to these subjects, minority pupils score lower in science and social studies even when their socioeconomic status is controlled for income and disability.

Table 13 zeroes in on the single factor of low income status and its impact on test scores. The explanatory power of this one factor alone was very powerful; the correlations ranged from a low of 0.642 for the language test to a high of 0.772 for the social studies test. Coefficient estimates were all highly significant statistically (that is, the probability that the observed relationship was false was less than 1%). Moreover, all signs were negative, indicating a negative correlation on all five tests. The higher the percentage of low income 4^{th} graders, the lower a school's 4^{th} grade test scores. And the standard errors were relatively narrow. As a linear relationship, for every 1% increase in a school's percentage of low income 4^{th} graders, the school's average test scores declined from 0.60 percentage points (science) to 0.73 percentage points (math).

This information is depicted graphically on Charts 11 through 15 in scatter plot format. Each chart covers one subject area. The horizontal axis measures each school's percentage of low income pupils, rising left to right from lower percentages to higher percentages. The vertical axis measures the percentage of each school's pupils that attained advanced or proficient levels, rising bottom to top as success increases. Each of the 60 schools' data is located on the scatter plot as indicated by the blue diamond. The regression line slopes downward from left to right, indicating that as the proportion of low income pupils increased, the school's test scores declined. The individual schools' data are closely grouped around the regression line, indicting a high degree of correlation.

In practical terms, what does this mean? It means that in Madison-Dane County, by simply knowing one fact – the percentage of a school's 4^{th} graders that qualify for subsidized meals – , one can predict the percentage of a school's 4^{th} graders that pass different tests at Advanced and Proficient levels (plus or minus four, five, or six percentage points) with a high degree of confidence. One doesn't need to know anything about the principal's background, teacher qualifications, pupil-teacher ratios, dollars spent per pupil, or other school inputs. Knowing who the kids are, as measured by this crude indicator of family economic status, is sufficient to predict very accurately whether a school is generally seen as "successful" or "unsuccessful" by the community at large.

* * *

Summing up Part III: The statistical evidence summarized by the six tables presented in this section should send a clear message. **The socio-economic status of a school's pupil population is the primary factor that is related to academic performance as measured by standardized tests.**

In the Madison-Dane County public schools, the percentage of each of the 60 schools' 4th grade test takers that were low income (that is, qualified for subsidized school meals), was highly correlated with the school-by-school variation in 4th grade passage rates at the advanced and proficient levels. Specifically, socioeconomic status accounted for

* 73% of the variation in reading scores;
* 64% of the variation in language scores;
* 71% of the variation in math scores;
* 76% of the variation in science scores; and
* 77% of the variation in social studies scores.

Measured at the level of the 16 school districts, variations in school inputs (educational expenditures per pupil, pupil-teacher ratios, and federal revenues per pupil) were not statistically related to test scores. While statistically dubious because of the small number of observations (16 highly divergent school districts), this finding is confirmed by other research.

Part IV: Impact of Middle Class Classmates on Low Income Pupils

Cautionary Note: Limitations of the Data

In this section I shall explore the second hypothesis: Did the test scores of low income pupils improve as they attended progressively more middle class schools in Madison-Dane County?

Initially, however, I must note some data problems.

1) Test scores for young children are subject to great variability. In my study of academic results for 1,108 public housing children in the Albuquerque Public Schools, there was only a 0.51 correlation between 3rd and 5th grade test scores for the same pupils. Within a two-year span, the same child's test performance could vary widely. The smaller the universe tested, the greater the variability.

2) There were relatively few low income pupils in Madison-Dane County's elementary schools. Over the three-year period (1998-99 to 2000-01), the number of FARM-eligible 4th graders averaged 634 children (15.5% of all 4th graders).

3) WINSS policy is to suppress data when there are only five or fewer members of a designated group. As a result, there were no data available whatsoever on test scores of FARM-eligible 4th graders for eight elementary schools, reducing the pool of observations to 52 schools. However, I was able to create three "composite schools" where I could combine data for several elementary schools within the same school district, raising the pool to 55 schools.[20]

4) Because of WINSS policy, only one year's data was available for 10 schools, and only two years' data was available for 17 schools. Barely half of the universe studied (28 schools) had three years' of test scores available. One-year and two-year averages were slightly more variable than three-year averages.

[20] The "composite schools" were Core Knowledge=Country View-New Century in the Verona Area district and Elm Lawn-Northside-Sunset Ridge-(West Middleton) in the Middleton-Cross Plains district.

5) Even when data were available, the number of low income pupils tested was small. The following table indicates the range of numbers of low income 4th grade test takers for each year studied.

Table 14
Distribution of Low Income 4th Grade Test Takers among 62 Elementary Schools in Madison-Dane County

No. of Pupils	2/99	2/00	2/01
0-5	20*	22	21
6-10	20	19	22
11-15	12	9	7
16-20	4	6	3
21-25	3	3	3
26 or more	3	3	6

*** includes three schools where 100% of low income pupils passed tests**

With such a limited and highly variable data base for low income pupils, statistically we must expect low explanatory values (i.e. adjusted r-squares) and high standard errors.

The evidence regarding the impact of middle class classmates on low income pupils' test scores in the 55 schools will be presented in three ways: by grouping scores, by linear regression analysis, and by scatter plot.

The Evidence: Grouping Scores

Table 15 groups the average test scores of low income pupils by the percentage of middle income classmates in their classes (an approach that tends to average out wide variations in test results that occurred).

There was a steady progression of test scores upward in all subject areas. For example, only 45% of low income pupils in the two schools with only 40% to 49.9% middle class classmates (Mendota and Lincoln in the Madison Metropolitan School District) achieved advanced and proficient (A & P) reading scores. Low income pupils' success rates moved rather steadily upward to a 68% A & P level in the 15 schools where they had 90% to 99.9% middle class classmates.

The progression is further smoothed if we eliminate the two poorest schools as too small a grouping (n = 2) and further omit Thoreau Elementary whose low income pupils had extraordinarily low scores though they had over 60% middle class classmates. The progression of low income pupils' science test scores, for example, would then read 52%, 54%, 67%, 72%, and 82% as they attended progressively more middle class schools.

The Evidence: Linear Regression

Table 16 summarizes the results of the now-familiar linear regression analysis used in earlier sections.

As forewarned, because of the high variability of test scores based on the low numbers of low income pupils tested and natural variability in young children's performance, "correlations" were low. The adjusted r-squares ranged from 0.163 (language) to 0.318 (science). These values were far below the range of values in table 13 (from 0.642 to 0.772).

The standard errors in Table 16 ranged from 0.146 (language) to 0.182 (math) – about three times larger than the standard errors in Table 13 that ranged from 0.044 (science and social studies) to 0.063 (language).

The difference was that, for example, in 1998-99, in Table 16 we were measuring the impact of an independent variable (percentage of middle class classmates) on test score results for only 513 low income 4^{th} graders scattered among 45 schools, or an average of 11 low income 4^{th} graders per school. In Table 13, for the same year, we were measuring the impact of an independent variable (percentage of low income 4^{th} grade test takers) on test scores results for all 3,982 4^{th} graders enrolled in 60 schools, or an average of 66 4^{th} graders per school. Test score variability averaged out much more among the larger group of pupils.

However, despite these statistical problems, what was most relevant for this study was that coefficient estimates in Table 16 were at the highest level of statistical significance for all tests, and all signs were positive. In other words, as the percentage of middle income classmates increased, average test scores of low income pupils also increased.

The coefficient estimates also tell us by how much average test scores of low income pupils should have increased. Table 16 shows that for every 1% increase in middle class classmates, the average low income 4^{th} grade pupil's test scores improved

* 0.64 percentage point in reading;

* 0.50 percentage point in language;

* 0.72 percentage point in math;

* 0.80 percentage point in science; and

* 0.74 percentage point in social studies.

The Evidence: Scatter Plots

Finally, the data are depicted on Charts 1 through 5 in scatter plot format. Each chart covers one subject area. The horizontal axis measures the percentage of middle class classmates, rising left to right from lower percentages to higher percentages. The vertical axis measures the percentage of low income pupils that attain advanced or proficient levels, rising bottom to top as success increases. Each of the 55 schools' data is located on the scatter plot as indicated by the red triangle.

Two phenomena are evident from these graphical illustrations.

1) The solid line drawn depicts the results of the regression analysis for each subject area presented in the previous section. It slopes upward from left to right, indicating that as the percentages of middle class classmates increased, low income pupils' test scores rose.

2) The individual school data are highly scattered with wide variations from the regression line. This indicates that the model does not predict outcomes with a high degree of certainty for any individual school (much less, of course, for any individual low income child).

Nevertheless, the results are consistent with other studies involving much larger numbers of low income pupils and schools, such as my study of 1,100 pupils from public housing families in Albuquerque Public Schools.

*   *   *

Summing Up Part IV: **The test scores of low-income pupils improved significantly the more they were surrounded by middle class classmates.**

For every 1% increase in middle class classmates, the average low income 4th grade pupil's test scores improved

* 0.64 percentage point in reading;

* 0.50 percentage point in language;

* 0.72 percentage point in math;

* 0.80 percentage point in science; and

* 0.74 percentage point in social studies.

In other words, the difference between a low income pupil's attending a school with 45% middle class classmates (e.g. Lincoln or Mendota) and that pupil's attending a school with 85% middle class classmates (e.g. Crestwood or Northside) would typically be *a 20 to 32 percentage point improvement in that low-income pupil's test scores.*

Part V: Impact of Low Income Classmates on Middle Class Pupils

In this section we shall explore the third hypothesis: Does a school's socioeconomic context matter far more for low income pupils than for their middle class counterparts?

The data constraints highlighted in the previous part are greatly ameliorated because we are dealing with a much larger number of pupils that are middle class (3,400 – 84% of all 4th grade enrollments – or 62 per school). Table 17 indicates the range of numbers of middle class 4th grade test takers for each year studied.

Table 17
Distribution of Middle Class 4th Grade Test Takers
among 62 Elementary Schools in Madison-Dane County

No. of Pupils	2/99	2/00	2/01
0-10	2	1	0
11-20	2	4	5
21-30	5	7	2
31-40	8	10	10
41-50	10	4	11
51-60	14	11	7
61-70	7	15	6
71-80	6	2	7
81 or more	8	8	13

Although the variability of individual pupil performance remains, with a larger data base, we can expect higher explanatory values (that is, adjusted r-squares) and lower standard errors. We shall present evidence of the affect of low income classmates on middle class pupils' test scores in the 55 schools in the same manner as in the previous part.

The Evidence: Grouping Scores

Table 18 groups the average test scores of middle class pupils by the percentage of low income classmates in their classes (again, an approach that tends to average out variations in test results).

There was some decline in test scores evident, though the decline was slight in schools where middle class pupils were heavily dominant. From schools where middle class pupils represent over 90% of total enrollment (that is, low income pupils were less than 10%) to schools where middle class pupils still constituted over 60% of total enrollment (that is, low income pupils were approaching 40%), the decline in the percentage of middle class pupils achieving advanced or proficient levels was

- only five percentage points on the reading exams (from 91% to 86%);
- only seven percentage points on the language exams (from 83% to 76%);
- only seven percentage points on the math exams (from 85% to 78%);
- only seven percentage points on the science exams (from 93% to 86%); and
- only six percentage points on the social studies exams (from 93% to 87%).

It appears that a more significant decline in middle class pupils' test scores occurred when the number of low income classmates exceeded the 40% threshold. (Once again, I am inclined to discount the statistics for the last category with 50.0% to 59.9% low-income pupils. Lincoln and Mendota, the only two schools in this group, both performed above expectations for both categories of pupils.)

The Evidence: Linear Regression

Table 19 indeed shows that for the larger universe of middle class pupils, the linear regressions indicated a more statistically significant correlation between middle class test scores and percentages of low income classmates. The adjusted r-squares were higher, ranging from 0.229 (reading) to 0.452 (social studies). Standard errors were much lower, ranging from 0.056 (science) to 0.080 (math) – less than half the standard errors calculated for projecting results for low income pupils.

The coefficient estimates were all negative and at the highest level of statistical significance. Table 18 would seem to show that for every 1% increase in low income classmates, the average middle class pupil's test scores declined

- 0.25 percentage point in reading;
- 0.33 percentage point in language;
- 0.41 percentage point in math;
- 0.28 percentage point in science; and
- 0.39 percentage point in social studies.

However, as I shall argue later, the crucial factor may be not primarily the presence of increasing levels of low income classmates but may be primarily changes in the composition of the middle class pupils themselves.

The Evidence: Scatter Plots

Charts 6 through 10 present the same data in scatter plot format for each subject area. In this instance, the horizontal axis measured the percentage of low income classmates, increasing the percentage as the scale moves from left to right. The vertical axis measured the percentage of middle class pupils that attained advanced or proficient levels, rising (as before) from bottom to top as success increased. Each of the 55 schools' data was located on the scatter plot as indicated by a green box.

Once again, the solid line drawn depicted the results of the regression analysis for each subject area. Data for individual schools were still widely scattered above and below the regression line – though not to the degree they were for low income pupils in Charts 1 - 5.

Thus, the analysis would indicate that middle class pupils' test scores were somewhat adversely influenced by rising percentages of low income classmates. The rate of decline for middle class pupils was less than half the rate of improvement for low income pupils. However, that observation would probably carry little weight with many middle class parents that are the great majority of families using Madison-Dane County's public schools.

However, were individual middle class children systematically being adversely affected? Or did the statistics really reflect the fact that there might have been not one, homogeneous middle class, but more finely differentiated income groups that clustered in different neighborhoods around different neighborhood schools? I will explore that issue next.

Deconstructing the Middle Class

WINSS data divide school populations into just two economic groups: those with family incomes low enough to qualify them for subsidized meals (FARM), and those with family incomes above the subsidy cut-off level.

To receive a totally free meal, a child's family income must fall below 125% of the federally-determined poverty income threshold; to receive a partially subsidized lunch, a child's family income must fall below 185% of the poverty threshold.

Unlike some states' school report cards, WINSS data did not distinguish between the two categories of relative need. All pupils receiving a subsidized meal were grouped together.

In Madison-Dane County, pupils designated "economically disadvantaged" (that is, FARM eligible) fell within the bottom 30% of the household income distribution. Pupils designated "not economically disadvantaged" (that is, non-FARM eligible) constituted the remaining 70% of the household income distribution.

As we tracked the test results for "middle class pupils" (that is, non-FARM eligible), the WINSS assumption was that middle class pupils are one homogeneous group. Was that really true?

Everyone's own life experience provides the answer: No. But school data did not differentiate. To get a more fine-tuned notion of the diversity of middle class pupils, we must turn to census data at the neighborhood level (in this case, 1990 census data since Census 2000 income data tract-by-tract have not yet been released).

Matching elementary school attendance zones with census tracts was not easy, especially for suburban and rural school districts. Thus, I tried to do so only for the 29 elementary schools within the Madison Metropolitan School District. Even that task was complicated. Many school shared portions of the same census tract, and I could not sub-allocate the data among them. The district also transported pupils from non-contiguous areas to some schools (e.g. Allis, Crestwood, Mendota, and Stephens).

However, I identified 11 elementary schools whose attendance zones reasonably matched census tracts in 1990. These were

High (42%) FARM: Emerson, Hawthorne, Lowell

Medium (29%) FARM: Schenck, Shorewood Hills

Low (11%) FARM: Elvehjem, Huegel, Kennedy, Orchard Ridge, Sandburg, and Van Hise

Using 1990 data, the cutoff for FARM was a household income of $16,100 for a hypothetical two-and-a-half person household (Madison's average for poor households in 1990). The 1990 census grouped household income in nine sets, ranging from "less than $5,000" to "$100,000 or more."

I assumed that all "economically disadvantaged pupils" came from households in the three lowest income levels (less than $5,000, $5,000 to $9,999, and $10,000 to $14,999). The household incomes of all "not economically disadvantaged pupils" were grouped in six sets ($15,000 to $24,999, $25,000 to $34,999, $35,000 to $49,999, $50,000 to $74,999, $75,000 to $99,999, and $100,000 or more).

Table 20 makes very clear that the "not economically disadvantaged" pupil populations in different categories of schools were not the same. In our sample high-FARM schools, 59% of the "middle class" households fell right around or below Dane County's median household income (which was $32,703 in the 1990 census). Only 2% of their "middle class" households were at the top end of the income scale.

Table 20
Percentage Distribution of *Middle Class Households*
by Income Group (per 1990 Census)
for 11 Elementary School Attendance Zones
in Madison Metropolitan School District

School Category	$15,000-$34,999	$35,000-$74,999	$75,000-$100,000+
High (42%) FARM	59%	38%	2%
Medium (29%) FARM	50%	37%	13%
Low (11%) FARM	36%	52%	12%

The proportion of highest income households jumped upward to 13% and 12% for the medium-FARM and low-FARM schools, respectively. Where low FARM schools had a decisive advantage was in the mid-range ($35,000 to $74,999), with 52% of all middle class households in this group compared to only 38% and 37% for high-FARM and medium-FARM schools, respectively.

In short, the slow decline in middle class pupils' test scores as the percentage of low income classmates increased may well have reflected primarily shifts in the composition of the "not economically disadvantaged" pupils in different schools. Schools with very low percentages of low income classmates were very attractive to higher-end, professional families. In schools with higher percentages of low income classmates, middle class pupils tended to come from more "blue collar" households.

Very simply, middle class test scores probably declined substantially because these weren't the same "middle class" kids in different schools.

Deconstructing the Poor

Does the evidence support the reverse argument? Could the dramatic gains in test scores of low income pupils as they attended more middle class schools simply be attributable to such schools having had "a better class of poor children"?

Table 21 analyzes the neighborhood composition of the 11 sample elementary schools at the low end of the income scale. Unlike these schools' attendance zones at the higher income levels, there was little differentiation apparent at the lower income levels.

The three high FARM schools' neighborhoods had a slightly higher percentage of desperately poor households (18%) than did the six low FARM schools' neighborhoods (13%), but both were exceeded by the percentage of desperately poor households in two medium FARM schools' neighborhoods (30%). All three categories had essentially the same proportion of households that fell just above the poverty line (which was $9,990 for a three-person household in the 1990 census).

In short, it appears from this sample that at least in Madison Metropolitan School District the household incomes of "economically disadvantaged" pupils were much more uniformly distributed among the

Table 21
Percentage Distribution of *Low Income Households*
by Income Group (per 1990 Census)
for 11 Elementary School Attendance Zones
in Madison Metropolitan School District

School Category	Less than $5,000	$5,000- $9,999	$10,000 $14,999
High (42%) FARM	18%	36%	46%
Medium (29%) FARM	30%	27%	43%
Low (11%) FARM	13%	43%	44%

different income groupings that comprised the lower 30% of the income scale than was true of the "not economically disadvantaged" pupils that comprised the upper 70% of the income distribution.

In summary, the substantial test score gains of low income children as the proportion of middle class classmates increased substantially represented real gains for such children. Economic integration works!

Post-script: High-Poverty Schools

I have noted earlier the uncommon circumstance that Madison-Dane County had no elementary school where the percentage of low income pupils exceeded 60%. What would have occurred had Madison-Dane County had a number of truly high-poverty schools?

One need drive only two hours eastward to encounter one of the USA's biggest concentrations of high-poverty schools – the Milwaukee Public Schools. The overall percentage of low income 4th grade pupils in Milwaukee's 100 regular elementary schools was 66.7% from 1998-01. In fact, as Table 22 shows, only 21 of Milwaukee's 100 regular elementary schools had *less* than 60% low-income pupils.[21]

[21] I omitted 13 charter or special schools whose enrollments were so small and whose academic performance was so erratic (on the low side) that their inclusion would distort the numbers further. All had majorities of low income pupils as well.

What happened to average test scores? In the three schools in Milwaukee's most privileged bracket (30-39.9% FARM), the small number of low income pupils did very well with 83% achieving advanced or proficient levels in reading; 72% of the larger numbers of pupils that were middle class reached advanced and proficient levels. (These results must be approached cautiously since only three schools were involved.)

In the next two brackets (40-49.9% FARM and 50-59.9% FARM), middle class pupils outscored low income pupils by 18-20 points. Middle class pupils maintained advanced and proficient pass rates around 72%. Meanwhile, in schools where they were becoming dominant, low income pupils' scores dropped into the 50%-55% range where they stayed thereafter.

However, when schools passed a 60% FARM threshold, middle class scores dropped first to 65% pass rates, and then precipitously to 53-54% pass rates. In effect, in over-70% FARM schools, any academic distinction between low income pupils and middle class pupils disappeared.

Among Milwaukee's 100 elementary schools, there were 43 in which middle class pupils' reading scores fell below low income pupils' reading scores. (By contrast, there were only three such schools where that occurred out of 30 in suburban Dane County – primarily a statistical quirk of the very low number of low income pupils tested.) Middle class pupils' scores exceeded low income pupils' scores in all 29 Madison schools.)

Physicists speculate that the gravitational forces within a black hole are so powerful that many of the Newtonian laws of physics are suspended. It appears that within the tremendous disadvantages of very high-poverty schools, the benefits of coming from a somewhat higher income home are just torn asunder. For middle class children sucked into the social vortex of a very high-poverty school, the normal laws of society don't work.

In reality, unlike black holes in the cosmos, very high-poverty schools expel rather than attract middle class pupils. There would have been very few pupils from higher income families attending the Milwaukee Public Schools and probably none enrolled in very high-poverty schools. In very high-poverty schools, most of the non-FARM eligible pupils were probably just a shade above qualifying for subsidized lunches themselves.

*   *   *

Summing Up Part V: **A school's socioeconomic context does matter far more for low-income pupils than for their middle class counterparts.** The statistical analysis did show a slight decline of middle class pupils' test scores as the percentage of low income classmates increased.   The rate of decline for middle class pupils was less than half the rate of improvement for low income pupils.

However, that apparent decline in middle class pupils' performance most probably reflected the changing composition of the "middle class" in schools with increasingly higher percentages of low income classmates. "Middle class" schools with very few low income pupils had higher percentages of children from the highest income, largely professional households.   In "middle class" schools with much larger numbers of low-income pupils, children from more modest "blue collar" households predominated.

That was most likely the primary contributing factor to the apparent slow decline in middle class test scores and not any directly adverse effect of having more low income classmates.   From a larger perspective, middle class pupils' performance levels never dropped below 70-75% achieving advanced and proficient levels under any socioeconomic circumstances in Madison-Dane County (which had *no* very high-poverty schools).

Part VI: Housing Policy Is School Policy

Where children live shapes their educational opportunities – not in terms of how much money is spent on their education but on whom their classmates are.

This study of the Madison-Dane County public schools reconfirms the three basic findings of many other studies of the link between academic performance and socioeconomic status.

1. **The socioeconomic status of a school's pupil population is the primary factor that is related to academic performance as measured by standardized tests.**

2. **The test scores of low income pupils improve significantly the more they are surrounded by middle class classmates.**

3. **A school's socioeconomic context matters far more for low income pupils than for their middle class counterparts.**

The most import "inputs" for any school are who the kids are and how many of them will there be. School boards, superintendents, and principals don't really control these crucial inputs. However, other local public officials do through planning and zoning policies and infrastructure investment. "Public policy dictates where development occurs," states the National Association of Home Builders.

Housing policy *is* school policy.

Only 80 miles as the crow flies may lie between Madison and Milwaukee but light years separate the two regions. Madison is one of America's more favored communities while deep economic and social divides afflict greater Milwaukee.

As a recent catch phrase had it, "you don't want to go there."

Nevertheless, in recent decades, Madison-Dane County's housing patterns have become more economically segregated. Madison-Dane County will never reach the hyper-segregated conditions of metro Milwaukee, but Madison-Dane County may be on the road towards greater problems stemming from deepening socioeconomic divisions.

Breaking Up Concentrated Poverty

Across the USA, many "little box" governments adopt exclusionary zoning – banning apartments, requiring large home lots, etc. – to exclude low- and modest income families. About 70 cities, however, have adopted *inclusionary* zoning laws that require new sub-divisions to include a modest proportion of affordable housing (typically 15 percent).

Montgomery County, Maryland, the USA's pioneer of inclusionary zoning, took a crucial second step. The county's Moderately Priced Dwelling Unit (MPDU) law requires homebuilders to sell one-third of the affordable units (in effect, 5 percent of each subdivision) to the county's public housing authority.

To assure that building mixed-income communities will be profitable, Montgomery County provides builders with a 22 percent density bonus.

What if an MPDU-type inclusionary zoning law had been in effect throughout Dane County for the last 25 years? Some 86,000 new housing units were built. Assuming that half were individual spec homes or in very small developments to which an MPDU law wouldn't have applied, inclusionary zoning would still have yielded

- 4,300 new affordable homes and apartments for teachers, police officers, firefighters, store clerks, and other modest income workers; and
- 2,150 new units to be purchased or rented by the Madison Community Development Authority and the Dane County Housing Authority.

Most of this housing would be scattered in new subdivisions in low-poverty neighborhoods in Madison and its suburbs.

Just 1,000 of the CDA-DCHA acquired units would be needed to provide sufficient relocation alternatives to bring family poverty rates below 10 percent in all 17 higher poverty census tracts in Madison-Dane County.

That would mean that no elementary school would have more than about 25 percent low income pupils.[22] Thoreau Elementary would not have 35% low income pupils, nor Falk 39%, nor Allis, Leopold, and Lake View 47%, nor Glendale and Hawthorne 48%, nor Emerson 50%. Lincoln would not have 62% low income pupils nor would Mendota have 66%. All could be solidly middle class schools with the enormous educational benefits that flow from that fact both for the low income children who remain and for those who moved to new neighborhoods and new neighborhood schools while their middle class classmates would do just fine in local schools in both "sending" and "receiving" communities.

It would be most desirable for the policy to apply to all 59 local governments. A place to start, however, would be the city of Madison itself that still accounts for almost half of new housing starts in Dane County.

> *It may not be within our power to eliminate poverty completely, but though inclusionary zoning Madison-Dane County can eliminate concentrated poverty.*

The greatest challenge facing Madison-Dane County is: are we going to live – *and learn* – together?

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[22] With the exception of Lincoln Elementary, for which no income data after 1998-99 were available, all FARM percentages reflect total school enrollment (not just 4th grade test takers) for 2000-01.

TABLE 8: REGRESSION ANALYSIS
DEPENDENT (*Y*) VARIABLES: (AVERAGE SCHOOLWIDE 4TH GRADE TEST SCORES
SIX INDEPENDENT (X) VARIABLES:
(THREE "CLASSMATE INPUTS" AND THREE "SCHOOL BOARD INPUTS")
FOR 16 SCHOOL DISTRICTS IN MADISON-DANE COUNTY
(*n*=16)

independent variable	***y1* =** **average reading score**	***y2* =** **average language score**	***y3* =** **average math score**	***y4* =** **average science score**	***y5* =** **average social studies score**
Adjusted R square (explanatory value)	0.711	0.588	0.246	0.851	0.848
x1 = pct of low-income test takers (FARM)					
Coefficient estimate	-0.890***	-0.903***	-0.560	-0.555***	-0.581***
Standard error	0.240	0.345	0.497	0.157	0.161
x2 = pct of test takers with disabilities					
Coefficient estimate	-0.593*	-0.989**	-0.760	-0.252	-0.301
Standard error	0.330	0.475	0.684	0.216	0.222
x3 = pct of test takers that were minorities					
Coefficient estimate	0.316	0.575*	0.347	-0.059	-0.083
Standard error	0.210	0.302	0.435	0.137	0.141
x4 = education expenditures per pupil (all grades) (per $1,000)					
Coefficient estimate	0.004	0.006	-0.016	-0.034**	-0.013
Standard error	0.024	0.034	0.049	0.015	0.016
x5 = federal revenues per pupil (all grades) (per $100)					
Coefficient estimate	-0.005	-0.019	-0.029	0.010	0.005
Standard error	0.024	0.035	0.050	0.016	0.016
x6 = pupils per licensed staff (all grades)					
Coefficient estimate	-0.009	-0.001	-0.011	-0.029***	-0.021**
Standard error	0.016	0.023	0.033	0.010	0.011

** = <0.10% level of significance   ** = <0.05% level of significance   *** = <0.01% level of significance*

TABLE 9
SUMMARY OF AVERAGE TEST SCORES BY CHARACTERISTICS OF 4TH GRADE TEST TAKERS
IN THE MADISON METROPOLITAN SCHOOL DISTRICT FROM 1998-99 TO 2000-01

pupil characteristics	average reading score	average language score	average math score	average science score	average social studies score	mean battery score
all pupils	74%	64%	69%	76%	76%	72%
female	76%	68%	68%	75%	76%	73%
male	72%	60%	67%	77%	75%	70%
American Indian	*75%*	*50%*	*50%*	*66%*	*75%*	63%
Asian	55%	50%	54%	59%	57%	55%
Black	50%	34%	36%	51%	51%	45%
Hispanic	54%	44%	36%	55%	54%	49%
White	86%	76%	81%	87%	87%	84%
Limited English proficiency (LEP)	40%	27%	27%	34%	33%	32%
English proficient	78%	68%	72%	80%	80%	76%
with disabilities	40%	27%	34%	48%	48%	39%
without disabilities	82%	73%	75%	82%	82%	79%
economically disadvantaged	46%	36%	39%	53%	52%	45%
not economically disadvantaged	85%	76%	80%	86%	86%	83%

Note: Scores for American Indian pupils are for 2000-01 only.

TABLE 11: REGRESSION ANALYSIS
DEPENDENT (*Y*) VARIABLE: PERCENTAGE OF LOW INCOME 4TH GRADERS (FARM)
INDEPENDENT (*X*) VARIABLES: FOUR PUPIL RACIAL GROUPINGS
FOR 60 ELEMENTARY SCHOOL IN MADISON-DANE COUNTY (*n* = 60)

independent variable	*Y* = FARM *X* = black	*Y* = FARM *X* = Asian	*Y* = FARM *X* = Hispanic	*Y* = FARM *X* = white
Adjusted R square	0.745	0.339	0.366	0.828
Coefficient Estimate	1.16***	1.176***	2.713***	-0.803***
Standard Error	0.088	0.210	0.458	0.047

* = <0.10% level of significance ** = <0.05% level of significance *** = <0.01% level of significance

TABLE 12: REGRESSION ANALYSIS
DEPENDENT (*Y)* VARIABLES: AVERAGE SCHOOLWIDE 4TH GRADE TEST SCORES
INDEPENDENT (*X)* VARIABLES: LOW INCOME, DISABILITY. AND MINORITY STATUS FOR 60 ELEMENTARY SCHOOL IN MADISON-DANE COUNTY (*n* = 60)

independent variable	***y1* = average reading score**	***y2* = average language score**	***y3* = average math score**	***y4* = average science score**	***y5* = average social studies score**
Adjusted R square	0.796	0.756	0.801	0.834	0.856
x1 = pct of low income test takers (FARM)					
Coefficient estimate	-0.521***	-0.494***	- 0.686***	- 0.280***	- 0.356***
Standard error	0.107	0.138	0.132	0.097	0.093
x2 = pct of test takers with disabilities					
Coefficient estimate	-0.519***	-0.819***	- 0.735***	- 0.547***	- 0.617***
Standard error	0.124	0.161	0.153	0.112	0.108
x3 = pct of test takers that were minorities					
Coefficient estimate	0.038	0.013	0.112	-0.199**	-0.134*
Standard error	0.038	0.114	0.108	0.079	0.076

* = <0.10% level of significance ** = <0.05% level of significance *** = <0.01% level of significance

TABLE 13: REGRESSION ANALYSIS
DEPENDENT (*Y*) VARIABLE: AVERAGE SCHOOLWIDE 4TH GRADE TEST SCORES
INDEPENDENT (*X*) VARIABLE: PERCENTAGE OF 4TH GRADE LOW INCOME TEST TAKERS
FOR 60 ELEMENTARY SCHOOL IN MADISON-DANE COUNTY (*n* = 60)

independent variable	*y1* = average reading score	*y2* = average language score	*y3* = average math score	*y4* = average science score	*y5* = average social studies score
Adjusted R square	0.733	0.642	0.709	0.762	0.772
X = pct of low-income 4th grade test takers (FARM)					
Coefficient estimate	0.592***	-0.655***	-0.726***	-0.604***	-0.626***
Standard error	0.046	0.063	0.060	0.044	0.044

* = <0.10% level of significance ** = <0.05% level of significance *** = <0.01% level of significance

TABLE 15
PERCENTAGE OF LOW INCOME 4TH GRADE PUPILS
SCORING ADVANCED OR PROFICIENT ON STANDARDIZED TESTS
BY PERCENTAGE OF MIDDLE CLASS 4TH GRADE CLASSMATES
IN 55 ELEMENTARY SCHOOLS IN MADISON-DANE COUNTY WI

Pct of Middle Class Pupils	Number of Schools	Pct A & P Reading 3-yr avr	Pct A & P Language 3-yr avr	Pct A & P Math 3-yr avr	Pct A & P Science 3-yr avr	Pct A & P Soc Std 3-yr avr
90.0-99.9	15	68%	52%	64%	83%	82%
80.0-89.9	22	65%	52%	58%	72%	70%
70.0-79.9	6	57%	46%	50%	67%	63%
60.0-69.9	5	41%*	34%*	37%*	50%*	50%*
50.0-59.9	5	46%	34%	39%	52%	52%
40.0-49.9	2	45%	37%	34%	52%	58%

** Omitting Thoreau ES, that had extraordinarily low scores, would have changed this grouping's averages to reading (44%), language (38%), math (40%), science (54%), and social studies (52%)*

Note: Madison-Dane County had no elementary schools with more than 60% low income (FARM) pupils.

TABLE 16: REGRESSION ANALYSIS
DEPENDENT (*Y*) VARIABLE: AVERAGE TEST SCORES OF LOW INCOME PUPILS
INDEPENDENT (*X*) VARIABLE: PERCENTAGE OF MIDDLE CLASS CLASSMATES FOR 55 ELEMENTARY SCHOOL IN MADISON-DANE COUNTY (*n* = 55)

independent variable	***y1* = average reading score**	***y2* = average language score**	***y3* = average math score**	***y4* = average science score**	***y5* = average social studies score**
Adjusted R square	0.223	0.163	0.211	0.318	0.276
X = pct of middle class classmates					
Coefficient estimate	0.642***	0.495***	0.717***	0.800***	0.741***
Standard error	0.158	0.146	0.182	0.156	0.159

* = <0.10% level of significance ** = <0.05% level of significance *** = <0.01% level of significance

TABLE 18
PERCENTAGE OF MIDDLE CLASS 4TH GRADE PUPILS
SCORING ADVANCED OR PROFICIENT ON STANDARDIZED TESTS
BY PERCENTAGE OF LOW INCOME 4TH GRADE
CLASSMATES
IN 55 ELEMENTARY SCHOOLS IN MADISON-DANE COUNTY WI

Pct of Low Income Classmates	Number of Schools	Pct A & P Reading 3-yr avr	Pct A & P Language 3-yr avr	Pct A & P Math 3-yr avr	Pct A & P Science 3-yr avr	Pct A & P Soc Std 3-yr avr
0.0-9.9	15	91%	83%	85%	93%	93%
10.0-19.9	22	87%	78%	82%	89%	90%
20.0-29.9	6	83%	76%	78%	86%	86%
30.0-39.9	5	86%	76%	78%	85%	87%
40.0-49.9	5	76%	64%	66%	80%	74%
50.0-59.9	2	83%	72%	67%	84%	77%

Note: There were no elementary schools with more than 60 percent low income pupils in Madison-Dane County

TABLE 19: REGRESSION ANALYSIS
DEPENDENT (*Y*) VARIABLE: AVERAGE TEST SCORES OF MIDDLE CLASS PUPILS
INDEPENDENT (*X*) VARIABLE: PERCENTAGE OF LOW INCOME CLASSMATES
FOR 55 ELEMENTARY SCHOOL IN MADISON-DANE COUNTY (*n* = 55)

independent variable	***y1* = average reading score**	***y2* = average language score**	***y3* = average math score**	***y4* = average science score**	***y5* = average social studies score**
Adjusted R square	0.229	0.244	0.314	0.307	0.452
X = pct of low income classmates					
Coefficient estimate	-0.246***	-0.326***	-0.408***	-0.282***	-0.389***
Standard error	0.060	0.076	0.080	0.056	0.058

* = <0.10% level of significance ** = <0.05% level of significance *** = <0.01% level of significance

TABLE 22
SUMMARY OF AVERAGE 4TH GRADE READING SCORES
FOR 100 ELEMENTARY SCHOOLS IN MILWAUKEE PUBLIC SCHOOLS
ORGANIZED BY PERCENTAGE OF LOW INCOME (FARM) TEST TAKERS
GROUPED IN DECILES FOR 1999 TO 2001

Pct FARM by Decile	Number of Schools	Mean Pct FARM	Mean Pct A & P FARM	Mean Pct A & P non-FARM
0.0 - 9-9	0	***	***	***
10.0 - 19.9	0	***	***	***
20.0 - 29.9	0	***	***	***
30.0 - 39.9	3	32.3%	82.6%	72.0%
40.0 - 49.9	6	44.1%	54.5%	72.7%
50.0 - 59.9	12	56.5%	51.4%	71.1%
60.0 - 69.9	17	65.1%	55.9%	65.1%
70.0 - 79.9	33	74.5%	52.7%	52.9%
80.0 - 89.9	19	84.2%	51.0%	54.1%
90.0 - 100.0	0	***	***	***