

Parsing the Achievement Gap II



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Preface

Despite a long-running national focus on closing gaps in academic achievement among America's students, by race/ethnicity and by socioeconomic status, they remain wide and persistent. Efforts to narrow these gaps commenced in earnest with the Elementary and Secondary Education Act of 1965, and have continued through periodic funding increases, legislative amendments, program expansions such as Head Start, and, most recently, the No Child Left Behind Act of 2002. At the state level, basic-skill and compensatory education programs have operated for many years.

The first *Parsing the Achievement Gap* report, published in 2003, focused on expanding our knowledge about why these gaps exist. It asked two questions: What does the accumulated body of research reveal about the correlation between life experiences and life conditions on the one hand, and cognitive development and school achievement on the other? And knowing this, are there differences in these critical life experiences and conditions among racial/ethnic and socioeconomic subgroups that mirror the differences in average achievement in school? The answers were yes and yes — that is, life experiences and conditions affect cognitive development and academic achievement and there are differences in these experiences and conditions among subgroups.

This follow-up report, which brings the synthesis of the research up to date, asks and answers a third question: Have these gaps in experiences and life conditions that mirror the achievement gap narrowed, widened, or stayed the same since the earlier report was published?

These “correlates of achievement” span the entire period from birth to the time the last standardized achievement test is taken in school. They include what happened during infancy, in the home before school, in the school, after school, and in the summer. Focusing on these “beyond school” factors in no way diminishes the critical importance of the schools and their quality. As Daniel Patrick Moynihan put it, “You do not learn algebra at home.” Rather, the focus on “beyond school” conditions aims to round out our understanding of academic achievement gaps.

Paul Barton and Richard Coley have tackled the task of assembling a large and disparate body of research. They also note the importance of improving the research base for identifying and tracking the gaps. Our nation's willingness to do so will say much about our resolve to confront and eliminate the gaps that threaten our society in deep and basic ways.

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Highlights

Syntheses of many research studies establish that 16 factors related to life experiences and conditions are correlated with cognitive development and academic achievement. This report asks whether there are differences in these 16 “correlates of achievement” among different population groups that mirror the large and persistent gaps that are found in school achievement. The answer is yes, there are differences in these correlates of achievement among racial/ethnic and income groups, and those differences do mirror the achievement gaps. The unavoidable conclusion is that if we are to close the gaps in achievement, we must first close the gaps in these life experiences and conditions.

This report is an update and expansion of the 2003 ETS Policy Information Report *Parsing the Achievement Gap: Baselines for Tracking Progress*. Although a few of the gaps in the correlates of achievement have become a bit narrower in some instances and a bit wider in others, overall the gaps identified in the earlier report remain apparent and disturbing. Overall, there is little change.

The correlates are best viewed as three clusters of factors — school factors, factors related to the home and school connection, and factors that are present both before and beyond school. Below, we briefly summarize the findings for each of the correlates. We encourage readers to view the entire report for more detail and/or review the Summary Table at the end of the report.

School Factors

- Curriculum rigor – While some gaps remain, there has been progress across all racial/ethnic groups in taking what is called a “midlevel” curriculum in high school. Gaps exist in participation in the Advanced Placement® (AP®) Program, particularly for Black students.
- Teacher preparation – Minority and low-income students are less likely to be taught by certified teachers and more likely to be taught by math teachers with neither a major nor minor in mathematics. The gap in students having teachers prepared in the subjects they teach widened between White and Hispanic students and remained about the same for the other populations.

- Teacher experience – Minority and low-income students are more likely to be taught by inexperienced teachers. These gaps have not changed.
- Teacher absence and turnover – Minority and low-income students are more likely to attend schools with high levels of teacher absence and teacher turnover. There was little change in the gaps.
- Class size – Teachers in high-minority schools are more likely to have large classes. The gap has widened between high-minority and low-minority schools.
- Availability of instructional technology – Minority and low-income students have less access to technology in school, although there is improvement in access across the board, and the gap has narrowed.
- Fear and safety at school – Minority students are more likely to report issues of fear and safety at school. The gaps widened for students reporting the presence of street gangs and fights in school, and remained unchanged for students reporting feeling fearful in school.

The Home and School Connection

- Parent participation – White students’ parents are more likely to attend a school event or to volunteer at school. The gap in parents volunteering in schools remained unchanged; the gap in parents attending school events narrowed.

Before and Beyond School

- Frequent changing of schools – Minority students are more likely to change schools frequently, although there has been improvement. There was little change in the gap.
- Low birth weight – The percentage of Black infants born with low birth weight is higher than that for White and Hispanic infants. The rate of low birth weight increased among all groups.
- Environmental damage – Minority and low-income children were more likely to be exposed to environmental hazards.

Exposure to lead – The gaps were unchanged but levels of exposure were down.

Exposure to mercury – There were gaps in exposure to mercury, but no trend data were available.

- Hunger and nutrition – Minority and low-income children were more likely to be food insecure. The White-Black gap was unchanged; the White-Hispanic gap narrowed.
- Talking and reading to babies and young children – Minority and low-income children were less likely to be read to daily. The gaps were unchanged.
- Excessive television watching – Minority and lower-SES children watch more television. The gap was unchanged between White and Black students; the gap widened among students whose parents have different education levels.
- Parent-pupil ratio – Minority students were less likely to live with two parents. The gaps were unchanged.
- Summer achievement gain/loss – Minority and low-SES students grow less academically over the summer. Trend data were unavailable.

As noted earlier, the placement of the correlates into clusters is an effort to put the 16 correlates into a broader perspective. It is important to note that one is likely to find varying degrees of intercorrelations both within and among the clusters. For example, a student’s developmental environment is likely to be closely related to community characteristics and to support for education generally in the community.

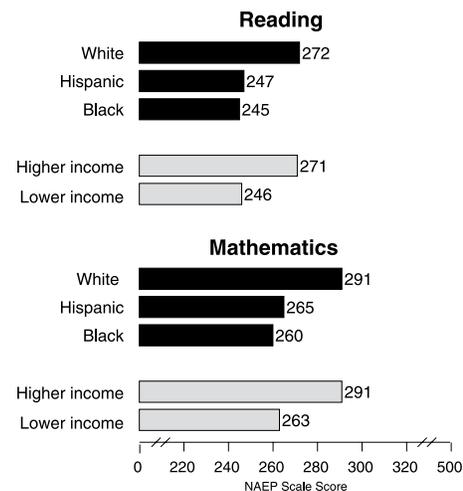
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The bottom line is that gaps exist in the correlates of achievement. Some gaps have narrowed, some gaps have widened, but more often there was little or no change. The stark fact remains, then, that gaps in the life and school experiences of minority group and low-income children — all correlated with school achievement — mirror the achievement gaps in school, just as they did five years ago.

Introduction

Gaps in school achievement among racial/ethnic groups and between students from different socioeconomic circumstances are well documented. They are wide and persistent, well known and widely acknowledged. They arrive early and stay late — beginning before birth and continuing through to high school graduation for those fortunate to obtain a diploma. To illustrate these gaps, Figure 1 shows the most recent eighth-grade reading and mathematics scores for White, Black, and Hispanic students and for students of different income levels using data from the National Assessment of Educational Progress (NAEP).¹ Gaps of this size are considered to be large in statistical terms. Data on other subjects and grade levels are available from NAEP (<http://nationsreportcard.gov>). The gaps reflected in these scores begin much earlier in these students' lives and remain present in other important areas like educational attainment and earnings.²

Figure 1
Average Eighth-Grade NAEP Reading and Mathematics Scores
by Racial/Ethnic Group and Income Level, 2007



Note: Higher income students are defined as those not eligible for free lunch; lower income students are defined as those eligible for free lunch.

Source: U.S. Department of Education, Institute of Educational Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), 2007 Reading and Mathematics Assessments.

From a public policy perspective, these gaps were elevated in priority during the 2000 presidential campaign, with the president and vice presidential candidates vowing to establish federal legislation to close academic achievement gaps. After the election, President George Bush proposed and the Congress enacted the No Child Left Behind Act (NCLB), which contained strong accountability provisions and the specific requirement that states track the scores of key population subgroups, not just the average scores of schools. As of this writing, Congress is considering reauthorizing the act.

This report focuses on the conditions and experiences that create and perpetuate achievement gaps. It is the second edition of the report *Parsing the Achievement Gap: Baselines for Tracking Progress*, published in 2003.³ The report focuses on the many antecedents of differences in school achievement. The review begins by identifying school and home conditions that the research community, to a reasonable extent, agrees are closely associated with school achievement, although there are points of disagreement. Research is a continuing process of thesis and antithesis, and what seems to be established may be challenged. In the physical world, this is seen in continuing debates over whether birds are descended from dinosaurs and what is causing global warming. This new report adds another dimension to the original report by assessing whether there have been *changes* in these critical factors since then, and judges whether any progress has been made in closing the gaps in these correlates of achievement.

Achievement differences among subgroups of the population have deep roots. This report is a search for the roots of the gaps — those aspects of life and formal school experiences that are found to be correlated with school achievement. This report is not about specific school interventions or programs to improve instruction, or evaluations of the effectiveness of such programs.

We refer throughout the report to the correlates of achievement. For each of the 16 correlates identified and examined, we sought data that would permit disaggregation by race/ethnicity and some measure of family income. In most cases we found the data.

¹ A student's eligibility for free or reduced-price school lunch is used as an indicator of low income.

² See, for example, Richard J. Coley, *An Uneven Start: Indicators of Inequality in School Readiness*, Policy Information Report, ETS Policy Information Center, March 2002; Paul E. Barton and Richard J. Coley, *The Family: America's Smallest School*, Policy Information Report, ETS Policy Information Center, September 2007; and Paul E. Barton, *One-Third of a Nation: Rising Dropout Rates and Declining Opportunities*, Policy Information Report, ETS Policy Information Center, February 2005.

³ Paul E. Barton, *Parsing the Achievement Gap: Baselines for Tracking Progress*, Policy Information Report, ETS Policy Information Center, October 2003.

Often, of course, race/ethnicity and income are themselves thought of as being associated with student achievement. Yet we know that skin color does not determine student achievement. We also know that parent income alone does not determine achievement in school; many students from low-income backgrounds excel in school, while many from higher-income families lag. Our goal is to deconstruct these broad classifications into those actual life conditions that young people experience — conditions and experiences that exercise strong influence on cognitive development and academic achievement.

The remainder of this section describes the process used to identify the correlates, identifies the sources of the research findings, and provides a brief overview of the 16 correlates of achievement. The following sections in the report provide a more detailed review of the research for each correlate.

The information in this report can be useful in helping to reveal the threads in the fabric of educational outcomes for subgroups of the population. One of the purposes of the first report was to encourage periodic assessments of progress in closing the gaps in these achievement correlates, a critical step toward closing academic achievement gaps. Wherever the data permit, this second edition tracks change since 2000, the year for which most of the data were available for the first report.

Identifying the Correlates of Achievement

Identifying the correlates of achievement that research has established would involve examining, evaluating, and synthesizing hundreds, perhaps thousands, of individual research studies. Such an undertaking, however, is unnecessary if we rely instead on the compilations, evaluations, syntheses, and meta-analyses that competent researchers have already done. That is the approach we use here, updating research where it was available.

For school factors that are correlates of achievement, the most exhaustive and reliable work to date is a report by Mathematica Policy Research, titled *Monitoring School Quality: An Indicators Report*.⁴ For nonschool factors that are correlates of achievement, we relied extensively on data from Child Trends, a

nonpartisan research organization that conducts and synthesizes research across the broad area of child well-being. Several other research syntheses addressing specific factors were also useful.

By organizing and condensing the available research on the correlates of achievement, we hoped to identify the sources of the achievement gaps among students of different racial/ethnic groups and of different levels of family income. Because the available information does not tell us all that we want to know, several caveats are in order.

- First, the list of correlates is the result of what researchers in different disciplines have thought important to pursue. For example, class size has been deemed important, and so there are hundreds of studies on this topic. Alternatively, there is little research on curriculum rigor, where the measurement problems are formidable and where we have to rely on course titles that reveal little about the real academic content of the courses that students take in the classroom.
- Second, there is the question of whether there have been sufficient studies of a particular factor to enable a reasonable degree of consensus that it is related to educational achievement. In research, replication is always needed.
- Third, the quality of educational research, relative to the quality of research in many other fields, is limited. Large, carefully designed studies are expensive and require long time periods; yet the investment in education research has been relatively meager. It is therefore necessary to operate from a knowledge base that does not inspire as much confidence as might be desired.
- Finally, the quality and comprehensiveness of the research used to identify the correlates is necessarily dependent on the quality of the underlying analyses and syntheses. While we are confident about the sources of the syntheses included in this report, it is quite possible that other research should be considered or other correlates could be identified.

⁴ Daniel P. Mayer, John E. Mullins, and Mary T. Moore, *Monitoring School Quality: An Indicators Report*, National Center for Education Statistics, John Ralph, Project Officer, NCES 2001–030, December 2000.

Based on the review of the research described above, we identified 16 correlates of elementary and secondary school achievement. Although we found each correlate to be related to an independent correlate of educational achievement, none of them is unique and many are interrelated. For example, a child's educational development can be affected by a variety of environmental factors. One is the level of lead in a child's bloodstream, one of 16 factors examined in this report as a correlate on achievement. But lead is only one of many environmental factors — proximity to hazardous waste sites, for example — that can have a negative effect on children. Thus, a single factor such as exposure to lead may very well be a marker for a set of environmental hazards to which children may be exposed. If research had been more extensive, the effects of these other hazards might have been identified as separate factors.⁵

The correlates examined here therefore are best viewed as representative of a group of related or similar factors that research has found to be correlated with achievement. To reinforce the caveat that none of the correlates is unique and should be singled out for attention in the world of policy and practice, the correlates are presented in the context of clusters that include other related variables. The 16 correlates of achievement are listed below, grouped with their clusters.

School Factors

The school factors are related to teaching and learning and to the learning environment. They include the instructional infrastructure, including the quality of leadership, pedagogy, and professional development. The factors are also indicators of the general conditions and ambiance of the school, such as the academic expectations placed on students, the commitment of teachers and staff, and school security. The correlates we chose are:

- Curriculum rigor
- Teacher preparation
- Teacher experience
- Teacher attendance and turnover
- Class size
- Availability of instructional technology
- Fear and safety at school

The Home and School Connection

This correlate relates to the two-way street of parents trying to be supportive of school efforts and schools reaching out to inform, encourage, and show receptivity to parents' input. The correlate is:

- Parent participation

Before and Beyond School

This set of correlates includes the child development environment, the home learning connection, and the community in which the child lives and grows. The child's early environment comprises the conditions and experiences that are related to early cognitive and physical development, including parent expectations and interactions with the child. The community factors include the extent to which the community and its essential institutions support or hinder the efforts of families and schools.⁶ The correlates we chose are:

- Birth weight
- Exposure to lead
- Hunger and nutrition
- Talking and reading to babies and young children
- Excessive television watching
- Parent-pupil ratio
- Frequent changing of schools
- Summer achievement gain/loss

As noted earlier, the placement of the correlates into clusters is an effort to put the 16 correlates into a broader perspective. It is important to note that one is likely to find intercorrelations both within and among the clusters, to varying degrees. For example, the development environment is likely to be closely related to community characteristics and support for education, generally, in the community.

The Indicators of Gaps and Disaggregation

For each of the 16 correlates, we want to know about gaps. Are there gaps in the characteristics of school, in the conditions of growing up, and in the conditions of living that have been found to be associated with school achievement? If low birth weight is correlated with slower cognitive development and lower achievement in school, do Black or Hispanic children, or poorer children, have a higher incidence of low birth weight than other children? If the subject matter knowledge of teachers is linked to student

⁵ This edition has added mercury poisoning.

⁶ Included here is the concept of social capital developed by James Coleman and Robert Putnam.

achievement, are there gaps among different groups of students with regard to the preparation of teachers in the subject matter they teach?

It was possible in most instances to find the data to answer these questions. When the data were available, it was a relatively straightforward process to identify it, in contrast to identifying the correlates. In some cases, an extended search was required. Sometimes what was available was not an ideal measure — and it was not always possible to find current data.

This edition of *Parsing the Achievement Gap* goes considerably beyond the first in an important respect. The subtitle of the first edition was “*Baselines for Tracking Progress.*” The report urged that a research/statistical organization or agency with adequate resources take on the job of tracking these correlates, as well as conducting further research on them, to see whether progress is being made over time — progress that could translate into a narrowing of school achievement gaps. This call received no response that we are aware of, so this edition was undertaken to measure change since the first report was issued. We were successful in finding the data to track change, though for some correlates it was not as complete as desirable.

Putting it Together

In the pages that follow, we marry the correlates of school achievement with statistics on gaps by race/ethnicity and income or poverty status. The following sections provide an in-depth look at each of the correlates. First, we summarize the research establishing a correlation with achievement, and then chart gaps showing both what they were in 2000 or thereabouts and the change since then. In the last section of the report, “Summing Up,” we provide some judgment calls on what these indicators reveal about changes in the correlates over the time periods we were able to examine.

Rigor of the Curriculum

Not surprisingly, research evidence shows that students' academic achievement is closely related to the rigor of the curriculum. John Chubb and Terry Moe, using longitudinal data from the *High School and Beyond* study, found that "academic program participation has a strong, independent effect on achievement gains. ... All things being equal, academic programs promote academic achievement." Another analysis of the same data by Anthony Bryk and colleagues came to similar conclusions.⁷

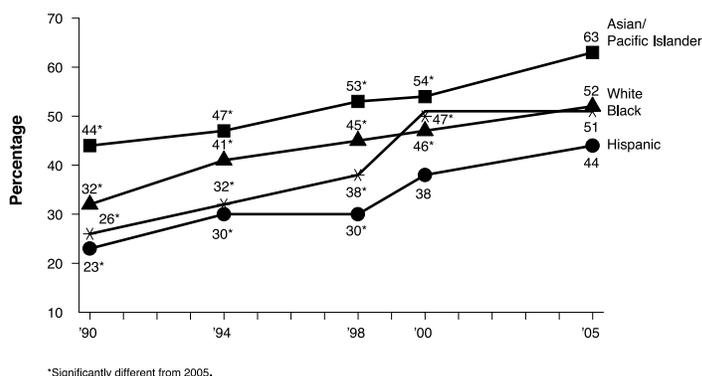
In the research literature, terms such as "challenging curriculum," "academic environment," and "academic press" are used to denote rigor. Although "challenging curriculum" generally refers to course taking, "academic press" refers to schools having strong goals emphasizing academic achievement, an area where research is relatively new.

Typically, the only available measure of academic rigor is the title of courses. In kindergarten through eighth grade, students often take what nominally seems to be the same curriculum. Little data are available on the depth of study over these years, so it is hard to measure statistical differences in elementary school rigor among population subgroups. There is also the matter of expectations placed on students; even when students are taught the same content, expectations for achievement may differ greatly.

At the high school level, similar problems occur in comparing participation in courses. For example, geometry courses within or across schools may offer different content. High school students also have some choice in what they take, so motivation is involved. And some students are simply foreclosed from taking rigorous courses because their prior preparation was inadequate or courses were not offered in their schools.

The only information we have is based on course titles — "Geometry," for example — from periodic transcript studies. Since the recommendations of the National Commission on Excellence in Education Report of 1983, increasing course requirements has been a focus of educational reformers.⁸ Newly collected data from the NAEP provides a picture of the differential high school experiences for the class of 2005. These data reveal some progress, as well as some lingering gaps in narrowing the differences in academic experience among students of different racial/ethnic groups. Since 1990, African American high school graduates have closed a six-point gap with White graduates in the percent completing at least a midlevel curriculum; by 2005 there was no significant difference between Black and White graduates. However, the corresponding White-Hispanic gap in 2005 was not significantly different from that in 1990. In addition, African American and Hispanic graduates were less likely than their White classmates to have completed calculus or advanced science courses.⁹ Trends in completing a midlevel curriculum are shown in Figure 2.

Figure 2
Percentage of Graduates Completing Curriculum at or above Midlevel, by Racial/Ethnic Group, 1990 to 2005



Source: C. Shettle, et al., *The Nation's Report Card: America's High School Graduates*, U.S. Department of Education, National Center for Education Statistics, Washington, D.C., 2007.

⁷ Mayer, et al., 2000 cite the following works: John E. Chubb and Terry M. Moe, *Politics, Markets, and America's Schools*, Washington, D.C., The Brookings Institution, 1990; Anthony S. Bryk, Valerie E. Lee, and Peter B. Holland, *Catholic Schools and the Common Good*, Cambridge, MA and London: Harvard University Press, 1993.

⁸ *A Nation at Risk: The Imperative for Educational Reform*, The National Commission on Excellence in Education, 1983.

⁹ C. Shettle, et al., *The Nation's Report Card: America's High School Graduates*, U.S. Department of Education, National Center for Education Statistics, Washington, D.C., 2007. Midlevel curriculum is defined as meeting a standard curriculum (at least four credits in English and three each in social studies, mathematics, and science) plus completion of geometry and algebra II; at least two courses in biology, chemistry, and physics; and at least one credit in a foreign language.

Although the upward trend in course taking is good news, it has not translated into improved test scores as measured by NAEP. While math scores have been on the rise, scores in other subjects were generally flat or up only slightly. Reasons for this lack of correspondence between increased course taking and scores on NAEP are unknown. It is likely that many courses don't live up to their names, and rapid expansion of enrollment in advanced offerings may have required the use of less-prepared teachers.

While studies of students' transcripts may not convey content, there is no such problem with data on the percent of graduating public high school seniors who took AP examinations, since both courses and AP exams are standardized.

Table 1 compares the relative racial/ethnic proportional composition of the cohort of graduating high school seniors with the proportional composition of the population of AP examinees for 2002 and 2007. The table shows that in 2007 Black and White students were underrepresented in the AP program, i.e., their share of the population was larger than their share of AP exam taking. There was a very small gap for

Hispanic students. The underrepresentation was most significant for Black students, who made up 14 percent of the high school senior population but only represented 7.4 percent of the AP-exam-taking population. Other than a small (about 1 percent) decline in the gap for Black students, there has been little change since 2002 in these data.

Substantial gaps exist in exam scores. Sixty-three percent of White test takers scored 3.0 or better, compared with 47 percent of Hispanic test takers. The percentage was 29 percent for Black test takers.¹⁰

Table 1

Percentage of Graduating Seniors Taking AP Examinations Compared with Percentage of Public High School Graduating Seniors

	2002		2007	
	Percentage of Student Population	Percentage of AP Exams	Percentage of Student Population	Percentage of AP Exams
White	68.6	66.3	64.0	61.7
Black	13.2	5.8	14.0	7.4
Hispanic	11.9	11.6	14.6	14.0

Source: Personal communication, Maureen Ewing (College Board).

¹⁰ National Center for Education Statistics, Table SA-14, downloaded 2/17/2008. Original source was The College Board.

Teacher Preparation

The first *Parsing* report identified differences in teacher preparation as having a strong association with student achievement. Research has established the importance of teachers being prepared in the subject matter they teach and of their certification status.

With passage of NCLB in 2002, it has become widely acknowledged both that teacher quality is critical to raising achievement and reducing gaps, and that minority and poor students are more likely to have less-qualified teachers than are other students. NCLB requires all core academic classes to be taught by teachers who are “highly qualified.” It also requires states to make sure that low-income and minority students have equal access to qualified teachers. Policy-maker attention has turned to compliance with these NCLB requirements.

In 2006, the Education Trust issued a release titled *Missing the Mark: States’ Teacher Equity Plans Fall Short*. In its analysis of reports from the 50 states and the District of Columbia, Education Trust concluded “that most states failed to properly analyze data that would determine whether poor and minority children get more than their fair share of unqualified, inexperienced, and out-of-field teachers. Only two states, Nevada and Ohio, fully complied with the requirements and offered specific plans to remedy inequities.”

The Center on Education Policy (CEP) also studied the issue, and in 2007 published *Implementing the No Child Left Behind Teacher Requirements*. Its findings were based on survey reports from the states and a sample of school districts, as well as interviews in 17 school districts and roundtable discussions with representatives of nearly two dozen education associations. With regard to achieving the “equitable distribution” requirements, CEP found that “only 5 states reported that this distribution had become more equitable to

a great extent, 17 said it had become somewhat more equitable, and another 17 said it had become minimally more equitable.” CEP also found that many state and district officials thought that the definition of a highly qualified teacher was too narrowly focused on content knowledge.

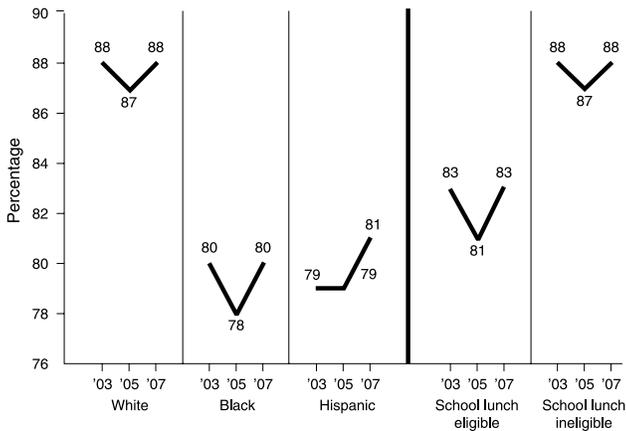
An evaluation of the teacher quality provisions of NCLB commissioned by the U.S. Department of Education provides data on the percentage of teachers who judge *themselves* to be “highly qualified” based on the definitions in NCLB. Those so identified were more likely to be found in schools with a low proportion of minority students, although the percentage of not highly qualified was reported to be low overall. Teachers who were not highly qualified were three times more likely to be teaching in high-minority schools than in low-minority schools. Also, they were three times more likely to be teaching in high-poverty than low-poverty schools. However, 23 percent of all teachers in the survey did not know what their status was in terms of meeting the NCLB definition of being highly qualified, about the same for the different categories of schools.¹¹ It is, therefore, hard to draw a firm conclusion from this data. In any event, we do not have data for an earlier period with which to compare.

Trend data are available from NAEP on two more objective measures of teacher quality — the percentage of eighth-grade math students whose teachers have regular or standard state certification or advanced professional certification, and the percentage of students whose teachers have neither an undergraduate major nor minor in math.

¹¹ Beatrice F. Birman, et al., *State and Local Implementation of the No Child Left Behind Act, Volume II, Teacher Quality Under NCLB: Interim Report*. U.S. Department of Education, Office of Planning, Evaluation and Policy Development, August, 2007.

Figure 3 shows that while most students have teachers who are fully certified, there is a difference among racial/ethnic groups and school lunch eligibility. Black students, Hispanic students, and students eligible for school lunch are less likely than White and nonschool-lunch-eligible students to have certified teachers. There has been little change in the gap over the period for which we have comparable data.

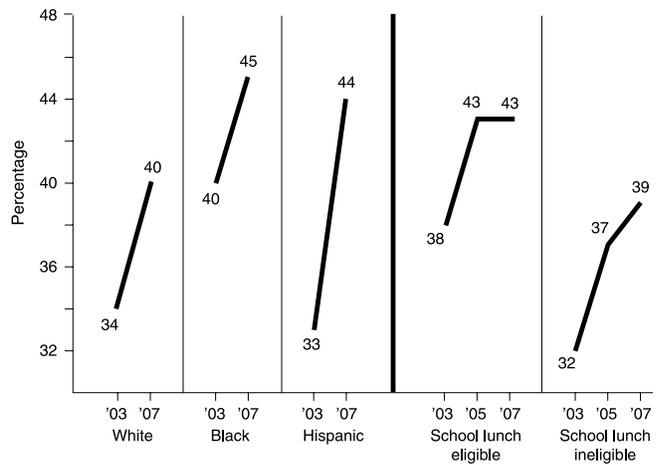
Figure 3
Percentage of Eighth Graders Whose Teachers Have Regular or Standard Certification or Advanced Professional Certification by Racial/Ethnic Group and School Lunch Eligibility



Source: U.S. Department of Education, Institute of Educational Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.

Figure 4 shows the percentage of students whose teachers have neither a major nor minor in mathematics. The percentage rose between 2003 and 2007 for all groups, but increased the most for Hispanic students, from 33 percent to 44 percent. The gap between White and Black eighth graders was about the same over the two time periods. However, the gap between White and Hispanic eighth graders increased between 2003 and 2007. Figure 4 also shows a decrease in undergraduate math preparation, both for students eligible for school lunches and those not eligible. The gap between the two remained about the same.

Figure 4
Percentage of Eighth Graders with Teachers Having Neither a Major nor a Minor in Mathematics, by Racial/Ethnic Group and School Lunch Eligibility



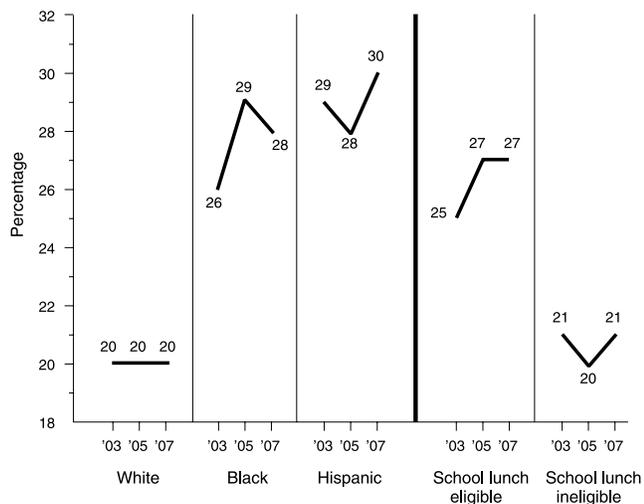
Source: U.S. Department of Education, Institute of Educational Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.

Teacher Experience

The initial *Parsing* report identified teacher experience as having a strong association with student achievement. Research has found a difference in effectiveness between teachers with less than five years of experience and teachers with more.

Changes in the way NAEP has captured teacher experience over the years limit the extent to which we can track trends. We are able to show the percentage of eighth-grade math students whose teachers have four years or less of experience working as elementary or secondary school teachers. For the periods 2003, 2005, and 2007 we can track these data for racial/ethnic groups and for students who are and are not eligible for free and reduced-price lunch. As shown in Figure 5, in 2007 White students were less likely than Black and Hispanic students to have inexperienced teachers. Similarly, students who were eligible for free and reduced-price lunch were more likely than those not eligible to have inexperienced teachers. These percentages have been stable and the gaps have remained unchanged over the time period examined.

Figure 5
Percentage of Eighth Graders Whose Teachers Have Four Years or Less Experience as an Elementary or Secondary School Teacher, by Racial/Ethnic Group and School Lunch Eligibility



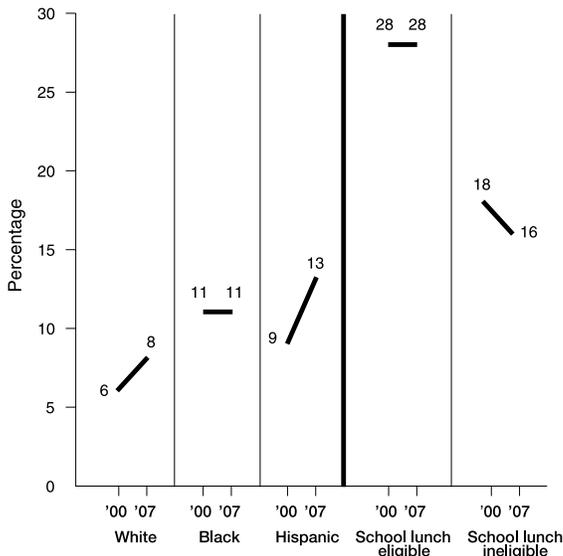
Source: U.S. Department of Education, Institute of Educational Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics Assessment.

Teacher Absence and Turnover

In a recent study, three Harvard University researchers found large variations in teacher absence rates among schools, and they estimated that each 10 days of teacher absences will reduce students' math achievement substantially — in statistical terms, by 3.3 percent of a standard deviation.¹² In another recent study, Duke University researchers, using data on elementary school students in North Carolina, also found that teacher absences are associated with lower student achievement.¹³ We would expect that the use of substitute and replacement teachers would have a similarly adverse effect, although we are not aware of any research that addresses this issue specifically.

We can use data from NAEP to assess the extent of teacher absence. Schools report the percentage of teachers who are absent on an average day and these data can be assigned to students. For eighth-grade math students, the rate of teacher absence is higher for minority students and students eligible for school lunches than for White students and students not eligible for school lunches. As shown in Figure 6, in 2007 8 percent of White eighth graders attended schools where 6 percent or more of the teachers are absent on

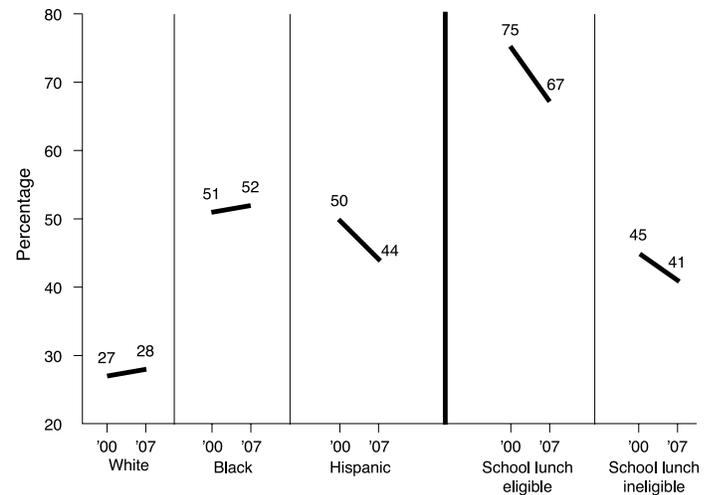
Figure 6
Percentage of Eighth-Grade Students Attending Schools Where Six Percent or More of Teachers Are Absent on an Average Day, by Race/Ethnicity and School Lunch Eligibility, 2000 and 2007



Source: U.S. Department of Education, Institute of Educational Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics.

an average day. The comparable percentages for Black and Hispanic eighth graders are 11 and 13, respectively. For Hispanic students, there was an increase of four percentage points over the two time periods. There was little change in the gap from 2000 to 2007.

Figure 7
Percentage of Eighth-Grade Mathematics Students Whose Teachers Left Before the End of the School Year, by Racial/Ethnic Group and School Lunch Eligibility, 2000 and 2007



Source: U.S. Department of Education, Institute of Educational Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2007 Mathematics.

The gap in the percentage of teachers who leave before the end of the school year is very large, as shown in Figure 7. In 2007, 52 percent of Black and 44 percent of Hispanic eighth graders had a teacher who left before the end of the school year, compared with 28 percent of White eighth graders. A full two-thirds of eighth graders who were eligible for the school lunch program had a teacher who didn't make it through the school year.

These statistics are evidence of substantial discontinuity in instruction, particularly if there is a lag in getting a permanent replacement. The gap between White and Black students was about the same from 2000 to 2007; there was some decline in the gap for Hispanic students. There was a slight narrowing of the gap between those eligible for school lunches and those not eligible.

¹² Raegen Miller, Richard Murnane, and John Willett, *Do Teacher Absences Impact Student Achievement? Longitudinal Evidence From One Urban School District*, National Bureau of Economic Research, Working Paper Number W13356, August 2007.

¹³ Charles Clotfelter, Helen Ladd, and Jacob Vigdor, *Are Teacher Absences Worth Worrying About in the U.S.?*, National Bureau of Economic Research, Working Paper Number W13848, November 2007.

Class Size

Many years ago, Marshall Smith and Gene Glass synthesized the results of 77 studies of class size, finding benefits of higher achievement in smaller classes, mainly in classes of fewer than 20 students,¹⁴ as well as other benefits. Reanalysis by others came to different conclusions. Nevertheless, Project STAR (1985), the only large-scale class-size study to use control groups, reached the same conclusion as Smith and Glass. Project STAR's findings are still being examined. Dr. Jeremy D. Finn, an external evaluator of STAR, concluded that, "Project STAR and related studies provide compelling evidence that small classes in the primary grades are educationally superior to regular-size classes. The findings were confirmed for every school subject tested."¹⁵

The data from Project STAR and other studies have been extensively reanalyzed, most notably by Eric A. Hanushek and Alan B. Krueger; the two have engaged in a debate for several years over whether smaller classes resulted in higher achievement. In *The Class Size Debate*, the editors concluded:

A careful reading of the papers that follow cannot fail to lead readers to the conclusion that there is substantial agreement between the antagonists. It is perhaps best expressed by Dr. Hanushek when he states, "Surely class size reductions are beneficial in specific circumstances — for specific groups of students, subject matter and teachers."

Similarly, in his paper, Dr. Krueger states, "The effect sizes found in the STAR experiment and much of the literature are greater for minority and disadvantaged students than for other students."¹⁶

Although the debate continues, the different viewpoints in the policy world have more to do with cost and alternative measures to reducing class size than with whether studies show any educational benefits in doing so. Meanwhile, many class-size reduction programs are under way throughout the country. As addressed in this report, the issue is one of equality among racial/ethnic groups and the poor and nonpoor with respect to class size. There is likely more of a consensus on the value of such equality.

Teachers in schools with large minority enrollments are more likely to have large classes (25 or more students). Between 1999 – 2000 and 2003 – 2004, there was a decrease in the percentage of teachers with large classes, both in schools with a low concentration of

minority students and in schools with a high concentration of such students (see Figure 8). The decrease was somewhat smaller; however, for teachers in schools with high concentrations of minority students. In addition, there has been a decrease in the percentage of teachers with large classes, both in schools with a high concentration of low-income students as well as in those schools with a low percentage of such students (Figure 9).

Figure 8
Percentage of Teachers with Classes of 25 or More Students by Percentage of School Minority Enrollment

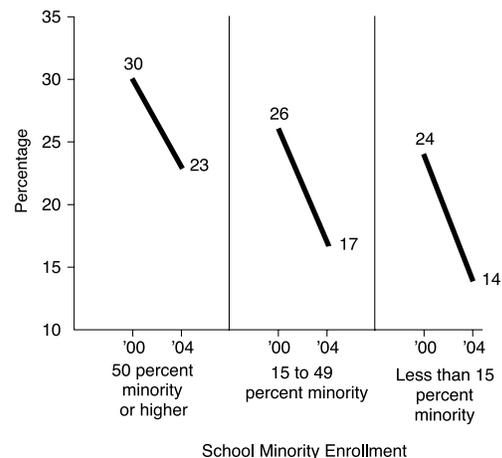
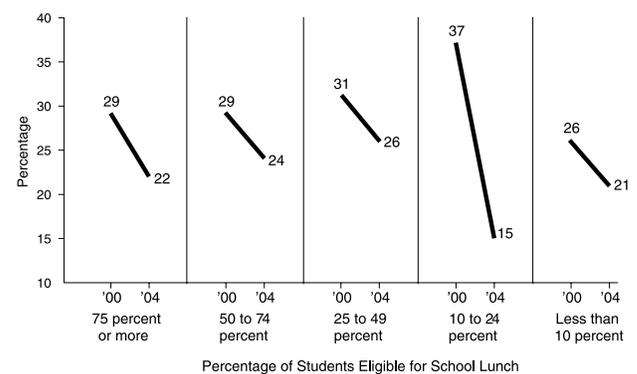


Figure 9
Percentage of Teachers with Classes of 25 or More Students by Percentage of Students Eligible for School Lunch Program



Source: Data from the School and Staffing Survey analyzed by ETS.

In terms of the gap, it increased between schools with high and low minority student concentrations. While the percentage of large classes decreased across the board, it decreased more in schools with low percentages of minority students than it did in schools with high minority concentrations. The gap remained about the same when schools are grouped by the concentration of students eligible for school lunch.

¹⁴ Gene Glass and Marshall Smith, "Meta-Analysis of Research on the Relationship of Class Size and Achievement," *Educational Evaluation and Policy Analysis*, 1 (1), pp. 2 – 16, 1978.

¹⁵ Jeremy D. Finn, *Class Size and Student Risk: What is Known? What is Next?*, a paper commissioned by the Office of Educational Research and Improvement, U.S. Department of Education, April 1998 (<http://www.ed.gov/pubs/classsize/title.html>).

¹⁶ Lawrence Mishel and Richard Rothstein (Eds.), *The Class Size Debate*, The Economic Policy Institute, Washington, D.C., 2002.

Technology in the Classroom

Computers are becoming ubiquitous in the schools, and Internet access is steadily increasing. Much data have been collected about quantities of and access to computer hardware, but much less information is available about the specific uses of classroom technology and how computers and the Internet are being integrated into instruction. There is research on the effectiveness of the uses of the computer, but little on the use of the Internet.

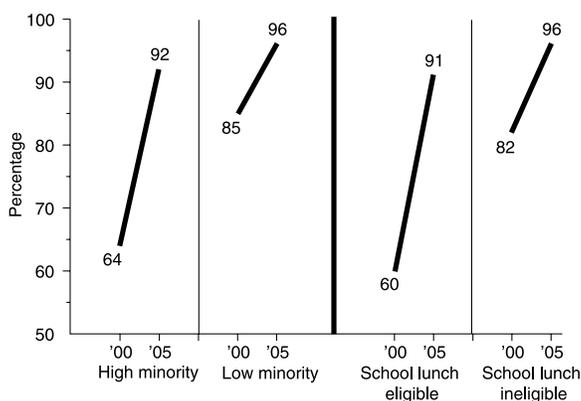
Numerous studies have been conducted on the use of computers for “drill and practice.” In 1997, the President’s Committee of Advisors on Science and Technology summed up the findings of four “meta-analyses,” or syntheses, of the existing studies.¹⁷ The effect on achievement was seen as consistently positive and considerable, and strongest for low-achieving students and those of lower socioeconomic status. Daniel Mayer and his colleagues report that, “Research on the application of computers for developing higher-order thinking skills, problem-solving group work, and hands-on learning activities, however, is less extensive and less conclusive.” Two studies show positive effects, although one concluded that it was unknown whether computers for such instruction would be cost-effective.¹⁸

Computer and Internet availability in the classroom continue to increase, as shown in Figures 10 and 11. Although five years ago we reported substantial gaps,

some gaps have narrowed. As shown in Figure 10, by 2005, 92 percent of schools with 50 percent or more minority enrollment had Internet access in the classroom, compared with 96 percent of schools with less than 6 percent minority enrollment. A similar narrowing occurred between students eligible and not eligible for school lunches.

There was a large decline in the ratio of students to computers for both majority and minority students between 2000 and 2005, and the gap in the ratio narrowed over the five-year period (see Figure 11). By 2005, there was only a very small gap in the ratio of students to instructional computers with Internet access, based on school lunch eligibility.

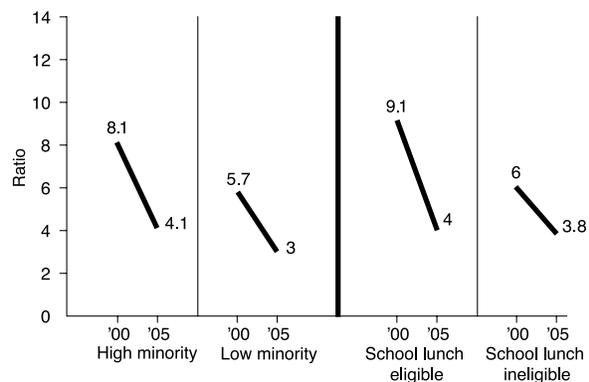
Figure 10
Percentage of Public School Instructional Rooms with Internet Access, by Minority Enrollment and School Lunch Eligibility



Note: High minority is defined as 50 percent or more minority; low minority is defined as less than 6 percent minority. High lunch eligible is defined as 75 percent or more eligible; low lunch eligible is defined as less than 35 percent eligible.

Source: National Center for Education Statistics, *Internet Access in U.S. Public Schools and Classrooms: 1994 – 2005*, NCES 2007 – 020, 2007.

Figure 11
Ratio of Public School Students to Instructional Computers with Internet Access, by Minority Enrollment and School Lunch Eligibility, 2000 and 2005



Note: High minority is defined as 50 percent or more minority; low minority is defined as less than 6 percent minority. High lunch eligible is defined as 75 percent or more eligible; low lunch eligible is defined as less than 35 percent eligible.

Source: National Center for Education Statistics, *Internet Access in U.S. Public Schools and Classrooms: 1994 – 2005*, NCES 2007 – 020, 2007.

Having access to computers, however, is a very gross and inadequate measure of the extent of their use for instruction, the quality of content, the integration of the content into the curriculum, and the preparation of teachers in the instructional use of the computers. We simply do not have such measures. *Education Week’s* “Technology Counts 2004” provided an example of the kind of data needed regarding teachers’ skill levels. Although 77 percent of teachers in low-minority schools were at the intermediate or advanced skill level in 2003, just 52 percent were at a similar level in the high-minority schools.¹⁹

¹⁷ President’s Committee of Advisors on Science and Technology, panel on Educational Technology, *Report to the President on the Use of Technology to Strengthen K – 12 Education in the United States*, 1997, as cited in Mayer, et al., 2000.

¹⁸ Mayer, et al., 2000 cites three studies: Thomas K. Glennan and Arthur Melmed, *Fostering the Use of Educational Technology: Elements of a National Strategy*; Santa Monica, CA, Rand, 1996; Harold Wenglinsky, *Does it Compute? The Relationship Between Educational Technology and Student Achievement in Mathematics*, Policy Information Report, ETS Policy Information Center, 1998; and President’s Committee of Advisors on Science and Technology, 1997.

¹⁹ *Education Week*, “Technology Counts 2004,” p. 65. Data from Market Data Retrieval, “Technology in Education 2003.”

Fear and Safety at School

A general lack of student discipline and an atmosphere in schools that produces fear in students are not conducive to learning. The research synthesis *Monitoring School Quality: An Indicators Report* had this to say:

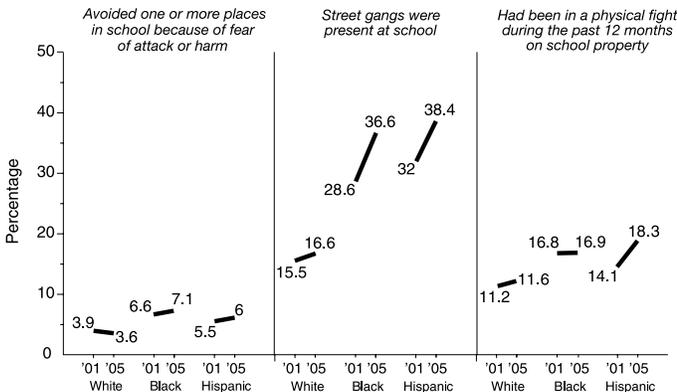
Researchers have found that a positive disciplinary climate is directly linked to high achievement (Barton, Coley, and Wenglinsky, 1998; Byrk, Lee, and Holland, 1993; Chubb and Moe, 1990). An orderly school atmosphere conducive to learning could be an example of a “necessary but not sufficient” characteristic of quality schools. Quality schools with high levels of student learning may have an accompanying high level of orderliness and discipline throughout the school as students are actively engaged in educationally productive activities. ... The issues that school discipline policies are designed to address are well known and range from the disconcerting to the dangerous. They include student disrespect for teachers, absenteeism, tardiness, use of alcohol and controlled substances, fighting, and possession of firearms.²⁰

In 2005 there were very substantial gaps by race/ethnicity in the available measures of fear and safety at schools (see Figure 12). The percentage of minority students ages 12 to 18 who avoided places in school for fear of attack or harm, and who reported that street gangs were present in the school, was about double that of White students. Reports of having been in a physical fight were also considerably higher for minority students.

Between 2001 and 2005 there were changes on some of the measures. There was an increase for Black and Hispanic students in reporting gangs in the schools, and thus a widening of the gap. For White and Black students, the percentage reporting physical fights was stable from 2001 to 2005, but it rose for Hispanic students from 14.1 percent to 18 percent, which widened the gap with White students.

Researchers have given less attention to the ordinary garden variety of disruptive student behaviors that handicap learning in the classroom, and less current data exist on that type of behavior. In 1992, NAEP asked fourth graders how much they agreed or disagreed with the following statement: “Disruptions by other students get in the way of my learning.” Forty-three percent of White students agreed or strongly agreed, compared with 56 percent of Black students and 52 percent of Hispanic students. Since then, no similar measure is available.

Figure 12
Percentage of Students Ages 12 to 18 Who Reported Issues of Fear or Safety at School in the Previous Six Months



Source: Rachel Dinkes, et al., *Indicators of School Crime and Safety: 2006*, National Center for Education Statistics, Bureau of Justice Statistics, Tables 16.2, 16.1, 8.1, 12.1.

²⁰ Mayer, et al., 2000 cite the following: Paul Barton, Richard Coley, and Harold Wenglinsky, *Order in the Classroom: Violence, Discipline and Student Achievement*, Policy Information Report, ETS Policy Information Center, 1998; Anthony S. Byrk, Valerie E. Lee, and Peter B. Holland, *Catholic Schools and the Common Good*, Cambridge, MA, and London: Harvard University Press, 1993; and John E. Chubb and Terry M. Moe, *Politics, Markets and America's Schools*, Brookings Institution, Washington, D.C., 1990.

Parent Participation

Although schools are charged with the primary responsibility for education, their success depends on a cooperative effort among students, teachers, parents, and the schools themselves. Child Trends summarizes the research on the effect that parental involvement has on student learning:

Students with parents who are involved in their school tend to have fewer behavioral problems and better academic performance, and are more likely to complete secondary school than students whose parents are not involved in their schools. Parental involvement allows parents to monitor school and classroom activities, and to coordinate their efforts with teachers. Teachers of students with highly involved parents tend to give greater attention to those students, and they tend to identify problems that might inhibit student learning at earlier stages. Research has found that students perform better in school if their fathers as well as their mothers are involved, regardless of whether the father lives with the student.²¹

A Child Trends publication contains this synthesis of the research:

Studies report that children whose parents are involved in their schooling are more likely to earn high grades and enjoy school than children whose parents are not involved in their children's schooling. This result holds for students in both elementary and secondary school. Children of involved parents are also more likely to have higher educational aspirations and motivation to achieve. In addition, parent involvement in school is related to fewer student suspensions and expulsions and higher levels of student participation in extracurricular activities. Data also suggest that schools that welcome parental involvement are likely to have highly involved parents.²²

Using the Chicago Longitudinal Study database, Arthur Reynolds and Melissa Clements' recent research documents the contributions of family involvement. Their research spanned a period of 17 years, involving 1,539 low-income children, of whom 93 percent were Black, with a matched comparison group. The study found that parent involvement serves as a mechanism through which the long-term effects of interventions are achieved, ultimately leading to higher levels of student performance.²³

On some measures of parental involvement, such as whether parents attend a scheduled meeting with a teacher, there is little difference by race/ethnicity or measures of family income. However, on measures reflecting a greater degree of involvement, larger differences emerge. Figure 13 shows two measures of parent involvement for two periods of time, by students' racial/ethnic group. As the figure shows, parents of Black or Hispanic students are much less likely to attend a school event or to act as a volunteer or serve on a committee. For example, in 2003, 74 percent of White students had a parent who attended a school event, compared with 63 percent and 61 percent, respectively, of Black and Hispanic students' parents. A similar gap shows up in the percentage of students whose parents volunteer or serve on a committee.

This is also true of parents with lower household incomes. Parent involvement is lower for students whose household is at or below the poverty level.²⁴ Also, teachers are much more likely, in the case of parents from high-poverty schools, to report that lack of parental involvement is a moderate or serious problem.²⁵

²¹ Child Trends DataBank, <http://www.childtrendsdatabank.org/family/thefamily/39/parentalinvolvementinschools.htm>. cites: Ann T. Henderson and Nancy Beria, *A New Generation of Evidence: The Family Is Critical to Student Achievement*, National Committee for Citizens in Education, Washington, D.C., 1994; Nicholas Zill and Christine W. Nord, *Running in Place: How American Families Are Faring in a Changing Economy and Individualistic Society*, Child Trends, Washington, D.C., 1994; Christine W. Nord and Jerry West, *Fathers' and Mothers' Involvement in Their Children's Schools by Family Type and Residence Status*, National Center for Education Statistics, Washington, D.C., 2001, (NCES 2001 – 032).

²² *Charting Parenthood: A Statistical Portrait of Fathers and Mothers in America*, produced by Child Trends, Tamara Halle, Project Director, 2002. Research cited and not included above: Kathryn R. Wentzel, "Social-Motivational Processes and Interpersonal Relationships: Implications for Understanding Motivation at School," *Journal of Educational Psychology*, 91 (1), 76 – 97; Joyce Epstein and Susan Dauber, "School Programs and Teacher Practices of Parent Involvement in Inner City Elementary and Secondary Schools," *The Elementary School Journal*, 91, 189 – 305.

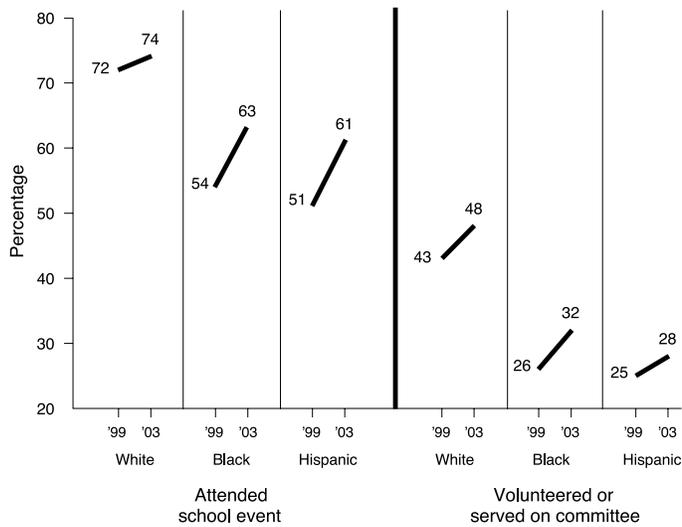
²³ Arthur J. Reynolds and Melissa Clements, "Parental Involvement and Children's School Success?," in Evanthia Patrikakov, et al., *School-Family Partnerships for Children's Success*, New York, Teachers College Press, 2005.

²⁴ U.S. Department of Education, *Parent and Family Involvement in Education: 2002 – 2003*, as reported in Child Trends DataBank.

²⁵ *Education Week*, "Quality Counts," 2003, p. 62.

The good news is that parent involvement showed an increase from 1999 to 2003, for all racial/ethnic groups. In addition, the racial/ethnic gap narrowed for attending a school event; it remained about the same for volunteering or serving on a committee. Similar data on trends by family income are not available.

Figure 13
 Percentage of Students in Grades K to 12 Whose Parents Reported Involvement in Their Child's School, by Racial/Ethnic Group, 1999 and 2003



Source: Data are from U.S. Department of Education, National Center for Education Statistics, *The Condition of Education 2007*, reported in Child Trends DataBank.

Frequent School Changing

The matter of frequent school changing and its effects on student achievement received national attention in a report from the General Accounting Office, now called the General Accountability Office: “About 17 percent of all third graders — more than a half million — have changed schools frequently, attending three or more schools since first grade.”²⁶ Unfortunately, more recent data are not available. A change in schools can mean that a student faces work he or she is not prepared for, a teacher who is not likely to be familiar with the student’s prior learning, and an environment in which the student has to deal with being an outsider who has to make all new friends.

The study reported that 41 percent of these frequent school changers were below grade level in reading and 33 percent were below grade level in math, compared with 26 percent and 17 percent, respectively, of students who had never changed schools.

In 2002, a volume published by the Citizens Commission on Civil Rights synthesized the extensive number of research studies that have examined school changing and its effect on student achievement. Its conclusion was that high student mobility has consequences for mobile students, teachers, and schools. For students, the long-term effects of high mobility include lower achievement levels and slower academic pacing, culminating in a reduced likelihood of high school completion.²⁷

Russell Rumberger reviewed the research literature on the effects of frequent school changing and concluded: “Although a substantial body of research suggests that students may be affected psychologically, socially, and academically from changing schools, the impact of mobility depends on such factors as the number of school changes, when they occur, the reason for the changes, and the student’s personal and family situation.”²⁸ That makes it important for the receiving school to have as much information as it can about the circumstances of each student.

Russell Rumberger also cautions that by no means is all school changing due to residence changing, citing research data showing that 30 to 40 percent of such changes are not due to this reason. Other factors include overcrowding, class-size reductions,

suspension and expulsion policies, and the general academic and social climate. NCLB, with its parental choice options, may also contribute.²⁹

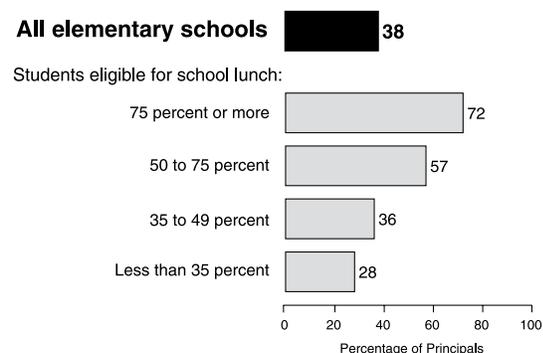
In addition to lower achievement, a study by Christopher Swanson and Barbara Schneider found that mobility during elementary school increases the odds of dropping out of high school.³⁰

It is important for a student’s new school to have good information from the student’s previous school. That frequently is not the case. This deficiency can be remedied by concerted efforts like those under way in a number of states and districts to create “student identifiers” so that students, along with their records, can be tracked throughout their school years.

Supplementing the academic research on the effects of mobility, elementary school principals expressed their beliefs that mobility is a barrier to “applying high standards to all students in the school.” According to this NCES survey, shown in Figure 14, more than one-third of all elementary school principals cite student mobility as a barrier. As the percentage of low-income students increases, the percentage of principals who cite mobility as a barrier rises sharply.³¹ We are unaware of any more recent data on this issue.

Figure 14

Percentage of Elementary School Principals Citing Student Mobility as a Barrier to Applying High Standards to All Students, by Percentage of Students Eligible for Free or Reduced-Price School Lunch, 1996



Source: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey Systems, “Public School Survey on Educational Reform,” FASS54, 1996.

²⁶ United States General Accounting Office, *Elementary School Children: Many Change Schools Frequently, Harming Their Education*, February 1994. This analysis was based on the U.S. Department of Education’s *Prospects Study* of 1990 – 91.

²⁷ Chester Hartman, “High Classroom Turnover: How Children Get Left Behind,” in Diane Piche, et al., (Eds.), *Rights at Risk: Equality in an Age of Terrorism*, Citizens’ Commission on Civil Rights, Washington, D.C., 2002.

²⁸ Russell W. Rumberger, “Student Mobility and Academic Achievement,” *ERIC Digest*, 1998. <http://www.ericdigests.org/2003-2/mobility.html>.

²⁹ Rumberger, 1998.

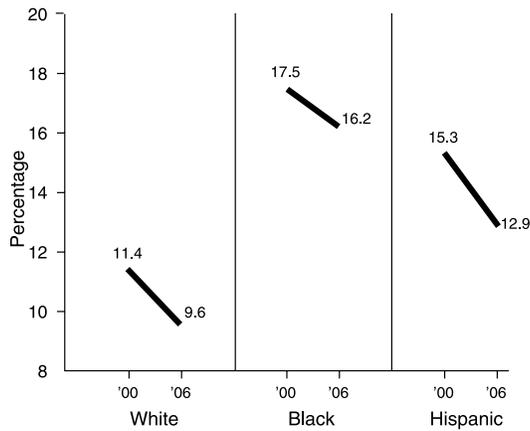
³⁰ Christopher B. Swanson and Barbara Schneider, “Students on the Move: Residential and Educational Mobility in America’s Schools,” *Sociology of Education*, v72, n1, January 1999.

³¹ U.S. Department of Education, National Center for Education Statistics, Fast Response Survey Systems, “Public School Survey on Educational Reform,” FASS54, 1996.

According to data from NAEP, a fifth of the nation's White fourth graders have changed schools two or more times, compared with a fourth of Black fourth graders and a fifth of Hispanic fourth graders. The good news is that throughout the 1990s, the rate of changing schools declined, with the exception of the period 1998 – 2000 for Hispanic students. As the rates have declined, however, the gap has remained largely unchanged in relative terms.

In addition, in the period 1998 – 2000, the rates were unchanged for poor and nonpoor fourth graders; the rate for the poor students was more than double that for the nonpoor.

Figure 15
Percentage of Households with Children Ages 6 to 17 That Moved in the Prior Year by Racial/Ethnic Group, 2000 and 2006



Source: U.S. Census Bureau, Current Population Survey, March 2000, downloaded 12/15/07, and U.S. Census Bureau, Current Population Survey, 2006 Annual Social and Economic Supplement, Internet Release Date: October 16, 2007, Table 15.

While the data on levels and trends in school changing are from NAEP, the question has been dropped from the survey and there has been no information from NAEP since 2000.

The best data now available on school changing are from the Census Bureau's Current Population Survey, which reports how many households with children aged 6 to 17 moved over the prior year. As seen in Figure 15, there is more mobility among Hispanic than White households, and considerably more among Black than White households.

From 2000 to 2006, the frequency of moving declined among all three subgroups; the largest decline was among Hispanic households. The gap between Black and White households and between White and Hispanic households changed very little.

For a better understanding of who the highly mobile students are and examples of efforts to help them, see *Fragmented: Improving Education for Mobile Students* by Lynora Williams and published in 2003 by The Poverty and Race Research Action Council.

Low Birth Weight

Low birth weight can lead to severe problems, ranging from mortality to learning difficulties. Child Trends summarizes the findings of research from an education standpoint this way:

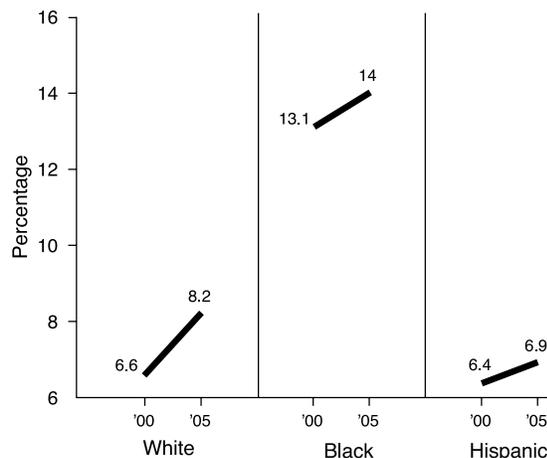
Infants born at low birth weight are at risk of long-term disability and impaired development. Infants born under 2,500 grams are more likely than heavier infants to experience delayed motor and social development, and children aged 4 – 17 who were born at low birth weight were more likely to be enrolled in special classes, to repeat a grade, or to fail in school than children who were born at a normal birth weight.³²

Figure 16 shows the variation in the incidence of low birth weight by race/ethnicity. The highest incidence is among Black infants, at 14 percent in 2005. This is about double the incidence for White and Hispanic infants.

As shown in Figure 16, there was an increase in low birth weight for all three groups from 2000 to 2005, with the largest increase for White infants, rising from 6.6 percent to 8.2 percent, and now exceeding the 6.9 percent rate for Hispanic infants. The gap between the rate for White and Black infants narrowed from 2000 to 2005 because the increase for White infants was greater than the increase for Black infants.

The rate for White infants also increased more than the rate for Hispanic infants. By 2005, a gap opened between White and Hispanic rates, with the White rate at 8.2 percent compared with 6.9 percent for Hispanics.

Figure 16
Percentage of Infants Born at Low Birth Weight by Racial/Ethnic Group, 2000 and 2005



Source: Child Trends DataBank (http://www.childtrendsdatabank.org/pdf/57_PDF.pdf).

³² Child Trends DataBank. The research summarized by Child Trends is as follows: Maureen Hack, Nancy K. Klein, H. Gerry Taylor, "Long-Term Developmental Outcomes of Low Birth Weight Infants," *The Future of Children: Low Birth Weight*, Vol. 5 (1): 19 – 34, Center for the Future of Children, the David and Lucile Packard Foundation, Los Altos, CA, http://www.futureofchildren.org/pubs-info2825/pubs-info.htm?doc_id=79872; Mary L. Hediger, Mary D. Overpeck, W. June Ruan, and James F. Troendle, "Birthweight and Gestational Age: Effects on Motor and Social Development," *Pediatric and Prenatal Epidemiology*, 16:33 – 46, 2002; National Education Goals Panel, *Special Early Childhood Report*, 1977, <http://www.negpgov/reports/spcl.pdf>.

Environmental Damage

In the first *Parsing* report, information on environmental damage focused solely on lead poisoning in children. The problem of lead in a child's environment is well known and measured, and research on its harmful effects is extensive. However, awareness of other environmental dangers that affect children's health is growing, and public policy is increasingly attempting to deal with these dangers. We start with an update on lead poisoning and provide data on trends since the late 1970s. In this updated version of *Parsing*, we expand the discussion to include mercury poisoning.

Lead Poisoning. The U.S. government began its efforts to eliminate lead poisoning with the enactment of the Lead Contamination Act of 1988. Decades ago, the greatest threats from lead came from lead paint in houses and other structures, and from lead in gasoline.

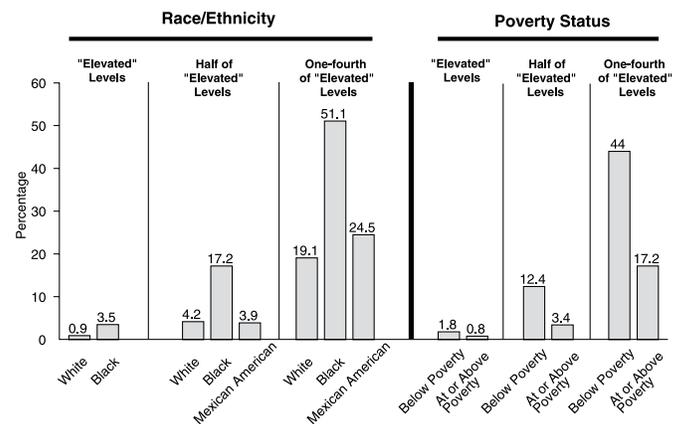
As occupancy of old houses declines, so does the lead threat, and the elimination of lead in gasoline has had benefits as well. However, old houses are still around, there is lead in the paint of other old buildings — from office facilities to factories — and dirt at old building sites may retain contamination. In addition, “as many as 35 percent of children identified with elevated blood lead levels have been exposed to items decorated or made with lead.” Also, a dispersion of naturally occurring lead deposits results from widespread industrial activity.³³ In recent years, schools in Chicago, Boston, Philadelphia, and Washington, D.C., shut down their drinking fountains because of lead in the water pipes; old lead pipes are still a problem in many places.

Levels that exceed the CDC's standard cause “reductions in IQ and attention span, reading and learning disabilities and behavior problems,” according to a 1999 report by the General Accounting Office. Fewer than 20 percent of children most at risk have ever been screened,³⁴ however, so we do not know how many among the remaining 80 percent have lead poisoning.

Over the years, the CDC has lowered the threshold of lead blood levels considered dangerous. However, a synthesis of recent studies, including one dating as far back as 1986, established that there is **no** safe threshold. A review of available research “did not suggest a threshold below which no association between blood lead level and intelligence in young children has been found.”³⁵ Therefore, based on current knowledge, there is no safe level of lead in the bloodstream.

Children in minority and low-income families have a higher risk of exposure to lead from living in old houses or around old industrial areas with contaminated buildings and soil. Figure 17 shows these higher levels of lead. Since there is no safe level of lead in the blood, we show the percentage of children exceeding the official CDC definition of elevated levels, and also the percentage exceeding one-half and one-fourth of that level. The percentage of children exceeding this official elevated level is relatively small. However, the rate is about four times higher for Black than for White children, and more than double for children below the poverty line than for those above it.

Figure 17
Blood Lead Levels in Children Ages 1 to 5, by Racial/Ethnic Group and Poverty Status, 2001 – 2004 (Combined)



Source: Federal Interagency Forum on Child and Family Statistics, *America's Children: Key National Indicators of Well Being, 2007*, 2007, p. 133. The original data are from the National Health and Nutrition Examination Survey. The “Elevated” Level is set by the Center for Disease Control at $\geq 10 \mu\text{g}/\text{dL}$ or greater. We have called $\geq 5 \mu\text{g}/\text{dL}$ “half of ‘Elevated’ Level” and $\geq 2.5 \mu\text{g}/\text{dL}$ “a fourth of ‘Elevated’ Level.” Data on elevated levels in Mexican American children were not used because it was considered “unreliable.”

³³ Centers for Disease Control and Prevention, *Preventing Lead Poisoning in Young Children*, August 2005. This is an excellent overview of the problem and what should be done about it. An appendix contains *A Review of Evidence of Adverse Health Effects Associated with Blood Levels $\geq 10 \mu\text{g}/\text{dL}$ in Children*.

³⁴ U.S. General Accounting Office, *Lead Poisoning: Federal Health Care Programs Are Not Effectively Reaching At-Risk Children* (GAO/HEHS 99 – 18), Washington, D.C., 1999 (as cited in Richard Rothstein, *Out of Balance: Our Understanding of How Schools Affect Society and How Society Affects Schools*, the Spencer Foundation, 2002).

³⁵ Centers for Disease Control and Prevention, 2005.

When we look at children whose blood lead levels are at half the official elevated level, the proportions rise dramatically, to 17 percent for Black children and about 4 percent for both White and Mexican American children. At one-fourth the official elevated level, we find over half of Black children, a fourth of Mexican American children, and a fifth of White children. Similar patterns in lead exposure appear when children are grouped by poverty status.

In Figure 18, we see the dramatic drop in blood lead levels, particularly in the period from 1976 – 1980 to 1988 – 1991, but leveling off in recent years. Note, however, that the rates for minority children remain above those for White children. In Figure 19, we track the gaps by race and ethnicity, irrespective of the levels. The gaps are relatively constant throughout this long period, in terms of the ratio of median blood lead levels of Black and Mexican American children to White children.

Figure 18
Median Blood Lead Concentrations Among Children Ages 1 to 5, Selected Years from 1976 to 2004, by Race/Ethnicity

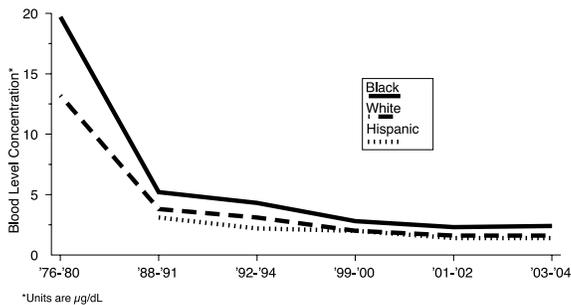
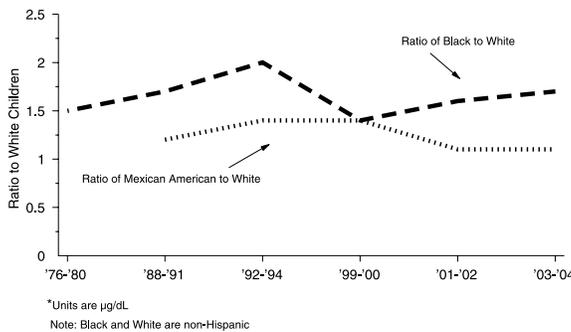


Figure 19
Comparisons (Ratios) of Blood Lead Concentration Between White and Black and White and Mexican American Children Ages 1 to 5, Selected Years from 1976 to 2004



Source: Federal Interagency Forum on Child and Family Statistics, *America's Children: Key National Indicators of Well Being, 2007*, 2007, p. 133. The original data are from the National Health and Nutrition Examination Survey.

Mercury Poisoning. Long known to be poisonous, mercury has risen to the level of a national policy debate in the last five years or so. The effects of mercury are severe:

*For fetuses, infants, and children, the primary health effect of methylmercury is impaired neurological development. Methylmercury exposure in the womb ... can adversely affect a baby's growing brain and nervous system. Impacts on cognitive thinking, memory, attention, language, fine motor and visual spatial skills have been seen in children exposed. ... symptoms of methylmercury poisoning may include impairment of the peripheral vision; disturbances in the sensations ... lack of coordination of movements; impairment of speech, hearing, walking; and muscle weakness.*³⁶

The symptoms are somewhat different for other forms of mercury, such as metallic mercury and other mercury compounds, but the effects are similarly detrimental to cognitive development and achievement in school.

Mercury poisoning has been measured in children aged 1 to 5 and women 16 to 49, the major child-bearing years. That study concluded that approximately 8 percent of the women had concentrations higher than the U.S. Environmental Protection Agency recommendation.³⁷

The findings are described below. No trend data are available.

Geometric mean total mercury levels in non-Hispanic Black and Mexican American children were higher than in non-Hispanic White children; the differences were small but statistically significant. Among women aged 16 to 49 years, non-Hispanic Blacks had higher geometric mean mercury levels compared with non-Hispanic Whites and Mexican Americans.

³⁶ Environmental Protection Agency, *Mercury Health Effects*, <http://www.epa.gov/mercury/effects.htm> (last updated May 11, 2007).

³⁷ Susan E. Schober, et al., "Blood Mercury Levels in U.S. Children and Women of Childbearing Age, 1999 – 2000," *Journal of the American Medical Association*, v289, n13, April 2, 2003.

Hunger and Nutrition

The importance of adequate nutrition for the development of the mind and body is broadly accepted, and it is reasonable to conclude that young people with empty stomachs are likely to find it difficult to concentrate on their studies. There is research that explores some aspects of the relationship between nutrition and school achievement.

- Experimental studies with control groups found that children given vitamin and mineral supplements had test score gains that exceeded those of the control group.³⁸
- A study of inner-city kindergarten children found that those who were underweight tended to have lower test scores.³⁹
- Poor children given a free breakfast at school gained about three percentile points on standardized test scores and had improved attendance compared with children who were eligible but did not participate.⁴⁰

According to a recent synthesis of research:

... food insecurity may be associated with a heightened incidence of behavior problems and hinder cognitive development and achievement in preschool-age and school-age children. Food insecurity appears to be related to children's developmental outcomes even when socio-economic factors, such as family income and poverty, are taken into account, and even when samples are restricted to very low income families.⁴¹

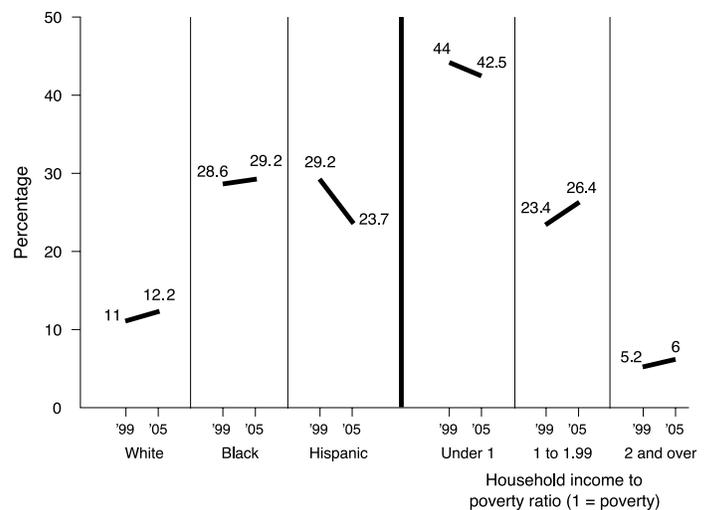
In 2006, the World Bank reported that children are irreversibly damaged by malnutrition by age two, and argued that better efforts need to be made worldwide to fight child hunger. Intervention must come before age two, based on a large body of research by nutritionists. "If you miss that period, the damage is irreversible, especially in cognition, but also in growth," said Marie Ruel, director of the division of food consumption and nutrition at the International Food Policy Research Institute.⁴²

The U.S. Department of Agriculture conducts regular surveys of food insecurity. Households are classified as "food insecurity" and "very low food security among children." In this latter category, children are at highest risk of getting inadequate nutrition.

Figure 20 shows trends in the percentage of children who live in food-insecure households by racial/ethnic group and poverty status.⁴³ In 2005, 29 percent and 24 percent, respectively, of Black and Hispanic children were food insecure, compared with 12 percent of White children. Thus, minority households had 2.5 times the food insecurity of White households. Forty-three percent of households below the poverty line were food insecure, compared with just 6 percent of households with incomes more than double the poverty line.

Figure 20

Percentage of Children Ages 0 to 17 in Food-Insecure Households by Racial/Ethnic Group and Poverty Status, 1999 and 2005



Source: Federal Interagency Forum on Child and Family Statistics, ChildStats.gov, Table Econ3.A, downloaded 11/21/2007.

While food insecurity rose slightly for White and Black children, it improved for Hispanic children. The Black-White gap remained essentially unchanged and the White-Hispanic gap narrowed from 1999 to 2005. There was little change in the gap based on income level.

³⁸ Ulric Neisser, et al., "Intelligence Knowns and Unknowns," *The American Psychologist*, 51, 77–101 (cited in Richard Rothstein, *Out of Balance: An Understanding of How Schools Affect Society and How Society Affects Schools*, Spencer Foundation, 2002).

³⁹ Robert Karp, et al., "Growth and Academic Achievement in Inner-City Kindergarten Schools," *Clinical Pediatrics (Philadelphia)*, 31, 336–340.

⁴⁰ Alan F. Meyers, et al., "School Breakfast and School Performance," *The American Journal of Diseases of Children*, 143 1237.

⁴¹ Martha Zaslow, et al., "Food Security During Infancy: Implications for Attachment and Mental Proficiency in Toddlerhood," *Maternal and Child Health Journal*, March 2008.

⁴² Celia W. Dugger, "Report Warns Malnutrition Begins in the Cradle," *New York Times*, March 3, 2006.

⁴³ Food insecurity is defined as households, at some time during the year, that were uncertain of having, or unable to acquire, enough food to meet the needs of all their members because they had insufficient money or other resources for food.

Parents play a critical role in language development and early literacy. In children's very early years, parents are often the only teacher, although they may share this role with a child care provider.

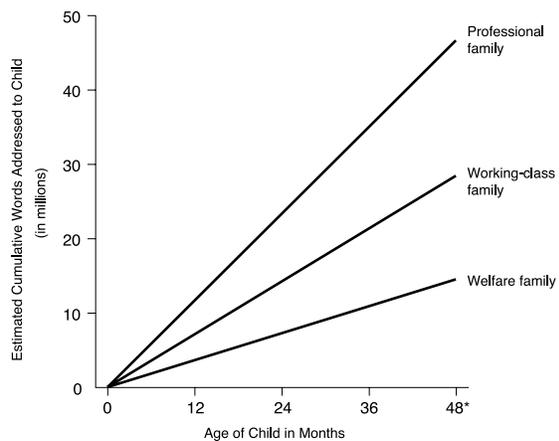
Our knowledge of how early experiences affect cognition and language acquisition took a leap forward with the work of Betty Hart and Todd Risley in their studies of language development from birth to age three.⁴⁴ They recorded and monitored many aspects of parent-child interactions and noted children's progress, finding that in vocabulary, language, and interaction styles, children mimic their parents. They recorded the number of words spoken to the child through age three and recorded the number of words the child could speak — and projected these numbers out to age four.

By the end of four years, the average child in professional families heard about 20 million more words than did children in working-class families, and about 35 million more words than the children in welfare families hear. The vocabulary development of the children paralleled the frequency of the number of words they heard from their parents.

The divergence in vocabulary development between children from the professional families and the other families began at around 15 months, and between children from working-class and welfare families at about 22 months.

By 36 months, the vocabulary of the children in professional families was more than double that of children in welfare families (see Figure 21). By about 36 months, the vocabulary of children in the professional families was greater than that of the parents of the children in welfare families. All families in the study were considered functional. These researchers were recording the early unfolding of the achievement gap.

Figure 21
Estimated Cumulative Differences in Language Experience by 4 Years of Age



*Projected from 36 to 48 months.

Source: Betty Hart and Todd R. Risley, *Meaningful Differences in the Everyday Experience of Young American Children*, Paul H. Brookes Publishing Co., 1995.

Recent advances have been made in understanding the practices of parents and the importance of reading to children in the first three years of life. In 2006, *Child Development* published a synthesis of existing research and the results of a new longitudinal study of the daily reading practices of 2,581 low-income mothers. One study included in the synthesis examined the availability of books in the home. Almost half of families receiving public assistance had no alphabet books in the home, compared with only 3 percent of professional families.

Even after controlling for a range of parent and child factors, the study found:

Concurrent reading is associated with child language. Associations were strong for child vocabulary production and comprehension at 14 months and for vocabulary production at 24 months. Moreover, reading daily or reading several days weekly was related to language outcomes. Thus, the relation between book reading and language outcome appears to be strong and direct during the first two years of life.

⁴⁴ Betty Hart and Todd R. Risley, *Meaningful Differences in the Everyday Experience of Young American Children*, Paul H. Brookes Publishing Co., 1995.

The study found sizeable gaps in the frequency with which children are read to. When they were 14 months old, English- and Spanish-speaking Hispanic children were about half as likely as White children to be read to daily, and boys were about two-thirds as likely as girls to be read to daily. At 24 months, African American and Hispanic children were much less likely to be read to frequently than White children. The same was true at 36 months. Daily reading to children during the first three years of life makes a difference, and the gaps in language development associated with this reading are opening in these years.⁴⁵

These studies also made an effort to measure the extent to which books are available to parents, the paucity of alphabet books in some families, the shortage of books in languages other than English in the libraries, and the problems of getting to libraries in rural and high-crime areas.

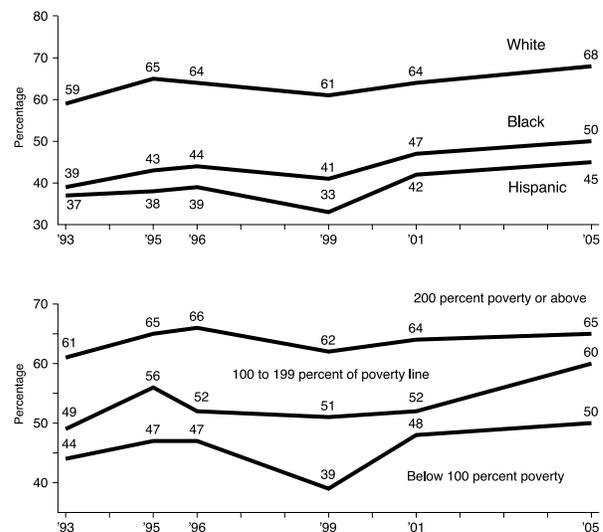
Reading to children goes on well after age three, of course. Over the years, the importance of this has generated considerable attention among researchers and policymakers. Citing the work of Gordon Wells, the Federal Interagency Forum on Child and Family Statistics noted in its 2002 report: “Reading to young children promotes language acquisition and correlates with literacy development, and later on, with achievement in reading comprehension and general success in school.”⁴⁶

The Child Trends DataBank sums up the results of research this way:

*By reading aloud to their young children, parents can help them acquire the prerequisite skills they will need to learn to read in school. Being read to has been identified as a source of children’s early literacy development, including knowledge about the alphabet, print, and characteristics of written language. In addition, shared parent-child book reading during children’s preschool years leads to higher reading achievement in elementary school.*⁴⁷

Figure 22 shows some trends in parents reading to their children and breaks the data out for racial/ethnic groups and for children grouped by the poverty status of their families. If the dip in the single year of 1999 is discounted, we see some increase for all three racial/ethnic groups. However, the gaps among the groups remain approximately the same over the period.

Figure 22
Percentage of Children Ages 3 to 5 Who Are Read to Every Day by a Family Member, by Racial/Ethnic Group and Poverty Status



Source: Federal Interagency Forum on Child and Family Statistics, *America’s Children: Key National Indicators of Well-Being 2007*, p. 149.

Although the percentage of children read to in non-poor families has been relatively stable from 1993 to 2005, we see clear gains in the middle group (100 to 199 percent poverty) as well as slight gains in families below 100 percent poverty — again discounting the dip in 1999. The gap narrowed between the “near poor” (100 to 199 percent of the poverty line) and non-poor families.

In the recent period of 2001 to 2005, there was a slight improvement among all racial/ethnic subgroups, with the gaps remaining about the same. The gaps also remained about the same for poor/nonpoor.

⁴⁵ Helen Raikes, et al., “Mother-Child Bookreading in Low-Income Families: Correlates and Outcomes During the First Three Years of Life,” *Child Development*, 77, 4, July/August 2006, pp. 924 – 953.

⁴⁶ Federal Interagency Forum on Child and Family Statistics, *America’s Children: Key National Indicators of Well-Being*, 2002; Gordon Wells, “Preschool Literacy-Related Activities and Success in School,” in David Olson, Nancy Torrance, and Angela Hildyard (eds.), *Literacy, Language and Learning: The Nature and Consequences of Literacy* (pp. 229 – 255). Cambridge, England: Cambridge University Press, 1985.

⁴⁷ Child Trends cites Catherine E. Snow, M. Susan Burns, and Peg Griffin (Eds.), *Preventing Reading Difficulties in Young Children*, National Research Council, Washington, D.C., National Academy Press, 1998; Adriana Bus, Marinus von Lizenboom, and Anthony Pellegrini, “Joint Book Reading Makes for Success in Learning to Read: A Meta-Analysis of Intergenerational Transmission of Literacy,” *Review of Educational Research*, 65 (1), 1 – 21, 1995.

Television Watching

In the first *Parsing* report, we noted that research examining the effects of television watching on school achievement was limited. The presence of television in the nation's households has been so ubiquitous for so long that it has not been possible to compare the effects of watching versus not watching using control groups. The Blue Ribbon Panel on the SAT® Score Decline, created by the College Board, examined the research available before 1977 and reached a similar conclusion. But the panel did conclude that it believed excessive TV watching affected school achievement negatively. Watching six or more hours of TV on a school day had to take time away from students' studies, the panel thought. Child Trends DataBank has this to say about TV watching:

When students are watching television excessively, they are less likely to be spending time doing homework, reading, after school activities, or other intellectually stimulating activities in which they are active participants. ... Eighth graders who watched more than 5 hours of television per day had the lowest average mathematics scores in all countries participating in the Third International Math and Science Study (TIMSS) in 1995.⁴⁸

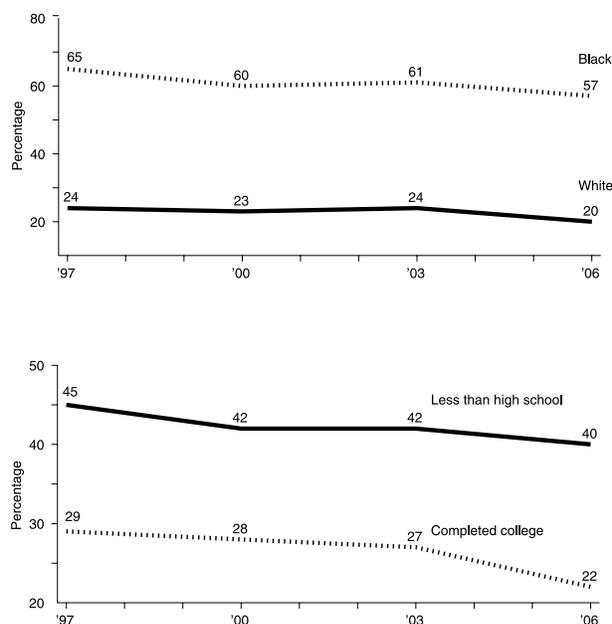
The April 2004 issue of *Pediatrics* reports a new study finding that “each hour of television watched on a daily basis at 1 to 3 years of age increases by 10 percent the risk that children will have attention problems, such as Attention Deficit Hyperactivity Disorder, by the time they reach age 7.” The American Academy of Pediatrics, which publishes *Pediatrics*, had previously recommended that parents limit TV watching for children less than 2 years old.⁴⁹

Concern about the effects of TV is valid well before children start school. The types of distractions to be concerned about also are growing — iPods, video games, and cell phones. As data become available, we need to track the time students spend with these newer devices — not to mention the electronic marvels likely to come.

Figure 23 shows the trend in the percentage of eighth graders who watch what many people might consider too much television — four hours or more on an average weekday. The top section of the graph shows that the trend in this measure for Black and White eighth graders is down somewhat over the decade, although more than half of Black and one-fifth of White students watched four hours or more of television in 2006. The gap between Black and White students has not changed since 2000.

The lower section of the graph shows this measure for students based on the educational attainment of the most educated parent (since income data were not available). The graph shows the trend for students with a parent who has less than a high school education and for students with a parent who has completed college. Again, both lines are trending downward, but the gap between these two groups of students is large: 40 percent compared with 22 percent. And this gap has widened since 2000.

Figure 23
Percentage of Eighth Graders Who Watch Four Hours or More of Television on an Average Weekday, by Race and Parent Education



Source: Child Trends DataBank, www.childtrendsdatbank.org/tables/55_Table_1.htm.

⁴⁸ Child Trends DataBank, http://www.childtrendsdatbank.org/eduskills/behaviors/95watching_TV.htm.

⁴⁹ Lisa Goldstein, “Study: TV Viewing by Young Children Leads to Attention Problems,” *Education Week*, April 14, 2004.

Parent-Pupil Ratio

Our society relies on parents to nurture and socialize children. It follows, then, that having two parents participate in the child-rearing effort is better than having just one, even if only from the standpoint of logistics and time: time to talk to children, read to them, help them with homework, get them up and off to school, check their progress with their teachers, and so on. A recent ETS Policy Information Center report entitled *The Family: America's Smallest School* argued this logic and referred to “the parent-pupil ratio.”⁵⁰

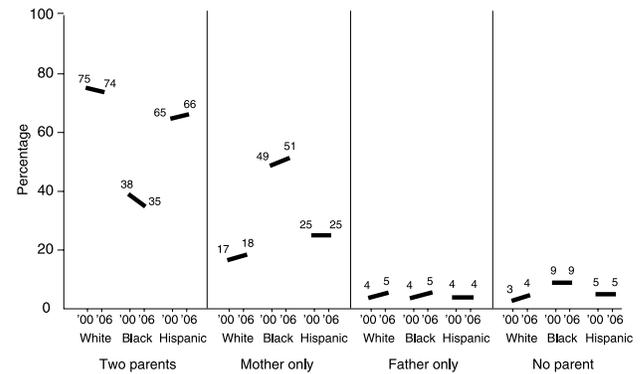
Research has pointed out that many of the large differences in achievement between children from two-parent and one-parent families are due to the effects of the average lower incomes of one-parent families, typically headed by a female earning less, on average, than males and with only one paycheck. Child Trends concludes that, “Single-parent families tend to have much lower incomes than two-parent families; recent research indicates that the income differential accounts for about half of the negative effects of parent absence on the many areas of child and youth well-being, including health, educational attainment and achievement, behavior problems, and psychological well-being.”⁵¹ This leaves half not accounted for by lower income.

A recent synthesis of decades of research concludes that father absence is correlated with:

- less academic success;
- behavior and psychological problems;
- substance abuse and contact with the police;
- sexual relationships at earlier ages;
- less economic well-being in adulthood; and
- less physical and psychological well-being as adults.⁵²

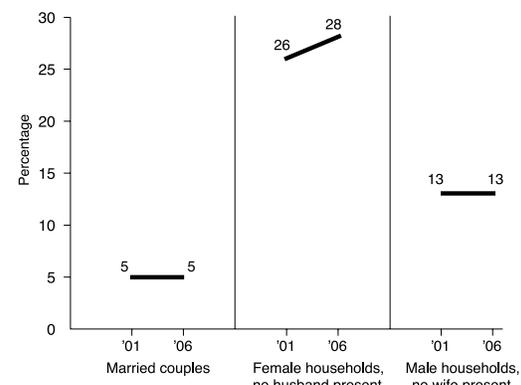
As seen in Figure 24, some groups of children are much less likely to have access to two parents in the home — just 35 percent of Black children and 66 percent of Hispanic children, compared with 74 percent of White children. These family structures have important effects — the poverty rate for female-headed households is 28 percent, more than five times the rate for married couples (see Figure 25).

Figure 24
Children's Family Structure by Racial/Ethnic Group, 2000 and 2006



Source: Child Trends DataBank, Family Structure, Table 1 (data from Current Population Surveys, U.S. Bureau of the Census).

Figure 25
Percentage of Households in Poverty by Family Structure, 2001 and 2006



Source: Income, Poverty, and Health Insurance Coverage in the United States, U.S. Census Bureau, Table B-3, 2006.

The good news is that the steady decline of the two-parent family, for all three subgroups, has recently stopped; as can be seen in Figure 24, there was little change from 2000 to 2006, but the gaps have not changed. From 2001 to 2006, the poverty rate for female-headed households edged up from 26 percent to 28 percent.

⁵⁰ Paul E. Barton and Richard J. Coley, *The Family: America's Smallest School*, Policy Information Report, ETS Policy Information Center, September 2007.

⁵¹ Child Trends DataBank, [http://www.childtrendsdatabank.org/family/thefamily\(59\)familystructure.htm](http://www.childtrendsdatabank.org/family/thefamily(59)familystructure.htm) cites Sara McLanahan, “Parent Absence or Poverty: Which Matters More,” in *Consequences of Growing Up Poor*, in Greg Duncan and Jeanne Brooks-Gunn (eds.), Russell Sage Foundation, 1977; Sara McLanahan and Gary Sandefur, *Growing Up With a Single Parent: What Hurts, What Helps?* Cambridge, MA, Harvard University Press, 1994.

⁵² Wendy Sigle-Rushton and Sara McLanahan, “Father Absence and Child Well-Being,” in Daniel P. Moynihan, Timothy M. Smeeding, and Lee Rainwater (Eds.), *The Future of the Family*, Russell Sage Foundation, 2004.

Summer Achievement Gain/Loss

Results from typical accountability testing systems, which measure change from one year to the next, mix learning that occurs in school with learning that occurs during the summer. Thus, schools are held accountable for not only the achievement of their students while in school, but also for the achievement of their students that accrues during the summer, over which they have no control. If summer growth were the same for all students, summer could be ignored when comparing the status and progress of students by race/ethnicity and by income. However, there are large differences in what happens to student achievement during summer vacations, and changes in scores from year to year cannot be attributed entirely to what happens during the school year.

Educators have long talked about “summer reading loss.” Many efforts, in a variety of past and present approaches, have attempted to stem that loss. Research to measure the extent of change during the summer extends back decades. A 1996 synthesis of 39 studies, and a meta-analysis performed on the 13 most recent studies, concluded that “the summer loss equaled about one month on a grade-level equivalent scale.

Middle-class students appeared to gain on grade-level equivalent reading recognition tests over summer, while lower-class students lost on them.”⁵³

A recent review of research, including important studies carried out since 1996, confirmed earlier findings that summer loss and gain varied, and a new study was conducted using data from the Baltimore Beginning School Study. The BBSS panel “consists of a representative random sample of Baltimore school children whose educational progress has been monitored from first grade through age 22.” Findings showed that in year nine, the high socio-economic status (SES) achievement average is 73.2 points above the low SES average. ... about a third of that SES difference, 26.5 points, traces to disparities in place when these children started first grade. ... the remainder of the difference is built up over the school years.” The researchers showed that the largest proportion of the remaining “differences, 48.5 points, or about two-thirds of the total, traces to summer learning differences over the elementary years.”⁵⁴ These data are shown in Table 2.

Table 2

Reading Comprehension Test Score Decomposition over the First Nine Years of School by Family SES

Reading Comprehension CAT Score Gains, Years 1 – 9	Total	Family SES			Gap High-Low
		Low SES	Mid SES	High SES	
Initial Test Score, Fall 1st Grade	279.81	271.99	277.89	298.47	26.48*
Winter Gain (5 winters)	194.97	191.30	210.19	186.11	-5.19
Summer Gain (4 summers)	1.12	-1.90	4.12	46.58	48.48*
Gain Over Years 6 – 9	61.69	60.95	60.73	64.34	3.39
Test Score, End Year 9	547.55	522.33	552.40	595.49	73.16*
(N)	(787)	(397)	(204)	(186)	

Note: Significant t-tests for mean differences between Low SES and High SES groups are shown in Gap column. * $\leq .05$ (two-tailed tests).

Source: Karl L. Alexander, et al., “Lasting Consequences of the Summer Learning Gap,” *American Sociological Review*, v72, April 2007.

⁵³ Harris Cooper, et al., “Effects of Summer Vacation on Achievement Scores: A Narrative and Meta-Analytic Review,” *Review of Educational Research*, Fall 1996, Vol. 66, No. 3, p. 227.

⁵⁴ Karl L. Alexander, et al., “Lasting Consequences of the Summer Learning Gap,” *American Sociological Review*, v72, April 2007.

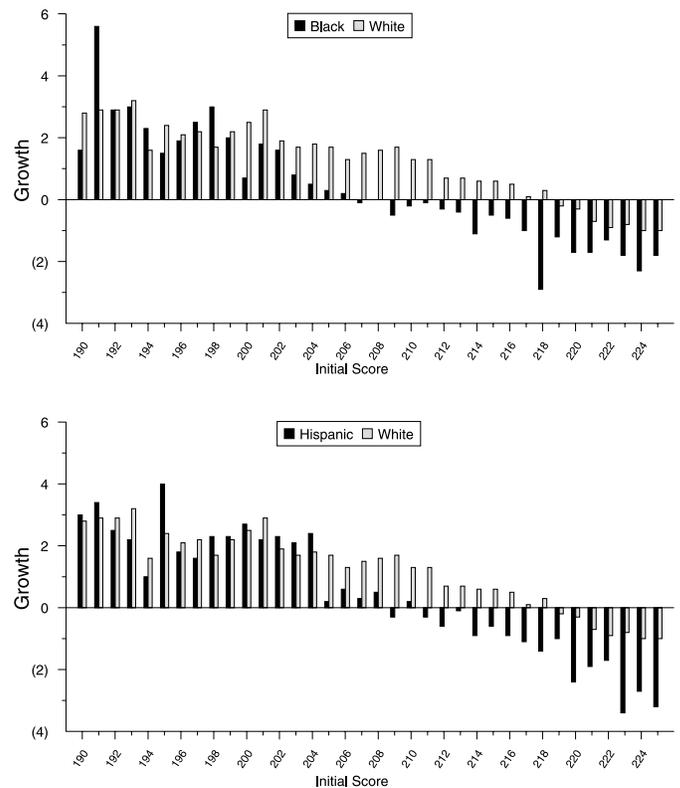
The largest body of test data using both spring and fall testing was collected by the Northwest Evaluation Association (NWEA). The sample covered grades three through nine, with 569,564 students in reading and 542,057 in math in 24 states. NWEA examined the data to trace achievement gain from fall to spring and from spring to fall. The association compared the scores of each student in the spring with their scores in the fall to see the change at each score level by race/ethnicity and income level. As shown by prior research, minority and lower-income students generally fared worse over the summer than their peers.⁵⁵

Figure 26 shows changes in reading scores comparing White, Black, and Hispanic sixth graders. Math data show similar patterns. The NWEA study includes these findings:

- Low-performing students in all groups continue to grow during the summer months, but minority and lower-income students grow less.
- High-performing students tend to lose achievement during the summer months, with minority students losing more than White students.
- High-performing students in high-poverty schools lose more achievement during the summer than similar students who are enrolled in low-poverty schools.⁵⁶

Data are not available for measuring trends in this gap in summer gain and loss in achievement.

Figure 26
Summer Score Changes in Reading for Black, Hispanic, and White Sixth-Grade Students, 2004



Source: Martha S. McCall, et al., *Achievement Gaps: An Examination of Differences in Student Achievement and Growth*, Northwest Evaluation Association, November 2006.

⁵⁵ Martha S. McCall, et al., *Achievement Gaps: An Examination of Differences in Student Achievement and Growth*, Northwest Evaluation Association, November 2006.

⁵⁶ McCall, et al., 2006.

Summing Up

This section summarizes what the data reveal about the status of the correlates of achievement and the changes in those correlates that have occurred over the period of time for which we found data. Some concluding comments and reflections are also offered.

The following table provides our judgment calls in summarizing the data on the correlates. The data summarize actual numbers in the body of the report. In the summary table, we offer three views for each correlate:

- Whether a gap exists among subgroups of the population.
- The direction of the trend for those subgroups.
- The direction of the trend in the size of the gap among the subgroups.

The terms we have chosen to use to describe the subgroup trends are “Improvement,” “Deterioration,” and “No Change.” For trends in the gap, we use “Closed,” “Widened,” “Narrowed,” and “No Change.” These are subjective terms, however, and since the data sets are quite diverse, we may classify small differences as showing “no change,” as opposed to “widened” or “narrowed.” A set of data as diverse as this is not easily described with statistical precision. Readers, therefore, are welcome to apply their own judgments about the meaning of the data.

There likely is no way to further distill the changes in all these correlates over the periods viewed, and there is surely no way to weigh the changes by their importance in terms of their impact on student achievement. However, with a summary term assigned to each comparison, the terms can be aggregated to yield an understanding of what has happened since the initial *Parsing the Achievement Gap* report.

In summarizing the trends in the correlates among subgroups (both race/ethnicity and income), we used:

- “improvement” 17 times
- “no change” 14 times
- “deterioration” 6 times

In summarizing the trends in the gaps among subgroups (both race/ethnicity and income), we used:

- “widened” 7 times
- “narrowed” 10 times
- “no change” 22 times

What this rough accounting tells us is that there is some good news, some “no news,” and some bad news in the distribution of life experiences and conditions that research has found to affect student achievement. Clearly, there has been substantial change in some areas over a five- or six-year period.

What gaps persist? The situation is about the same as in the first *Parsing* report. Gaps exist by race/ethnicity in 16 correlates (14 correlates were examined in the first report). By income, where data were available, we found gaps in 12 of the 16 correlates (data were unavailable for three). The only change is in the measure of taking challenging courses in high school — curriculum rigor. There, the gap between Black and White students disappeared, but the gap remained between White and Hispanic students. In participation in Advanced Placement courses, the gap between White and Black students remained. Another difference is that this report adds the measure of student summer loss/gain, in which gaps exist for both race/ethnicity and income. The bottom line is that gaps correlated with school achievement continue to show up in the life and school experiences of minority and low-SES children.

In this “parsing of the achievement gap,” while the hills and valleys look roughly the same as at the time of the last report, some changes in the terrain are worth noting. The first report underscored a need for a significant ongoing effort, fueled by adequate resources, to track the changes over time and to stay current with research on life and school experiences and conditions that are related to school achievement. That effort is essential if we are to make inroads into narrowing seemingly intractable achievement gaps. The subtitle of the first report, after all, was “Baselines for Tracking Progress.” The report suggested that one approach would be for the National Research Council to take on this effort. The NRC is an undertaking of the National Academy of Sciences, the nation’s most authoritative scientific voice. We undertook this relatively modest review of the changes in lieu of such a comprehensive effort.

We renew our recommendation because developing a complete understanding of these correlates of achievement and isolating the gaps among subpopulation groups is an enormous task. It involves identifying the gaps in the research on the correlates of achievement that need to be filled, and identifying the gaps in the statistics that we need to measure and track over time. Beyond identifying the correlates, the task

requires determining *how much* of a difference they make in school achievement, or what researchers call “effect sizes.” Accomplishing all of this involves not just dealing with one or two research studies, but with a composite of all of the research available about a particular correlate. Such a large task, along with reporting results to the nation regularly, would require the resources of an agency like the NRC.

From the research and statistics now available to us, we have determined that it remains clear that minority students and poor students continue to face conditions that undermine school achievement. At different points in their lives they will, on average, lag behind their peers in cognitive development. The achievement gap has deep roots — deep in out-of-school experiences and deep in the structures of schools. Inequality is like an unwanted guest who comes early in these children’s lives and stays late. Policies and practices that are likely to narrow gaps in achievement need to be broad and comprehensive if they are to check inequality at the outset of a child’s academic career and create the conditions in which every child can flower, achieve, and attain in school and in life.

Gains in student achievement can be accomplished at any point along the developmental continuum that efforts are made. And, of course, formal schooling is where the concentrated effort typically is applied to instill knowledge and understanding, through an institution created solely for that purpose.

But this is not at all to say that the education system can succeed in greatly reducing the gaps by going it alone. A learning policy needs to be mindful of what harms learning along the way. And an education policy directed at formal schooling needs to be mindful of what can be done beyond designing curriculum, setting standards, and establishing accountability. There are inequities in teacher preparation in subject matter, experience, and turnover, in class size, and in the environments of classrooms, schools, neighborhoods, and families. Schools can also make greater efforts to obtain parent involvement and develop better systems to track students who move from school to school. There are initiatives to extend efforts beyond school doors that we can learn from. The community schools movement, for example, has reached out to the community while retaining high academic standards. And our recent report *The Family: America’s Smallest School* looks in depth at the early learning environment, beginning at birth.

In public policy generally, a better understanding of the roots of inequality can contribute to an understanding of the importance of dealing with lead and other environmental hazards, and assuring adequate nutrition for families. Families, too, have a large responsibility to regulate use of the TV set, read to young children, see that they get to school, and support efforts to foster discipline and order in the schools.

There are also differences in school cultures that are associated with differences in student achievement, such as high standards with rigorous curriculum, qualified and experienced teachers, and orderly classrooms.

From time to time, there are disagreements about how much importance to assign to one set of factors or another. There is fear that looking outside school will provide schools with excuses. And there is fear that a focus entirely on the schools will foster neglect of other matters important to children’s well-being and learning, and may result in unrealistic expectations of the role that schools can play. Nothing in a child’s development or environment should result in lower expectations for that child, nor minimize what teachers and schools can accomplish. Yet ignoring the impact of a student’s home circumstances will do nothing to help teachers and schools narrow achievement gaps. Unrealistic expectations for schools may be used to provide excuses for public policy, and thus ignore policies that might prevent learning gaps from opening. Schools are where we institutionalize learning; they are also where we tend to institutionalize blame.

The consequences of tolerating these gaps that threaten our democracy and society are both recognized and feared — enough so, perhaps, for those who press for actions to reach children *outside* school, and those who press for high standards *inside* the schools, to march together with common cause.

It is important to recognize the correlates of achievement and how they differ among our population. It is also important to improve the research base for identifying the gaps in these critical life and school conditions, and to track the changes over time. The willingness to do so will say much about our resolve to confront and eliminate the gaps that threaten our society in deep and basic ways.

Correlate	Is There a Gap?		Subgroup Trend in the Correlates		Gap Trend	
	Race/Ethnicity	Income	Race/Ethnicity	Income	Race/Ethnicity	Income
Curriculum Rigor						
High school curriculum	Yes	NA	Improvement	NA	White-Black Closed; White-Hispanic No Change	NA
AP participation	Yes	NA	No Change	NA	No Change	NA
Teacher Preparation						
Certification	Yes	Yes	No Change	No Change	No Change	No Change
Preparation in discipline	Yes	Yes	Deterioration	Deterioration	White-Black No Change; White-Hispanic Widened	No Change
Teacher Experience						
	Yes	Yes	No Change	No Change	No Change	No Change
Teacher Absence and Turnover						
Teacher absence	Yes	Yes	Deterioration for White and Hispanic; No Change for Black	No Change	White-Black Narrowed; White-Hispanic Widened	No Change
Teacher turnover	Yes	Yes	No Change for White and Black; Improvement for Hispanic	Improvement	White-Black No Change; White-Hispanic Narrowed	Narrowed
Class Size						
	Yes	No	Improvement	Improvement	High Minority-Low Minority Widened	No Change
Classroom Technology						
Internet access	Yes	Yes	Improvement	Improvement	Narrowed	Narrowed
Computer ratio	Yes	Yes	Improvement	Improvement	Narrowed	Narrowed

Correlate	Is There a Gap?		Subgroup Trend in the Correlates		Gap Trend	
	Race/Ethnicity	Income	Race/Ethnicity	Income	Race/Ethnicity	Income
Fear and Safety at School						
Fear at school	Yes	NA	No Change	NA	No Change	NA
Street gangs at school	Yes	NA	Deterioration for Black, Hispanic; No Change for White	NA	White-Black Widened; White-Hispanic Widened	NA
Physical fight	Yes	NA	No Change for White and Black; Deterioration for Hispanic	NA	White-Hispanic Widened; White-Black No Change	NA
Parent Participation						
	Yes	Yes	Improvement	NA	Narrowed for Attending Events; No Change for Volunteering	NA
Frequent School Changing						
	Yes	NA	Improvement	NA	No Change	NA
Low Birth Weight						
	Yes	Yes	Deterioration	NA	Narrowed for Both White-Black and White-Hispanic	NA
Environmental Damage						
Lead exposure	Yes	Yes	Improvement	NA	No Change	NA
Mercury poisoning	Yes	Yes	NA	NA	NA	NA
Hunger and Nutrition						
	Yes	Yes	No Change for White and Black; Improvement for Hispanic	No Change	No Change for White-Black; White-Hispanic Narrowed	No Change
Talking and Reading to Children						
	Yes	Yes	Improvement	Improvement	No Change	No Change
Television Watching						
	Yes	Yes	Improvement for Black and White	Improvement	No Change	Widened
Parent-Pupil Ratio						
	Yes	Yes	No Change	NA	No Change	NA
Summer Achievement Gain/Loss						
	Yes	Yes	NA	NA	NA	NA

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