RACIAL/ETHNIC ACHIEVEMENT INEQUALITY: SEPARATING SCHOOL AND NON-SCHOOL EFFECTS THROUGH SEASONAL COMPARISONS

DISSERTATION

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ABSTRACT

The stratification and education literatures have demonstrated a large and persistent achievement test score gap between black and white students. The gap is evident when students enter kindergarten and grows larger before students finish high school. One of the primary questions in the literature has been the role of schooling in the test score gap. However, the difficulty of empirically isolating the effect of schooling from that of family background is particularly challenging and has limited our confidence in the findings from existing research. I utilize seasonal comparisons to better isolate school effects from forces acting on students outside of school. By comparing the learning students experience during the summer to that which occurs during the school year, I more effectively examine the effect of schooling on the black-white test score gap. Extending previous seasonal comparisons research, I draw on the nationally representative Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K) and also examine the relative roles of school and non-school environments on the learning rates of Hispanic and Asian students in kindergarten and first grade. Results indicate that the black-white test score gap in both reading and math grows between the beginning of kindergarten and the end of first grade, and, contradictory to previous findings, the gap only grows during the school year yet remains constant over the
summer break. Unlike black students, Hispanic students do not learn slower than white students during the school year. The achievement gap in reading between Hispanic and white students does not grow between the beginning of kindergarten and the end of first grade, and the math gap only grows over the summer break from schooling. Asian students begin kindergarten with higher achievement than white students, but by the end of first grade have fallen behind whites in both reading and math. The relative losses of Asian students to white students occur during the school year while Asian children possibly gain ground over the summer break. Other results implicate differences between schools in the black-white gap but not in the disadvantage Asian students experience at school.
DEDICATION

Dedicated to Mom and Dad and Dinee, 
for all of your endless love and support 
through this long and demanding journey.

You have picked me up when I was down, 
Pushed me forward when I wanted to turn back, 
And, through all the days when I “had to work”, 
you never once complained.

You have held my soul so gently through some of the most trying times of my life.

I am eternally grateful for the love you share with me.
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CHAPTER 1
INTRODUCTION

Children from different racial/ethnic backgrounds begin formal schooling with disparate knowledge and skills. By the time students finish high school, gaps between racial/ethnic groups, particularly blacks and whites, have grown even larger (Hedges & Nowell 1999; Jencks & Phillips 1998). One of the greatest educational debates of the last half-century has been over the role that schools play in this growing disparity. While some herald schooling as the “Great Equalizer,” providing all children common opportunities to acquire knowledge and skills, others charge the system with fueling inequality by providing disparate educational opportunities to students from different racial/ethnic backgrounds. The debate over schools continues today for the simple reason that we lack clear evidence on the relative effects of school and non-school factors in growing achievement inequality over the schooling years.

Understanding the sources of racial/ethnic disparities in achievement is of great importance to broader racial/ethnic inequality. Achievement test scores have long influenced admissions in post-secondary education and are now being utilized to influence high school graduation (i.e., proficiency tests). For these reasons and others, achievement test scores also strongly predict future educational and occupational attainment as well as income (Jencks & Phillips 1998). For instance, among those with
equal achievement test scores, students from different racial/ethnic backgrounds are equally likely to complete high school, attend college and graduate from college (NCES, COE 2000). Indeed, some scholars believe that closing the black-white test score gap would do more for reducing racial/ethnic inequality in educational attainment, earnings, and in turn, crime, health and family life, than any other means (Jencks & Phillips 1998; Hedges & Nowell 1999). To this end, understanding the causes of differences in test scores between racial/ethnic groups is central to understanding the broader context of racial inequality.

While test score gaps (particularly between blacks and whites) have decreased over time, substantial disparities remain. More importantly, there is mounting evidence that reduction in the gap has stalled over the last twenty years. Identifying the sources of achievement gaps in test scores is key to resuming progress towards educational, and economic, parity between racial/ethnic groups. It is also especially timely in light of the growing need to attain higher levels of education for economic stability. Thus, although the use and interpretation of achievement test scores has been a widely debated and controversial issue, for better or for worse, test scores play a major role in the opportunity structure of the United States.

While a vast body of literature examining the causes of racial/ethnic test score gaps has amassed over the last half-century, the difficulty of estimating school effects independent from family background limits our confidence in the findings. Measuring the relative effects of school and non-school factors on racial/ethnic gaps in achievement is challenging due to the simultaneous effects of the two environments during the school

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1 See, for example, Fisher et al (1996).
year, coupled with the high correlation between family background and schools. Nonetheless, separating the two is fundamental to understanding the specific forces generating racial/ethnic inequalities. Entwisle and Alexander (1994) note "…the failure to estimate in-school and out-of-school learning may cause serious misspecification of ‘school effects’ estimates of the relative importance of home and school for student achievement…” (p. 457).

Arguably one of the most effective methodologies available for separating the effects is seasonal comparisons. By estimating the learning students experience during the summer, when school is not in session, separately from the learning that occurs during the school year, seasonal comparisons research is better able to interpret how schooling affects non-school inequalities. However, data and measurement limitations in existing seasonal comparisons research leave key questions regarding the relative roles of school and non-school environments unanswered.

Do schools reproduce, or even exacerbate, the advantages and disadvantages students from different racial/ethnic backgrounds experience in their everyday lives? Or, do they constrain what otherwise would be an even larger racial/ethnic gap in the absence of schooling? In the current political climate of the Bush Administration’s “No Child Left Behind” legislation, the debate over schools’ power to change the level of racial inequality in the educational and subsequent economic lives of our youth is center-stage. The federal “No Child Left Behind Act” (2002) is placing great demands on schools to raise the achievement levels of all students and reduce disparities, particularly between racial/ethnic groups. To comply with this legislation, federal, state and local entities are utilizing considerable resources to modify schooling in attempt to raise test scores,
particularly of low-achieving students. Without strong evidence that schools have the power to overcome the disparities students face in their families and neighborhoods and be able to raise low-performing students above the “proficient” level, this legislation may be a costly venture, both in terms of resources and progress towards reducing racial/ethnic inequality. My research addresses our timely need for untangling school and non-school effects on student outcomes in the hopes of stimulating effective intervention methods to reduce achievement gaps between students from different racial/ethnic backgrounds.
CHAPTER 2
RACIAL/ETHNIC ACHIEVEMENT GAPS

Historical Trends and Current Disparities

The study of racial/ethnic gaps in achievement has a long history in the social sciences. Dating back to World War I when the black-white test score gap first appeared in the U.S. Army’s testing of wartime recruits, there are now hundreds of studies on “the black-white gap” and growing attention to other racial/ethnic groups. Yet, only a few studies draw on nationally representative samples (Hedges & Nowell 1999). The first and most notable of these was the Coleman Report based on the 1965 Equality of Educational Opportunity Survey of U.S. students in grades K-12 (Coleman et al. 1966). Since then, only a handful of nationally representative data sources have become available that allow for examination of racial/ethnic gaps in achievement test scores: the National Longitudinal Study of the High School Class of 1972 (NLS:72), High School and Beyond (HSB:80), The National Longitudinal Surveys of Youth (1980), The National Education Longitudinal Study (1988), and the National Assessment of Educational Progress (on going).2 The patterns present in all of these data sources indicate that the black-white test score gap is relatively large. While it has decreased over time, a significant gap persists.

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2 See Mullis et al. (1993) for detailed explanation of the NAEP sampling design and data collection.
Results of the National Assessment of Educational Progress (NAEP) (U.S. Dept. of Education) offer a clear picture of this long-term trend between blacks and whites. Figures 2.1 and 2.2 demonstrate how the reading and mathematics achievement test scores of white and black students have converged over the last three decades, mainly as a result of improving test scores for black students. Taking a closer look, the convergence in reading test scores occurred mainly between 1975-1984, and has since held fairly constant. Unlike reading test scores, the convergence in mathematics test scores between whites and blacks has been fairly constant up until the last decade when it appears to have taken a turn towards widening again. Importantly, the NAEP also includes data trends on Latino students in addition to black and white students. As shown in the figures, at age 17, Latino students have historically performed better than black students on both reading and mathematics achievement tests. Further, changes in average Latino achievement are similar to blacks over time.

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3 See also Bock and Moore (1986), Herrnstein and Murray (1994), Osborne (1982).  
4 For an explanation of the convergence during the 1970’s and 1980’s, see Grissmer, Flanagan & Williamson (in Jencks and Philips 1999).
Figure 2.1. 30 Year Trends in Reading Achievement Test Scores of 17 Year Olds by Race/Ethnicity.


Figure 2.2. 30 Year Trends in Mathematics Achievement Test Scores of 17 Year Olds by Race/Ethnicity

While Asian Americans are not studied as an independent racial/ethnic group in the NAEP, other research has consistently noted the high educational achievement of Asian Americans (Hirschman & Wong 1986; Kao 1995; Sue & Okazaki 1990). When it comes to performance on achievement tests, studies have demonstrated that Asian Americans have higher average standardized reading and math scores than whites, blacks or Latinos (Fejgin 1995; Reglin & Adams 1990; Schwartz 1970). Thus, if included in the NAEP trend figures, we would expect to see a trend line for Asian students slightly above that for whites and corresponding to white students' changes over time.

All of the aforementioned nationally representative data demonstrate similar patterns across racial/ethnic groups over time. On average, Asian American students score the highest with white students not far behind, while Latino and black students persistently score considerably lower. The gap between top and bottom has narrowed over the last half century, but remains relatively large. Most importantly, in the last two decades, the improvement of blacks’ and Latinos’ achievement relative to whites has stalled, and these gaps appear to be widening in recent years (Hedges & Nowell 1999).

Why do Asians and whites tend to score higher than blacks and Latinos?

A large body of theory has emerged attempting to make sense of these racial/ethnic patterns. Many scholars have detailed the ways in which the everyday lives, particularly the families, of students from differing racial/ethnic backgrounds influence

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5 The sample of Asian American students collected in the NAEP was not of sufficient size to report separately (NAEP 1999).
achievement. Others, however, have highlighted the experiences of students while at school that promote or hinder their achievement. What follows summarizes the general positions of these two perspectives.

The Non-school Environment

Many scholars contend that the disparate non-school environments of different racial/ethnic groups are the central forces generating achievement inequality. The majority of theory and research has pointed to group differences in family backgrounds, particularly in family socioeconomic status (including income and parents' educational attainment), parent structure and family size.

The link between race/ethnicity and socioeconomic status is well-known. Because racial/ethnic minorities, particularly blacks and Latinos, are disproportionately concentrated in homes and communities with fewer economic and educational resources, the correlation between racial/ethnic inequality and socioeconomic inequality is strong. Higher SES is believed to have many benefits for students' educational success because it is associated with living in safer, more stable communities, having a richer educational environment in the home, more parental time and resources to participate in children's education, and better relationships between parents and schools (Alexander et al 1987; Baker & Stevenson 1986; Coleman 1988; Lareau 1987; Massey & Denton 1992; Phillips et al 1998).6

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6 Roscigno (1998, 1999) further notes that high SES may have an indirect effect on achievement by funneling students into better school environments.
Despite the wealth of evidence that socioeconomic status plays a key role in explaining racial/ethnic achievement gaps (see, for example, Phillips et al 1998), studies of nationally representative samples demonstrate that significant gaps persist even after adjusting for the high correlation between race and class. Hedges and Nowell's (1999) study of six nationally representative data sets indicates that socioeconomic status explains only approximately 25-30% of the black-white test score gap in reading and math among older students. In the most recent data analyzed, this translates into a reduction of the black-white gap in reading test scores of 12th graders to .53 standard units from .70 (24%). Research on Hispanic students suggests that SES plays a similar role in their average achievement, explaining a significant amount, but not all, of the disadvantage they experience (see, for example, Rumbaut 1995). For Asians, however, SES is much less important for explaining their relative advantage (Fejgin 1995).

Beyond the economic and educational resources of SES, other key family background factors that affect achievement are living in a dual-parent home and having fewer siblings, both of which are positively related to academic achievement (Blake 1989; Downey 1995, 1997; Lareau 1989; McLanahan & Sandefur 1994; Menaghan 1996). Other results specifically demonstrate the power of these family characteristics in explaining achievement disparities, particularly for blacks and Hispanics (Fejgin 1995; Milne et al 1986; Phillips et al 1998). However, like SES, these family characteristics do not account for the higher achievement of Asian students (Fejgin 1995; Fryer & Levitt 2002; Schneider et al 1994).

7 One of the primary explanations for Hispanic students' historically lower achievement has focused on the high proportions of Hispanics who are language minorities. Language minority students experience lower achievement levels (Fernandez and Nielson 1986). For example, Peregoy and Boyle (1991) found that
Although Asian Americans represent a diverse range of ethnic groups, the dominant explanation for the relative educational success of Asian Americans is the “cultural perspective” (Hirschman & Wong 1986). Labeled by many as the "model minority", it is believed that the selective immigration of Asians to the United States has resulted in an Asian American population with higher educational values as well as other values (such as self-discipline, sacrifice and respect for authority) that promote success in the American education system (Kao 1995; Kitano 1976; Peng & Wright 1994; Schneider & Lee 1990; Sue & Okazaki 1990). More specifically, it is argued that Asian values and behaviors lead to non-school environments that are more conducive to education and also help Asian American students achieve better evaluations from and relationships with teachers while at school (Wong 1980). Thus, these non-school factors may carry over to provide additional advantages while at school.

While many of these studies indicate that Asians are more likely to have higher educational values and expectations, the ability of these cultural characteristics to explain Asians' higher achievement test scores is not yet clear. Fejgin's (1995) analysis indicates that measures of these characteristics explained significant variation in 10th graders achievement test scores but do not completely account for Asian Americans’ advantage over whites, blacks and Latinos, particularly on standardized math tests. For instance,

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Hispanic students speaking English as a second language had lower reading performance than native speakers. However, it appears that this effect may result more from family background and disadvantages related to segregation than language barriers. In particular, language minorities are more likely to live in poverty and in pronounced segregation (Fields 1988; Massey and Denton 1983; Tienda 1988; Warren 1996).

8 Note that the "model minority" thesis has been widely criticized for stereotyping diverse Asian cultures as well as ignoring the many barriers to success experienced by Asian Americans.
measures of cultural differences reduce the math coefficient by nearly two-thirds but leave a small but statistically significant advantage over whites and a relatively large advantage over blacks and Hispanics (over .1 standard deviations).

Given the frequently replicated and powerful relationship between non-school factors and achievement, many have concluded that non-school environments are the central source of the achievement disparities between whites, blacks, Latinos and Asians. However, other scholars have provided ample and compelling arguments for examining how schools influence non-school disparities.

Schools and Inequality

Scholars have focused on the role of schooling in affecting racial/ethnic achievement gaps ever since the Coleman Report (1966) first concluded that schools play little role in generating the disparities between students of different racial/ethnic backgrounds. Coleman et al. (1966) examined the family, school and achievement characteristics of approximately 645,000 third, sixth, ninth and twelfth grade students in over 4,000 public schools in 1965. Their analyses indicated that black and Puerto Rican students’ average test scores were a full standard deviation lower than those of their white peers at the beginning of first grade. This gap grew across higher grade levels. However, despite the divergence in test scores between racial/ethnic groups over the schooling years, and findings demonstrating that blacks and Puerto Ricans experienced systematic disadvantages at school in terms of the quality of their physical facilities, curriculums, teachers, and student bodies, Coleman et al. (1966) concluded that the “differences between schools account for only a small fraction of differences in pupil achievement”
once family characteristics and aspirations of students are controlled (p.21). The Coleman Report (1966) ultimately concluded that non-school environments were the primary force generating racial/ethnic disparities in achievement.

Nonetheless, strains of “reproduction theory” (see Collins 1976; Bourdieu 1976) continue to charge the schooling system with fueling disparities by providing unequal educational opportunities both across and within schools. For example, schools may reproduce, or even exacerbate, inequality because socioeconomically advantaged children, who are predominantly white, attend schools with better physical environments, stronger curriculums, higher levels of teacher experience and quality, and better educational materials (Kozol 1991). Still other scholars maintain that differences within schools systematically create unequal opportunities and challenges for students from different racial/ethnic origins, and this exacerbates disparities in achievement. Tracking and ability grouping in schools, for instance, have long been charged with unfairly separating students by race/ethnicity, with racial/ethnic minorities disproportionately represented in low academic tracks (Oakes 1985; Gamoran 1987; Roscigno & Ainsworth-Darnell 1999). For example, Kubitschek and Hallinan (1996) found that minority students are more likely to be assigned to lower academic tracks, even after controlling for their academic achievement. Once in these lower academic tracks, students tend to have teachers with fewer credentials and years of experience, have teachers who hold lower expectations for student achievement, and are more likely to be taught rote memorization, timeliness and deference than their higher-tracked peers (Oakes 1985; Roscigno & Ainsworth-Darnell 1999). It has further been argued that schools teach and reward the cultural skills of dominant classes, and thus middle and
upper class white students tend to have advantages, particularly in terms of their interactions and relationships with teachers and school personnel (Bourdieu 1973; Lareau 1987; Farkas 1996; Alexander, Entwisle & Thompson 1987). Exemplifying this line of reasoning, for instance, Downey and Pribesh (1999) found that black students’ performance is evaluated better when matched with black teachers.9

Evidence of these types of inequalities within and across schools has been coupled with research demonstrating that racial/ethnic disparities grow over the schooling years. In particular, Jencks and Phillips (1998), Hedges and Nowell (1999) and Phillips et al. (1999) all find that the black-white achievement gap grows by approximately one-half a standard deviation between kindergarten and 12th grade. Connecting these two lines of research, many have concluded that schools are a primary source of black-white achievement inequality. However, one common problem in the research impedes our ability to directly link schooling to growing disparities over the schooling years. The difficulty is separating forces that act on students while they are at school from those that occur outside of school. Even during the school year, students spend a significant amount of their time outside of school walls. It is estimated that the average 18 year old has only spent 13% of her/his waking hours at school (Walberg 1984). Thus, it is just as possible that growth in the gap, even over the schooling years, results from the inequalities in non-school environments as from what goes on in school. Further, many school and non-school forces are very highly correlated (e.g., socioeconomic status and school quality). These two issues make separating the two environments an empirical challenge.

Separating School and Non-school Environments

Students attend schools with varying characteristics and are simultaneously exposed to non-school environments that vary in significant ways affecting educational success. In order to fully separate the influence of the two environments, we must be able to control for all non-school forces simultaneously affecting achievement. Ideally, we would use experimental methods, in which students are randomly assigned to one of two groups: a group exposed only to a constant "school" environment and a group exposed only to a constant "non-school" environment. If, for example, a racial/ethnic gap in achievement was smaller in the group of students exposed only to the constant school forces, we could conclude that schools act to attenuate the inequality generated in unequal non-school environments. If, however, the gap was larger in the group exposed only to school forces, we would instead conclude that schools exacerbate the educational inequality generated outside of school. Obviously, neither experimental methods nor attempting to control for all non-school factors related to achievement is a realistic methodology for isolating the effect of schools on achievement gaps.

A powerful alternative exists in seasonal comparisons. The seasonal comparisons method rests on the simple notion that during the school year, both non-school and school factors shape student achievement, but during summers, when school is not in session, only non-school forces affect achievement. Thus, the summer period constitutes somewhat of a natural experiment during which the effect of schooling is, in theory, controlled. Heyns (1978) states,
As a quasi-experimental control for the effects of education, the summer months represent a plausible interval in which to contrast patterns of learning. When they are not exposed to schooling, children continue to be exposed to, and perhaps maximally influenced by, their families and peers. During the summer, it should be possible to disentangle the influences of schooling from those of social background, and to attribute the appropriate importance to each...although imperfect, summer seems a reasonable facsimile of non-schooling and a plausible temporal control. (p. 43)

Stated simply, the rate at which achievement gaps grow over the summer, when students are only exposed to their non-school environments, can be compared to the rate at which they grow during the school year. In theory, any difference in these rates can be interpreted as the effect of schooling on non-school learning rates.

Seasonal Comparisons Research

While not the first to employ seasonal comparison methodology, Heyns (1978) is widely cited because she conceptualized non-school forces acting on children during the summer months.10 Studying approximately 3,000 sixth and seventh grade students in the Atlanta Public Schools in 1971 and 1972, Heyns examined the school year and summer patterns of achievement to address the role of schooling in shaping the inequality between students from differing socioeconomic and racial backgrounds. Results of her analyses indicate that achievement gains for black and white students are “far more equal” as a result of schooling than if achievement were based solely on the non-school environments of the children. While all students learned less in the summer, black children lost more ground during the summer relative to white students than they did

during the school year. And, in all but the highest income level, black students’ skills actually regressed over the summer break. From this, Heyns concluded that, net of socioeconomic status, schools systematically promote racial equality by attenuating disparities between whites and blacks that would otherwise be larger in the absence of schooling.

Although Heyns’ sample was not nationally representative, her findings gained credibility when similar patterns of school year and summer achievement were reproduced in a sample of Baltimore students. Entwisle and Alexander (1992, 1994) employed similar methodology to examine the math and reading achievement of 790 first and second grade students in the Baltimore Public Schools in 1982. Unlike Heyns, Entwisle and Alexander (1992, 1994) focused on how school factors, particularly the school racial mix, affected student achievement. Results of Multivariate Analysis of Variance indicated that the racial gap in math widens over the first two years of schooling and that the gap grows mainly over the summer break. However, unlike Heyns (1978), the differences by race in summer gains or losses were not significantly different once poverty status was controlled. Thus, they concluded that the racial disparities in math achievement were actually due to non-school effects of economic status, not race (p. 82). In a second study, focusing on reading achievement, Entwisle and Alexander (1994) again pointed to the role of non-school environments. In particular, black students who
attended segregated schools fared significantly worse than others over the summer months, suggesting that schooling may attenuate some of non-school disadvantages associated with segregation.

Of note, Entwisle and Alexander’s (1992) findings indicate that black and white students score similarly on math and verbal tests at the beginning of first grade. In other words, in the Baltimore sample, there is no racial gap in achievement before schooling begins. This result calls into question the representativeness of the Baltimore Sample since most data indicate a gap at very young ages.

**Extending Seasonal Comparisons Research**

By separating school year from summer achievement, Heyns (1978) and Entwisle and Alexander (1992, 1994) offer the most direct evidence to date of the effect of schooling on racial/ethnic achievement gaps. However, even these studies leave important questions unanswered. In particular is whether or not the results from these samples are generalizable to the U.S. population. Both samples are composed of primarily disadvantaged children residing in large, urban environments. As a result, variation in both school year and summer learning rates may have been less than in the U.S as a whole. This may, in turn, result in misleading conclusions regarding the effect of schooling on non-school inequalities.

There are also other methodological concerns with existing seasonal comparisons studies. A major methodological hurdle in any longitudinal study is utilizing measures that adequately capture change over time. Particularly frustrating to studies of growth are ceiling and floor effects. Students scoring well on one test may have difficulty scoring
much better on subsequent tests (i.e. ceiling effect). Correspondingly, students scoring poorly on a test often cannot do much worse on subsequent tests (i.e. floor effects). Measuring true growth over time is challenging, particularly in studies focusing on the comparison of students who are advantaged versus disadvantaged. In the previous work, Heyns (1978) utilized norm-referenced scores to address the issue of ceiling and floor effects, capturing changes in groups relative to each other over time. However, this may still be problematic, failing to adequately capture changes in any group that is performing, on average, near the top or bottom of the scale. Because few students scored near the top or bottom of the scale in the sample utilized by Entwisle and Alexander (1992, 1994), they argued that ceiling and floor effects were not a critical concern in measuring changes over time. However, because of concerns over how well their measures address the problems inherent in longitudinal measures of growth, questions remain regarding the accuracy of growth estimates presented in these studies.

Of further concern is the treatment and estimation of “summer learning”. The main advantage in using seasonal comparisons methodology is the ability to estimate how much students learn during the summer, when they are not exposed to schooling. While simple in theory, obtaining accurate estimates of summer learning is difficult in practice. Ideally, to measure summer learning students would be tested on the last day of kindergarten and the first day of first grade. Because of the practical limitations of data collection in large surveys, many students experience significant amounts of schooling after taking the spring test and before taking the following fall test. Thus, adjusting
estimates of summer learning to remove these days of learning during the school year may offer a different picture of how much students are actually learning when they are not in school.

Finally, as a study of individuals nested within schools, it is important to utilize hierarchical modeling techniques (e.g. Bryk and Raudenbush 1992) given that correlated errors of individuals nested within single schools and group-specific error variances can produce biased estimates of coefficients and standard errors in single-level models (Kaufman 1995). Neither of these studies accounted for the hierarchical nature of the data. In this study, I address each of these limitations.

**Explaining Seasonal Patterns in Learning Rates**

The methodological limitations in these studies warrant further examination of the black-white gap, particularly in light of the fact that their findings lead to the conclusion that schools mitigate racial/ethnic achievement inequality (Entwisle et al 1997) - a conclusion that contradicts the vast reproductionist literature. However, disparities in non-school environments are great, seemingly much greater than disparities within and across schools. Thus, it is reasonable to expect that analyzing representative data with better methods will yield the same conclusion.

In particular, a much higher proportion of black children live in poverty than white children\(^{11}\) and this appears to lead to vast differences in learning opportunities between black and white children when they are not in school. In particular, more income in higher socioeconomic homes allow for investments into resources that promote

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\(^{11}\) In 2000, for example, 31% of black children lived in poverty compared to only 9% of white children (NCES, COE 2000).
cognitive growth. Examples of such include having more books, interactive games and computers that stimulate learning. Economic resources also allow for trips to places and events such as museums, historical sites and organized activities that may boost children’s learning during non-school periods (Heyns 1978; Schneider and Coleman 1993; Entwisle and Alexander 1995). And, non-economic resources in higher socioeconomic homes, such as higher educational expectations and parents reading to children, may also promote achievement.

Lareau’s (2002) recent ethnographic study of the relationship between class and social advantage offers further insight into other, more subtle, ways that higher socioeconomic status may advantage children over the summer break. In her study of black and white children from working class and middle class families, Lareau (2002) found that middle class parents are more likely to structure their children’s lives and interact with their children in ways that cultivate children’s social and cognitive skills, advantaging them in these areas. Key to enabling the activities and interactions is the economic and social resources associated with higher socioeconomic status. Specifically, the cost of structuring children’s lives in formal activities such as sports and music coupled with resources such as reliable transportation and flexible work schedules enabled middle class parents in her study to structure their children’s lives in this way. Particularly important to the present discussion, however, Lareau found that race had little, if any, influence on these aspects of child rearing, independent of class. She states, “…key aspects of daily life were shaped by racial segregation and discrimination. But, in terms of enrollment in organized activities, language use, and social connections, the largest differences between the families we observed were across social class, not racial
groups” (pp. 760-61). Thus, there is reason to believe that children of higher socioeconomic status learn more when school is not in session due home environments that are more intellectually and socially stimulating, and that, because black children are disproportionately represented in lower socioeconomic homes, this may be a key reason why black students fall behind over the summer break.

Further, high racial/ethnic segregation across neighborhoods may also play a primary role in shaping learning opportunities over the summer break. Black children are highly segregated in urban centers where high concentrations of poverty, joblessness and social disorganization leave neighborhoods void of important social institutions such as libraries and recreational facilities, as well as organized summer activities such as camps and youth sports leagues (Massey & Denton 1993; Wilson 1987). It is likely that living in such neighborhoods leaves many black children with significantly fewer experiences that stimulate cognitive growth than their white peers, resulting in growing achievement disparities, particularly over the summer.

Disparities in socioeconomic resources, as well as other resources associated with neighborhoods, are thus two primary sources that may generate black-white achievement disparities during non-school periods. And while school experiences may also differ in significant ways for black and white students (the reproductionist argument), it is likely that the inequality in school experiences is much less than the vast inequalities experienced outside of schooling. Compare, for example, the economic inequalities across families versus those across schools. In 1990, the bottom 10% of families had an income of just under $4000 while the top 1% earned over $400,000 (100 times
Across schools, however, economic disparity was much less, with the difference between the bottom ($6200 in per-pupil expenditures) and top ($7500 in per-pupil expenditures) only approximately .2 times higher (NCES, COE 2000). Thus, the economic resources available to children for learning opportunities are far more equal while they are at school, resulting in more equal rates of cognitive growth during the school year than during the summer break.

Further, public education in the United States is intended to enable any individual to achieve success (Brint 1998; Hoschild & Scovronick 2000). Thus, many school policies are aimed at reducing non-school inequalities in effort to equalize educational opportunity for students from different backgrounds. For example, compensatory programs at schools, such as free and reduced lunch, aim to reduce disparities in health and nutrition, and in turn achievement. Intervention programs, such as after-school and summer programming, are designed to provide children who live in disadvantaged homes and neighborhoods access to the institutions, organizations, and people that more advantaged children have in their non-school environments. And, in recent years, “multicultural” training for school personnel has specifically targeted reducing discrimination towards racial/ethnic minorities. Probably the most prominent policy aimed at equalizing racial/ethnic achievement was desegregation, which was specifically targeted at equalizing educational opportunities for blacks and whites while at school. Thus, school policies are designed to constrain the amount of inequality students experience in non-

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12 Income inequality in the U.S. is greater than in any other country (Fischer et al, 1996).
13 Many states are currently under legal obligation to further equalize school funding (e.g. Ohio, New Jersey).
school environments. To this end, schools conceivably reduce the disparity in learning opportunities between black and white students and, in turn, constrain the achievement inequality generated from home and neighborhood disparities.

For these reasons, it is reasonable to expect that my results will also indicate that the black-white test score gap grows primarily during the summer, largely as a function of socioeconomic status, and either does not grow at all during the school year or at least grows at a slower rate during the school year than summer. To test this expectation, I estimate the black-white gap at the beginning of kindergarten and analyze how this gap changes during the kindergarten and first grade school years relative to the summer break from schooling in between. I include measures of socioeconomic status and other family characteristics to test the relative power of these non-school factors in generating the black-white gap.

If socioeconomic status does indeed play a primary role in generating significantly different learning opportunities between black and white children during the summer break from schooling, we might also expect that, because Hispanic children are also more likely to live in poverty than white children\(^\text{14}\), the gap between Hispanic and white children also grows during the summer and is constrained during the school year. However, because many Hispanic children do not speak English at home, it is likely that they would experience more difficulty at school, especially at young ages, where English is typically the primary language utilized. To this end, the achievement gap between

\(^{14}\) In 2000, 28% of Hispanic children lived in poverty compared to 31% of black children and only 9% of white children (NCES, COE 2000).
Hispanic and white children may not be as constrained during the school year as the black-white gap. I examine this possibility by testing the effect of children’s home language on their school year and summer learning.

While socioeconomic status may not play as significant a role in differentiating Asian children from white children, the expectation that schooling constrains inequalities suggests that the advantage Asian students experience over white students results more from non-school environments. In other words, results should indicate that Asian students primarily gain ground on white students during the summer break, while learning equally during the school year. However, the cultural perspective also leads us to believe that Asian students' values and behaviors might additionally advantage them in their school environments by promoting behaviors and relationships that have positive consequences for achievement (see, for example, Wong 1980). Thus, existing theory suggests that Asian students are possibly advantaged both at home and at school. To consider this possibility, I also examine how parents’ educational “values” affect students’ rates of growth during non-school and school periods.
CHAPTER 3

METHODS

Only recently has data become available to examine seasonal learning disparities in a nationally representative sample of school children. *The Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K)* is a newly released, nationally representative sample of kindergartners from 1998. Children in this survey were tested on two occasions annually over the kindergarten and first grade years. By measuring achievement both near the beginning and near the end of the school year, these data offer the ability to employ seasonal comparisons methodology and thus isolate school year learning from summer learning.

The *ECLS-K* data also offer the opportunity to further extend our knowledge to other racial/ethnic groups. While previous studies have focused primarily on the black-white achievement gap, the *ECLS-K* sample includes large enough samples of Latino and Asian American students to estimate school year and summer learning rates for students from other racial/ethnic backgrounds. Thus, the overarching purpose of the present study is to utilize better data and methods to examine the relative power of school and non-school forces in generating racial/ethnic disparities in reading and math achievement. Results of such analyses will offer the most direct evidence of how schools affect
racial/ethnic achievement gaps. Are schools a source of racial/ethnic achievement inequality, or do they mitigate what otherwise would be even larger gaps in the absence of schooling?

The Data

The Early Childhood Longitudinal Study- Kindergarten Cohort (ECLS-K\textsuperscript{15}) is a nationally representative sample of 21,260 kindergartners during the 1998-1999 school year. The ECLS-K utilized a three-stage probability sampling design. The first stage selected 100 primary sampling units (PSU’s), consisting of counties or groups of counties, from a population of PSU’s meeting specific minimum criteria (n=1,404); the second-stage utilized a stratified design to select public and private schools with kindergarten programs within the PSU’s. The schools were sampled with probability proportional to size. The final stage sampled students within the selected schools. Only Asians and Pacific Islanders were over-sampled relative to population proportions. An average of 24 students were sampled from 1,277 schools.\textsuperscript{16}

The ECLS-K data is uniquely suited for this research study given that it is the only nationally representative data offering achievement measures at two time points during the school year (fall and spring). Further, by focusing on kindergartners, the ECLS-K provides the opportunity to study achievement gaps at an ideal time, the beginning of

\textsuperscript{15}Sponsored by the National Center for Education Statistics (U.S. Department of Education).
\textsuperscript{16}For more information on the sampling design of the ECLS-K, see the Kindergarten User’s Manual, chapter 5 (NCES).
formal schooling. Cognitive growth rates are much higher at younger ages (Jencks & Phillips 1998) and studying kindergartners offers the opportunity to examine the effects of schooling at children’s initial exposure to formal education.

While all students were tested near the beginning and near the end of their kindergarten school year and again at the end of the first grade year, only a sub-sample of students were tested in the fall of their first grade year. The final sample size of the longitudinal ECLS-K data is 17,212 children. As I will discuss in detail below, I utilize Hierarchical Linear Modeling (HLM; Bryk & Raudenbush, 1992; 2002) to estimate achievement growth rates and their covariates during kindergarten and first grade. HLM requires that there be no missing data at the second (student characteristics) or third (school characteristics) levels of analysis. To meet this requirement, I utilize list-wise deletion to remove cases with missing data. Specifically, students were removed from the sample if:

1. They were in year round schooling. These students were removed simply because they do not experience “non-school” environments at the same concentration (i.e. summer) as non-year round students.17

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17 Although there was a “year-round schooling” identifier in the first grade data, the equivalent identifier was not available in kindergarten. Further, many children were not ascertained on the first grade variable. To appropriately identify year-round students, school start and end dates were utilized. Any child indicating a school year length of 12 (or more) months was removed from the sample (n=11). Also note that children whose kindergarten school year ended after their first grade year began were also removed from the sample (n=42).
2. They changed schools during the 18 month period (13% of sample). Some of these students were not followed after changing schools, and even for students who were followed, HLM does not currently have the capabilities to examine a “cross-classified” (i.e. changing schools) model in a 3-level analysis (Bryk and Raudenbush 2001).

3. Any student missing individual-level data other than achievement test scores (e.g. SES), or missing school-level data (e.g. school begin and end dates).

The final sample used in my analyses remains over 6,600 students from 469 schools (n=6640). Table 3.1 presents the demographic comparison of my subsample to the full longitudinal sample. As shown in the table, my subsample has a slightly higher percentage of white students and corresponding lower percentages of other racial/ethnic groups. The average SES of my sub-sample is also slightly higher. Effects of these sample differences on results will be considered in the discussion.
Table 3.1. Un-weighted distributions of race/ethnicity, SES and gender in the ECLS-K Longitudinal Data* and the Sub-sample used in the Current Analysis.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>ECLS-K Full Longitudinal Sample (n=16,632)</th>
<th>Sample used in current analysis (n=6643)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>58%</td>
<td>66%</td>
</tr>
<tr>
<td>Black</td>
<td>14%</td>
<td>12%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>16%</td>
<td>12%</td>
</tr>
<tr>
<td>Asian</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td>Other Race</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>SES</td>
<td>.014**</td>
<td>.068**</td>
</tr>
<tr>
<td>Female</td>
<td>49%</td>
<td>50%</td>
</tr>
</tbody>
</table>

*Although the full ECLS-K longitudinal sample includes 17,212 cases, I only include here students that were not in year-round schooling in kindergarten or first grade (n=580).

**The SES measure, as describe below, ranges from –4.75 to 2.75.

Measures

One of the major contributions of this study is advancing the measurement of cognitive growth during the school-year and summer. In prior work, “summer growth” has been calculated merely as the difference between a test taken in the fall and one taken in the prior spring. However, because the tests are rarely administered to students on the very last or very first day of a school year, most students experience some amount of exposure to the school environment between these two test occasions. I call these “overlap days,” or the school days that students experience in kindergarten after taking the spring test and the school days they experience in first grade before taking the fall test. In my sample of the ECLS-K data, students spent, on average, 33 days in school after taking the spring kindergarten assessment. They further spent, on average, 41 days in first grade before taking the fall assessment. In total then, students were exposed to an average of 74 days of schooling, which should be attributed towards their “school-year gains”, but in previous work has been attributed to “summer gains” (or non-school
growth). Consequently, previous research that was not able to adjust for the “overlap” school days contaminating summer estimates likely overestimated students’ growth during the summer. In this study, I correct for this “contamination” problem by estimating a multi-level model in which each test score is associated with a student’s corresponding school year and summer exposure rates, explained in detail below.

**Cognitive Growth:**

To begin measuring cognitive growth, I utilize the Item Response Theory (IRT) based reading and math scale scores available in the *ECLS-K* data. IRT-based scores significantly reduce ceiling and floor effects by calculating scores based upon patterns of right, wrong and omitted answers, as well as the difficulty-level of each question. These scale scores are developed specifically to measure growth over time, and are thus the chosen measure of reading and math achievement in my study.

The reading test assesses cognitive skills at five levels of reading ability: (1) identifying upper- and lower- case letters by name; (2) associating letters with sounds at the beginning of words; (3) associating letters with sounds at the end of words; (4) recognizing common words by sight; and (5) reading words in context. The math test also assesses skills at five levels of ability: (1) identifying basic numbers and geometric shapes as well as counting up to 10; (2) reading all single-digit numerals, counting beyond ten, recognizing a sequence of patterns, and utilizing units of length to compare objects; (3) reading two-digit numerals, recognizing numbers in sequence, identifying the position of an object, and solving basic word problems; (4) solving basic addition and
subtraction problems; and (5) solving basic multiplication and division problems as well as recognizing complex number patterns. Because school years are typically longer in length than summer breaks, growth rates are standardized to growth per month.

Testing occurred at four time points during the first two waves of the ECLS-K data collection. All students were tested during the fall of kindergarten, the spring of kindergarten and during the spring of first grade, unless he or she was absent from school on the day of testing. For costs reasons, only a sub-sample of students was tested in the fall of first grade (n=5,470).

In order to estimate growth over time as a function of school and non-school environments, these four achievement test scores (fall kindergarten, spring kindergarten, fall first grade and spring first grade) are associated with the amount of exposure to school and non-school environments each student had experienced at the time of taking the test. Said differently, each child’s test score at each time point is associated with three “exposure rates,” one for “kindergarten exposure”, one for “summer exposure” and one for “first grade exposure”. To calculate students’ kindergarten, summer and first grade exposure (in months) at each time point, I totaled the number of days experienced of each at a given time point, and divided the days by 365/12. For example, if a student took the spring kindergarten test two days after her kindergarten school-year ended, her test score for spring kindergarten would be associated with a full school-year of kindergarten exposure, the two days of summer, and zero days of first grade, all calculated in months. By associating the four test scores for each child with their corresponding exposure rates, monthly learning rates in reading and math achievement
can then be estimated in HLM for the kindergarten school year, the first grade school year and the summer in between. Table 3.2 summarizes average reading and math scores at the four time points and their corresponding average exposure rates.

Table 3.2. Average Reading and Math Test Scores at Each of the Four Test Occasions During Kindergarten and First Grade in the ECLS-K.

<table>
<thead>
<tr>
<th></th>
<th>Reading Score</th>
<th>Math Score</th>
<th>K-garten Exposure</th>
<th>Summer Exposure</th>
<th>1st Grade Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Kindergarten</td>
<td>23.82</td>
<td>20.79</td>
<td>2.2</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Spring Kindergarten</td>
<td>34.13</td>
<td>29.04</td>
<td>8.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Fall first Grade</td>
<td>40.16</td>
<td>34.40</td>
<td>9.4**</td>
<td>2.6</td>
<td>1.3</td>
</tr>
<tr>
<td>Spring First Grade</td>
<td>57.19</td>
<td>44.44</td>
<td>9.3**</td>
<td>2.6</td>
<td>8.2</td>
</tr>
</tbody>
</table>

*Note that a very small number of children had experienced a little summer exposure at the time of taking the spring kindergarten test but the average exposure reported is 0, due to rounding. **The fall first grade sub-sample (n=1929) spent, on average, a little more time in kindergarten than children not in this sub-sample, which explains the lower average kindergarten exposure in the spring of first grade.

In addition to the exposure rates for kindergarten, summer and first grade, I also control for whether a student attended half or full-day kindergarten, an experience that directly affects kindergarten exposure rates (Bryk and Raudenbush, 2002; Chapter 6).

**Race/Ethnicity and Control Variables:**

**Race/Ethnicity:** I utilize 7 dichotomous race variables in the ECLS-K (white, black, Hispanic, Asian, American Indian, Pacific Islander, and multi-racial) to construct 5 new dichotomous race variables for my analysis (white, non-Hispanic; black, African-American; Hispanic; Asian; and “other”).
**Socioeconomic Status:** As recommended by NCES, the continuous measure of SES was utilized for multivariate regression analysis. As such, SES is a continuous composite variable available in *ECLS-K*. Parents’ education levels, parents’ occupations, and household income were utilized to create this composite variable. The composite SES measure is the average of up to 5 individual measures (1 or 2 parent education levels, 1 or 2 parent occupations, and 1 household income), all standardized with a mean of 0 and a standard deviation of 1. The final kindergarten year SES measure ranges from –4.75 to 2.75, and first grade measure ranges from –2.96 to 2.88, with higher levels equaling higher SES. To best capture the socioeconomic status of the home environment during the survey period, I averaged the two SES measures.

**Gender:** Gender is a composite variable available in ECLS-K recoded for this analysis as female=1.

**Age at Kindergarten Entry:** Due to the relationship between the age of children when they enter kindergarten and achievement, all models, other than the unconditional model, control for age at kindergarten entry. This measure is the age, in months, of the child on the first day of his/her kindergarten school year.

**Family Background**

**Parent Structure:** The number and type of parents in a child’ household is a composite measure available at 3 time points in the ECLS-K. I utilize the fall-kindergarten measure and, based on previous literature and preliminary analyses, recode values into 3 dichotomous variables (2-parent, 1-parent and “other”).

\[18\] For more detail on the creation of the composite SES measure, see NCES kindergarten User’s Manual chapter 7, pages 8-12.
**Number of Siblings:** Consistent with parent structure, I utilize the fall-kindergarten measure of number of siblings living in the home and collapse the number of siblings into a single categorical variable where 0= no siblings, 1=only 1 sibling, 2=2 or 3 siblings and 4=4 or more siblings.

**Cultural Perspective**

**Parent Educational Expectations of Child:** Following previous literature on educational expectations, I utilize a single measure available in the fall-kindergarten data that asks the parent what his/her educational expectations are for the child. The measure is recoded into single categorical variable (less than college, college, graduate or professional degree).

**Educational Values:** To measure how much importance parents place on the cognitive development and educational success of their child, I utilize two variables from the fall-kindergarten parent questionnaire which asked how important it was to the parent that their child be able to (1) count when they enter kindergarten and (2) know letters when they enter kindergarten. The combined measure ranges from 0-2, with 0 being “not very or not important” on both and 2 being “very important or essential” on both.

**Parent Reads to Child:** As a measure of the educational environment in the home, I utilize a single measure from the fall-kindergarten data, recoded and ranging from 0-3, where 0=does not read to child at all and 3=reads to child every day.
**Home Language:** To identify language minority students, I utilize a single variable from the kindergarten school year indicating whether the child’s home language was English or non-English. The measure was recoded into a dichotomous variable where 1=non-English.

**School Characteristics**

Many scholars have highlighted differences between schools attended primarily by black students and those attended primarily by white students. Most notably, Kozol (1991) detailed how black children, who are disproportionately segregated in disadvantaged urban areas, are much more likely to attend schools with deteriorating physical environments, weaker curriculums, lower levels of teacher experience and quality, and fewer educational resources (see also Roscigno 1998). Given the connection between these indicators of “school quality” and concentration of minority populations and levels of student poverty, research has many times relied on measures of racial/ethnic concentration and student poverty concentration as proxies for the numerous ways schools differ in quality. For example, Roscigno (1998) utilized these measures in his analysis of black-white disparities in high school achievement and found that they did indeed capture variation in schools that significantly relate to student achievement. In light of the success of these measures in previous research, I also utilize these two measures as proxies to capture the many important ways which schools vary.
**School Segregation**: 3 dichotomous variables indicating whether a school had (1) 75% or more minority student enrollment, (2) 90% or more white, non-Hispanic student enrollment, or (3) greater than 25% white, non-Hispanic student enrollment but less than 90% white, non-Hispanic student enrollment (omitted category).

**Percent on Reduced or Free lunch at School**: A combination of two measures reported by the school indicating the percentage of students eligible for (1) reduced lunch and (2) free lunch.

All variables, coding and descriptive statistics are available in Appendix A.

**Analytic Method**

I estimate growth rates for reading and math achievement during the school year (kindergarten and first grade) and summer using a multi-level model for individual change (Bryk and Raudenbush 2002). Despite the fact that the number of test observations and spacing between observations varies across students (“unbalanced data”), advanced modeling in HLM allows estimation of individual growth trajectories over the three time periods. Thus, in my models, achievement tests and corresponding exposure rates are nested within students, and then students are nested within schools.

In this manner, at level 1, each student’s cognitive growth is represented by a growth trajectory that varies as a function of exposure to the three different environments. The growth trajectories then become the outcome measures at level 2, where they may
vary as a function of individual characteristics. Finally, the relationships between individual characteristics and growth trajectories become the outcome measures at level 3, where they may vary as a function of school characteristics.

Level 1

For individual students, each of their four test scores is estimated as a linear function of months exposed to kindergarten, summer and first grade at the time of the test. Following Bryk and Raudenbush (2002), let $Y_{tis}$ represent the observed test score (reading or math) at time $t$ for individual $i$ in school $s$. $Y_{tis}$ then is a function of exposure to kindergarten, summer and first grade such that:

$$Y_{tis} = B_{0is} + B_{1is}(\text{Kindergarten Exposure}_{tis}) + B_{2is}(\text{Summer Exposure}_{tis}) + B_{3is}(\text{First Grade Exposure}_{tis}) + e_{tis}$$

where:

$B_{0is}$ = estimate of the child’s score had they been tested on the first day of kindergarten

$B_{1is}$ = estimate of the child’s monthly learning rate during kindergarten

$B_{2is}$ = estimate of the child’s monthly learning rate during summer between kindergarten and first grade

$B_{3is}$ = estimate of the child’s monthly learning rate during first grade

$e_{tis}$ = random variation in test scores
Level 2

By allowing random variation (e) at level-1, the model assumes that growth rates vary across children. The 4 individual growth parameters (B) estimated at level-1 thus become outcome measures at level-2, such that for each of the P + 1 individual growth parameters:

\[
B_{0is} = \beta_{00s} + \sum \beta_{qs} X_{qs} \\
B_{1is} = \beta_{10s} + \sum \beta_{qs} X_{qs} \\
B_{2is} = \beta_{20s} + \sum \beta_{qs} X_{qs} \\
B_{3is} = \beta_{30s} + \sum \beta_{qs} X_{qs}
\]

where:

\(\beta_{00s}\) = average initial score (first day of kindergarten) in each child’s school

\(\beta_{10s}\) = average kindergarten growth rate in each child’s school

\(\beta_{20s}\) = average summer growth rate in each child’s school

\(\beta_{30s}\) = average first grade growth rate in each child’s school

\(X_{qs}\) = a measured characteristic of the individual (1-q individual characteristics)

\(\beta_{qs}\) = the effect of X on the achievement growth parameter

Note that, unlike a cross-sectional hierarchical model, there are no random effects in level-2. This is because all individual random variation has been captured at level-1 (see Bryk and Raudenbush 2001; p. 166).
Level 3

Students are finally nested within schools to account for correlated errors of students within schools as well as the group specific error variances. At this level, the relationship between individual-level covariates and the growth parameters estimated at level-2 now become the outcome measures such that:

\[
\begin{align*}
\beta_{0qs} &= \gamma_{0qs} + \sum \gamma_{qs} W_q + \Lambda_{0qs} \\
\beta_{1qs} &= \gamma_{1qs} + \sum \gamma_{qs} W_q + \Lambda_{1qs} \\
\beta_{2qs} &= \gamma_{2qs} + \sum \gamma_{qs} W_q + \Lambda_{2qs} \\
\beta_{3qs} &= \gamma_{3qs} + \sum \gamma_{qs} W_q + \Lambda_{3qs}
\end{align*}
\]

where:

\[\gamma_{0qs} = \text{average initial score (first day of kindergarten) across all schools}\]
\[\gamma_{1qs} = \text{average kindergarten growth rate across all schools}\]
\[\gamma_{1qs} = \text{average summer growth rate across all schools}\]
\[\gamma_{1qs} = \text{average first grade growth rate across all schools}\]

\[W_{qs} \text{ is a measured characteristic of the school (1-q school characteristics)}\]
\[\gamma_{qs} \text{ is the effect of } W \text{ on the relationship between the achievement growth parameter and individual characteristic}\]
\[\Lambda_{qs} \text{ is a random school effect}\]
Treatment of level-1 variance is a key issue in modeling this 3-level analysis. I completed preliminary analyses on various treatments of the variance. Results indicated that an unrestricted structure was best for this analysis.\(^{19}\) In light of this finding, I utilize a hierarchical, multivariate linear model to estimate all models (HMLM; Bryk & Raudenbush, 2001).

In Chapter 4, I present results of a basic, unconditional model, which does not include any covariates. This model simply estimates (1) initial gaps at the beginning of kindergarten, (2) kindergarten growth per month, (3) summer growth per month and (4) first grade growth per month, for both reading and math outcomes. Results of this model will demonstrate the rates at which children learn both in and out of school and changes in levels of inequality over the first two years of schooling (i.e. do gaps grow?). Also, this basic model estimates variation between schools in initial gaps as well as school year and summer growth rates (which can be compared as an indicator of how schooling affects overall inequality in learning). Building on these initial models, Chapter 5 gets at the heart of this analysis by specifically exploring how schooling affects racial/ethnic inequality. Chapter 6 finally explores major theoretical explanatory factors for the patterns presented in Chapter 5.

\(^{19}\) Conclusions based upon (1) ability to estimate the variance-covariance matrix and (2) chi-square tests of deviance statistics indicating best model fit ($\Pi^2 < .001$).
CHAPTER 4
SEASONAL COMPARISONS, LEARNING AND INEQUALITY

Heyns (1978) and Entwisle and Alexander (1992, 1994) have both used seasonal comparisons to contribute to our understanding of racial/ethnic differences in learning. There are several important methodological weaknesses of past seasonal comparison studies, however, and so this issue merits further attention. In this chapter, I briefly review these limitations and how I improve upon past research, and present results from basic models assessing growth in learning rates during the school years and summer. As mentioned at the end of Chapter 3, these basic models for reading and math additionally offer insight into general changes in inequality over the first two years of schooling as well as how schools affect variation in growth rates.

Some scholars may not be convinced by the Atlanta and Baltimore studies due to the limited generalizability of their samples. Particularly, both samples consisted of disproportionately disadvantaged children residing in large urban environments. Because these samples lack the variation present in the U.S. population, variation in both school year and summer learning rates may have been reduced and thus results may not represent patterns present in the U.S. population. Additionally, while the Baltimore sample is comprised of relatively young children (first graders), examining kindergartners in the ECLS-K considers the effects of schooling when children are first
exposed, thus reducing possible contamination of school-year estimates. Other methodological concerns with Heyns (1978) and Entwisle and Alexander (1992, 1994) limit the usefulness of their findings. In particular are concerns over their approaches to dealing with ceiling and floor effects as well as estimation of summer learning that included “overlap days” when children were in school.20

Taken together, then, questions arising from data, measures and modeling issues may result in skepticism regarding conclusions drawn from the existing seasonal comparisons research. Thus, in this chapter, I utilize hierarchical modeling techniques, and draw on nationally representative data incorporating advanced measures of cognitive growth, to address these concerns and re-evaluate the seasonal learning patterns of students over the first two years of formal schooling.21 I also present results reflecting levels of inequality over the first two years of schooling as well as how schooling affects variation in learning rates during the non-school period.

School and Non-school Learning

In the ECLS-K data, the fall kindergarten test was not administered on the first day of school. Children were exposed to an average of 2.2 months of schooling before they were tested. Similarly, because each subsequent test was not administered to every child on the same day and because students’ school years differ in length, children were exposed to varying amounts of school and non-school environments between testing occasions. Thus, the amount of time between tests as well as whether that time was in school or out, must be considered uniquely for each individual when estimating school

20 See Chapter 2 for details regarding limitations of previous work.
21 Refer to Chapter 3 for specific details on the data, measures and modeling technique.
year and summer growth. Particular to summer estimates, students experienced an average of 1.1 months of kindergarten “overlap days” after taking the spring test and 1.3 months of first grade before taking the fall test. In order to accurately estimate summer learning rates, these school-year learning days must be removed from summer estimates.

The unconditional hierarchical model more accurately depicts achievement when children begin schooling by estimating the fall kindergarten test scores as if children took the test on the first day of school. The model also offers better estimates of the rates at which students learn during the kindergarten school year, the first grade school year, and the summer in between by utilizing information on the exact amount of schooling and summer break students experienced between tests. In particular, the model adjusts for the “overlap days” and in turn, estimates summer learning rates as if the spring and fall tests were taken on the last day of kindergarten and the first day of first grade, respectively.\(^\text{22}\)

The unconditional 3-level model mixes fixed and random effects and can be represented as follows:

\[
Y_{it} = (\gamma_{000} + \Lambda_{000}) + (\gamma_{100} + \Lambda_{100})(\text{exposure to kindergarten}_{it}) + (\gamma_{200} + \Lambda_{200})(\text{exposure to summer}_{it}) + (\gamma_{300} + \Lambda_{300})(\text{exposure to first grade}_{it}) + e_{it}
\]

\(^{22}\) See Chapter 3 for more detail on the estimation of school year and summer parameters.
where:

\[ Y_{it} \] is the outcome measure (i.e. reading or math) at time \( t \)

\[ \gamma_{000} + \Lambda_{00s} \] is average school initial achievement plus random school variation in initial achievement

\[ \gamma_{100} + \Lambda_{10s} \] is average school kindergarten growth per month plus random school variation in kindergarten growth per month

\[ \gamma_{200} + \Lambda_{20s} \] is average school summer growth per month plus random school variation in summer growth per month

\[ \gamma_{300} + \Lambda_{30s} \] is average school first grade growth per month plus random school variation in first grade growth per month

\[ e_{its} \] is individual random variation

As discussed in Chapter 3, all individual level variation is captured in the level-1 residuals, as estimated in the variance-covariance matrix, Delta. Variance in the test scores across the four test occasions offers some insight into how inequality changes during the first two years of formal schooling. Results of the Delta matrix for reading achievement indicates that the variance in test scores, presented in Figure 4.1 as standard deviations, increases over each of the four test occasions. Assuming that measurement error remains fairly stable across tests, this pattern suggests that inequality in reading achievement grows substantially over the first two years of formal schooling. Math achievement follows a similar pattern with one notable difference. While inequality in math achievement grows during kindergarten and the summer between kindergarten and first grade, results suggest that variance in scores decreases over the first grade school year. Also of note, there is much more variation in reading skills than math skills.
Results from the unconditional reading and math models are presented in Tables 4.1 and 4.2. As shown in Table 4.1, results of the Tau matrix\(^{23}\) indicate that great variation exists between schools on the first day of kindergarten, before schools have any effect on children. The variance in reading scores on the first day of kindergarten is 12.86 (3.6 standard units) between schools and variation in math scores is 10.09 (3.2 standard units). Thus, contrary to previous research concluding that variation between schools represents disparities in school environments, these results indicate that a significant amount of the variation between schools is due to the characteristics of the student populations attending the schools.

\(^{23}\) The Tau matrix estimates the variance and covariance of Beta coefficients. Because Beta coefficients represent the mean school effect, variance in Beta coefficients thus captures how much variation exists across schools.
Table 4.1. Variation across schools in initial Reading and Math Achievement and learning rates during kindergarten, summer and first grade.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Initial Achievement ($\overline{Y}_{00}$)</th>
<th>Kindergarten Growth ($\overline{Y}_{10}$)</th>
<th>Summer Growth ($\overline{Y}_{20}$)</th>
<th>First Grade Growth ($\overline{Y}_{30}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>12.86</td>
<td>.15</td>
<td>.28</td>
<td>.19</td>
</tr>
<tr>
<td>Math</td>
<td>10.09</td>
<td>.06</td>
<td>.32</td>
<td>.06</td>
</tr>
</tbody>
</table>

Parameter estimates from the unconditional models for reading and math are presented in Table 4.2. The intercepts indicate that on a 92-point scale, students enter formal schooling with an average reading score of about 20 points ($b=19.781$). In math, students begin scoring, on average, almost 17.5 points on a 64-point scale ($b=17.444$).

Table 4.2. Reading and Math Achievement Growth Rates During Kindergarten, Summer and First Grade.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Reading</th>
<th>Math</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score on First Day of Kindergarten</td>
<td>19.781*** (.199)</td>
<td>17.444*** (.173)</td>
</tr>
<tr>
<td>Exposure to Kindergarten (half-day)</td>
<td>1.612*** (.032)</td>
<td>1.327*** (.022)</td>
</tr>
<tr>
<td>Full-day of Kindergarten</td>
<td>.147*** (.041)</td>
<td>.059* (.027)</td>
</tr>
<tr>
<td>Exposure to Summer</td>
<td>.024 (.067)</td>
<td>.570*** (.059)</td>
</tr>
<tr>
<td>Exposure to First Grade</td>
<td>2.583*** (.031)</td>
<td>1.526*** (.021)</td>
</tr>
</tbody>
</table>
As expected, results in Table 4.2 further demonstrate that schooling tends to increase the learning of students. Coefficients in both reading and math for kindergarten learning, summer learning and first grade learning indicate that students learn at a much faster rate during the school year than during the summer break. For reading, students attending half-day kindergarten learn at a rate of about 1.6 achievement test points per month. During first grade, they learn reading at an even faster rate of about 2.6 points per month. The summer estimate indicates that students actually learn little, if any, reading over the summer break.

In math, students attending half-day schooling gain about 1.3 achievement test points per month during kindergarten and a little more during first grade (1.5 points). Unlike reading achievement, students appear to learn some math over the summer, but not nearly at the rate they learn during the school year (approximately 40% as quickly). Significance tests of a planned contrast between school-year learning and summer learning indicates that students do indeed learn reading and math significantly faster during the school year than they do during the summer (p<.001).

Comparing the variation between mean school year learning rates ($\exists_{10}$ and $\exists_{30}$) and summer learning rates ($\exists_{20}$) is one of the most striking results of the unconditional models. The school year and summer variance in learning rates clearly suggests that schooling constrains overall inequality. Variation in rates of learning is much higher

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24 Interestingly, while not a focus of the present study, students in full-day kindergarten did learn significantly more than their peers in half-day kindergarten. While the coefficient is small (.147), it is significant, and it translates into an extra 1.3 achievement test points over the course of the kindergarten school year (9% more than students in half-day kindergarten).

25 Attending full-day kindergarten has a much smaller affect on math achievement than reading achievement. While it is statistically significant, students gain only about a half a point more than students in half-day schooling over the course of the kindergarten school year (4% more).
during the summer, when school is not in session, than during the school year. For example, variation in reading scores between schools is .15 (kindergarten) and .19 (first grade) during the school year, which is less than the variation between schools during the summer (.28). For math scores, this difference is even more striking. Variation in math learning rates is reduced by over two-thirds during the school years. As Entwisle and Alexander (1992) note, because the student populations of elementary schools closely resemble the make-up of children’s neighborhoods, the fact that school year variation is reduced relative to summer is strong evidence that schooling does indeed help reduce inequality generated in non-school environments.

In sum then, results of the unconditional models suggest that, in general, schools help students gain knowledge and skills significantly faster than when not in school. Most important to this study, schools appear to reduce overall levels of inequality in achievement. Thus, skeptics of Heyns (1978) and Entwisle and Alexander (1992, 1994) might be assured to know that their general patterns are replicated with more representative data, better measures and advanced methods of estimation. However, what cannot be discerned from this basic model is whether schooling reduces inequality along different markers of stratification, namely race/ethnicity, or if racial/ethnic inequality is an exception to this general pattern. This is the focus of Chapter 5.
CHAPTER 5
SCHOOLING AND RACIAL/ETHNIC GAPS IN READING AND MATH

Results of the unconditional hierarchical model (presented in Chapter 4) suggest that students learn significantly more while they are in school than while they are out, and that generally, schooling reduces disparities between high and low achieving students. As the “Great Equalizer”, this is the ideal function of schooling - to promote learning while also reducing disparities generated in unequal non-school environments. But, does schooling promote learning equally for students from different backgrounds and act as an equalizer for different types of inequality? Specifically, how does schooling affect disparities between students from different racial/ethnic backgrounds?

Consistent with previous research, results indicate a gap between black and white children when they begin kindergarten. In the 1998 ECLS-K data, black children began formal schooling .4 to .6 standard deviations behind white children in reading and math, respectively. Hispanic children begin schooling scoring very similarly to black children while Asian children are on par, or modestly ahead, of white children.26 What happens to these gaps over the first two years of school?

26 For a more complete discussion of disparities at the beginning of kindergarten, see Appendix B.
Figures 5.1 and 5.2 depict how students grow from the beginning of kindergarten to the end of first grade. In reading, Asian and white children have grown the most over the 18-month period, gaining 33 and 34 raw achievement test points, respectively. Black and Hispanic students learn the least, gaining only 29 and 30 points in that time period. Thus, Asian and white students began kindergarten ahead of black and Hispanic children, and by the end of first grade, this gap has widened. The gap widens by .1 standard deviations. At this rate, black students will be over 1 standard deviation behind white and Asian students by the time they graduate from high school.

Figure 5.1. How Racial/Ethnic Gaps in Reading Achievement Change Over the First Two Years of School
For math, the disparity in growth over the first two years, while not as profound as it is in reading, grows. Between the beginning of kindergarten and the end of first grade, white and Hispanic students have gained 23 points in math, Asian students 22 points and black students 21 points. As shown in Figure 5.2, this modest advantage for white students appears to be enough to surpass Asian students in math achievement and, similarly, the overall growth of Hispanic students pushes them ahead of black students by the end of first grade.

Figure 5.2. How Racial/Ethnic Gaps in Math Achievement Change Over the First Two Years of School
Results of preliminary analyses thus indicate that gaps between advantaged and disadvantaged racial/ethnic groups, particularly in reading, appear to grow from the beginning of kindergarten to the end of first grade, exactly opposite of what we would expect to occur if schools were equalizing outcomes for students from different racial/ethnic backgrounds. However, these descriptive statistics, while informative of general patterns of growth over the 2-year period, may not present an accurate picture. Because of the different times students took the fall kindergarten test and spring first grade test, some groups of students may have simply had more time between the tests and thus grown more. Further, as results from seasonal comparisons research suggest, it is possible that schools are reducing the gaps between racial/ethnic groups and the gaps grow mainly during the summer, when students are not in school.

*Racial/Ethnic Inequality over the First Two Years of School*

I add indicators of students’ race/ethnicity to the hierarchical, multivariate linear model to estimate racial/ethnic differences in monthly growth rates during the school year independent from growth that occurs during the summer. Adding race/ethnicity into the unconditional models significantly improves the fit of both models (reading and math), indicating that racial/ethnic differences explain a significant amount of inequality in test scores ($\Pi^2; p<.001$). Table 5.1 presents results of these models, indicating the extent of racial/ethnic growth disparities in reading and math during the kindergarten school year, first grade school year and the summer in between. In order to compare differences in
school year and summer learning across racial/ethnic groups, I analyze the entire sample and utilize a reference group. Following previous literature, the reference group in all analyses is white, non-Hispanic students ("white").

Utilizing whites as a reference group may have the unintended effect of reifying the advantaged position of whites in society. While I utilize whites as a reference category for consistency with previous research, I acknowledge the important concerns of doing so.
Table 5.1. Racial/Ethnic Differences in Reading and Math Growth Rates During Kindergarten, Summer and First Grade.

<table>
<thead>
<tr>
<th>Variables</th>
<th>READING</th>
<th></th>
<th></th>
<th></th>
<th>MATH</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K-garten Growth</td>
<td>Summer Growth</td>
<td>1st Grade Growth</td>
<td></td>
<td>K-garten Growth</td>
<td>Summer Growth</td>
<td>1st Grade Growth</td>
</tr>
<tr>
<td>Black</td>
<td>-.200*** (.046)</td>
<td>-.013 (.185)</td>
<td>-.166* (.072)</td>
<td></td>
<td>-.211*** (.037)</td>
<td>.041 (.162)</td>
<td>-.062 (.055)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>.038 (.045)</td>
<td>.049 (.176)</td>
<td>-.113 (.067)</td>
<td></td>
<td>.025 (.036)</td>
<td>-.298* (.153)</td>
<td>.097 (.052)</td>
</tr>
<tr>
<td>Asian</td>
<td>.218** (.069)</td>
<td>.568* (.278)</td>
<td>-.228* (.104)</td>
<td></td>
<td>-.011 (.056)</td>
<td>.401 (.242)</td>
<td>-.226** (.081)</td>
</tr>
<tr>
<td>Female</td>
<td>.119** (.024)</td>
<td>.093 (.099)</td>
<td>.005 (.038)</td>
<td></td>
<td>-.029 (.020)</td>
<td>.044 (.085)</td>
<td>-.038 (.029)</td>
</tr>
<tr>
<td>Age at Kindergarten Entry</td>
<td>.012*** (.003)</td>
<td>.034* (.012)</td>
<td>-.015** (.005)</td>
<td></td>
<td>.005* (.003)</td>
<td>.015 (.011)</td>
<td>-.015*** (.004)</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.552*** (.035)</td>
<td>-.054 (.092)</td>
<td>2.634*** (.039)</td>
<td></td>
<td>1.359*** (.025)</td>
<td>.572 (.082)</td>
<td>1.553*** (.029)</td>
</tr>
</tbody>
</table>

Note: Model also includes controls for other racial/ethnic groups and full-day kindergarten.
How does schooling affect gaps between racial/ethnic groups?

Results presented in Table 5.1 indicate that gaps between racial/ethnic groups are exacerbated during the kindergarten school year. White and Hispanic students learn to read significantly faster than black students during the school year ($b = -0.200; p < .001$). Asian students gain even more than white or Hispanic students, resulting in almost 2 additional achievement test points by the end of the kindergarten school year ($b = 0.218; p < .01$). Thus, white and Asian children, who were advantaged relative to black children when the kindergarten school year began, were even further ahead by the end of the school year. Unlike black students, Hispanic students gain reading skills equally to their more advantaged peers during the kindergarten school year.

Coefficients for math in kindergarten exhibit a similar pattern. Although Asian students do not gain significantly more math skills than whites or Hispanics during the kindergarten school year (as they did in reading), they, along with white and Hispanic students, gain an additional two achievement test points over black students by the end of kindergarten ($b = -0.211; p < .001$). Thus, like reading, white and Asian students who entered kindergarten with an advantage, were even further ahead of black children by the end of the year. Hispanic students, again, held their ground during the school year.

While indicative of inequalities occurring during the school year, these results by themselves do not directly implicate schools as part of the problem. Even during the school year, the advantages that white and Asian students, in particular, experience relative to black students may result from differences in their non-school environments. To isolate the effect of schooling, I compare these school year learning rates to summer
learning rates. Because these findings suggest that the experiences of black, Hispanic and Asian students vary greatly, I separate results by racial/ethnic group to clearly explain their distinct experiences in school and out.

*School Year and Summer Learning of Black Children*

In addition to kindergarten, black students also lose significant ground in reading during the first grade school year. Although black students lose significant ground relative to white students during both school years, these losses may result from either school or non-school forces since students are exposed to both during the school year. Reiterating that the summer effect in essence captures the non-school influences on achievement, examining how schooling changes growth in achievement gaps that occur over the summer better isolates the effect of schooling on the gaps.

Contradictory to previous research, results presented in Table 5.1 indicate that black students are *not* losing any ground during the summer break. In both reading and math, the coefficients for summer learning indicate that black students learn at approximately the same rate as white students over the summer. If black students are not losing ground over the summer, we conclude that non-school factors are *not* the primary source of black students’ disadvantage over the first two years of schooling and further conclude that growth in the gap during the school year results from primarily school processes.

Contrast tests comparing the coefficients for school year learning with the summer learning of black students further confirm what seems obvious in Table 5.1. The learning rates of black students relative to whites during the school year (with the
exception of first grade math learning) are significantly worse than their rates over the summer break (all $\Pi^2$ are $p<.01$). Thus, results of these analyses indicate that something is going on in schools that fuels the growing black-white gap.

Because of the well-established relationship between race and socioeconomic status, some scholars may not be convinced of the patterns presented in these results without controlling for differences in SES between blacks and whites. Indeed, as presented in Chapter 2, SES is believed to be the primary source of disadvantage for black students. To address this important concern, Tables 5.2 and 5.3 present results of models demonstrating the effect of socioeconomic status. As suggested by the fact that black children are not losing ground over the summer, these results indicate that very little of the disadvantage black students experience is related to socioeconomic status. Between the beginning of kindergarten and the end of first grade, SES explains less than 12% of the disadvantage black students’ experience. All school year coefficients remain large and statistically significant. I further examine the school-year disadvantage of black students in Chapter 6.
Table 5.2. The Effect of Socioeconomic Status on Racial/Ethnic Differences in Reading Growth Rates During Kindergarten, Summer and First Grade.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Kindergarten Growth</th>
<th>Summer Growth</th>
<th>1st Grade Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(SE)</td>
<td>(SE)</td>
<td>(SE)</td>
</tr>
<tr>
<td>Black</td>
<td>-.200*** (.046)</td>
<td>-.176*** (.047)</td>
<td>-.166* (.072)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-.160* (.073)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>.038 (.045)</td>
<td>.071 (.045)</td>
<td>-.113 (.067)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-.107 (.068)</td>
</tr>
<tr>
<td>Asian</td>
<td>.218** (.069)</td>
<td>.221** (.069)</td>
<td>-.228* (.104)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-.227* (.104)</td>
</tr>
<tr>
<td>Female</td>
<td>.119** (.024)</td>
<td>.120*** (.022)</td>
<td>.005 (.038)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.003 (.038)</td>
</tr>
<tr>
<td>Age at Kindergarten Entry</td>
<td>.012*** (.003)</td>
<td>.012*** (.003)</td>
<td>-.015** (.005)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-.015** (.005)</td>
</tr>
<tr>
<td>SES</td>
<td>-</td>
<td>.063*** (.015)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.021 (.023)</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.552*** (.035)</td>
<td>1.552*** (.034)</td>
<td>2.634*** (.039)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.635*** (.040)</td>
</tr>
</tbody>
</table>

Note: Model also includes controls for other racial/ethnic groups and full-day kindergarten.
Table 5.3. The Effect of Socioeconomic Status on Racial/Ethnic Differences in Math Growth Rates During Kindergarten, Summer and First Grade.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Kindergarten Growth</th>
<th>Summer Growth</th>
<th>1st Grade Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>-.211*** (.037)</td>
<td>-.185*** (.037)</td>
<td>-0.062 (.055)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-0.057 (.055)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>.025 (.036)</td>
<td>-.298* (.153)</td>
<td>-0.226** (.081)</td>
</tr>
<tr>
<td></td>
<td>.053 (.037)</td>
<td>-.316* (.154)</td>
<td>-0.233** (.081)</td>
</tr>
<tr>
<td>Asian</td>
<td>-.011 (.056)</td>
<td>.401 (.242)</td>
<td>-0.226** (.081)</td>
</tr>
<tr>
<td></td>
<td>-.010 (.056)</td>
<td>.434 (.242)</td>
<td>-0.233** (.081)</td>
</tr>
<tr>
<td>Female</td>
<td>-.029 (.020)</td>
<td>.044 (.085)</td>
<td>-0.038 (.029)</td>
</tr>
<tr>
<td></td>
<td>-.029 (.020)</td>
<td>.043 (.086)</td>
<td>-0.038 (.029)</td>
</tr>
<tr>
<td>Age at Kindergarten Entry</td>
<td>.005* (.003)</td>
<td>.015 (.011)</td>
<td>-0.015*** (.004)</td>
</tr>
<tr>
<td></td>
<td>.005* (.003)</td>
<td>.015 (.011)</td>
<td>-0.015*** (.004)</td>
</tr>
<tr>
<td>SES</td>
<td>-.050*** (.012)</td>
<td>-.050 (.050)</td>
<td>-0.001 (.017)</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.359*** (.025)</td>
<td>.572 (.082)</td>
<td>1.553*** (.029)</td>
</tr>
<tr>
<td></td>
<td>1.354*** (.024)</td>
<td>.587*** (.083)</td>
<td>1.551*** (.029)</td>
</tr>
</tbody>
</table>

Note: Model also includes controls for other racial/ethnic groups and full-day kindergarten.
While Hispanic children begin formal schooling similarly disadvantaged to black children, their experiences over the first two years of school are not similar. In reading, Hispanic students do not lose ground, relative to whites, during the kindergarten school year (b= .038) as did their black peers. Nor do they lose ground during the summer (b=.049). However, Hispanic students’ experiences in first grade may not be as neutral on reading skills as it was in kindergarten. The coefficient for first grade learning for Hispanic students relative to whites is negative and approaches statistical significance (b=-.113). Returning to Table 5.1, the magnitude of effect is fairly large relative to the summer coefficient. However, the contrast test of these two coefficients for reading reveals no significant difference in Hispanics’ relative position to whites during first grade compared to summer. From these results, it appears that both during the school year and during summer break, Hispanic students learn to read at an equal rate as white children. Thus, unlike for black students, there is no indication that schools disadvantage the reading skills of Hispanic children.

This is not the case for math, however. While Hispanic students learn math at approximately an equal rate to whites during the kindergarten school year (b= .025) and first grade school year (b= .097), they lose significant ground during the summer break (b= -.298;p<.05). Thus, while schooling had little affect on the gap between whites and Hispanics in reading, results for math indicate that schools mitigate a significant non-school disadvantage in math skills experienced by Hispanic students over the summer.
Overall then, unlike reading, schools appear to attenuate the non-school disadvantages in math of Hispanic students, resulting in a smaller gap relative to whites than if they did not experience schooling.

Is this non-school disadvantage primarily the result of socioeconomic differences between Hispanics and whites, as suggested in previous literature? Table 5.3 shows the effect of SES on the summer learning rates for math. From these results, there is no indication that disparities in socioeconomic status explain the disadvantage of Hispanic students during the summer between kindergarten and first grade. In fact, the negative coefficient gets slightly larger, suggesting that none of the effect is related to SES. Chapter 6 explores this non-school disadvantage of Hispanic students.

School Year and Summer Learning of Asian Children

Asian students’ achievement at the beginning of formal schooling is modestly higher than that of white students.28 During the kindergarten school year, Asian students extend this advantage in reading (b=.218;p<.01) but not math (b= -.011). They further extend their advantage in reading, and possibly math, over the summer break. Comparing their school year advantage in reading with their non-school gains over the summer break (b=.568;p<.05), it appears that much of the advantage Asian students experience during the kindergarten school year can be attributed to their non-school environments. In fact, comparing the magnitude of effects suggests that schooling actually inhibits some of Asian students’ non-school advantages, given that their advantage in learning to read during the school year is only about half as much as it is

28 For more detail on skill disparities at the beginning of kindergarten, refer to results presented in Appendix B.
during the summer break. Indeed, results of a contrast test indicates that Asian students’ advantage during kindergarten is significantly less than it is over the summer break ($\Pi^2=16.46;p<.001$). These results suggest that schooling takes away some of the non-school advantage Asian students experience relative to white students. Note that this result is not inconsistent with the argument that schools constrain disparities.

First grade results in reading surely strengthen the evidence that schooling disadvantages Asian students relative to their non-school environments. In kindergarten, Asian students learned slower during the school year than during summer, but maintained an advantage over white students. During the first grade school year, however, not only are Asian students losing some of their non-school advantage, they are now losing significant ground relative to white students ($b=-.228;p<.05$), more so than even black students.

Results for math follow this same pattern. Asian students are losing significant ground in learning math skills during first grade ($b=-.226;p<.01$). Thus, in both reading and math, schools appear to disadvantage Asian students relative to their non-school environments. By first grade, they are learning reading and math skills the slowest of all four racial/ethnic groups and their achievement is significantly declining relative to white students’, creating a gap that did not exist prior. Controlling for socioeconomic status does not alter these findings. In fact, once SES is taken into account, Asian students relative advantage in the summer, and disadvantage during first grade become even more definitive.
Some may interpret the school year disadvantage of Asian students as evidence that schools are reducing disparities generated in non-school environments. Indeed, the gap between Asians and whites is closed during the first two years of schooling. However, while schooling does narrow the gap between Asian, white and Hispanic students, it does little to equalize Asian and black student outcomes. Further, by the end of first grade, the gap between Asians and whites has reversed, now favoring white students. If these trends in learning rates were to continue, the gap between whites and Asians would continue to grow – evidence in contrast to the argument that schooling constrains inequalities.

Taken all together, white and Asian children are advantaged relative to blacks and Hispanics in both reading and math when they begin kindergarten. Over the first two years of school, the reading gap grows between whites and blacks, and the math gap grows between whites and both blacks and Hispanics. For Hispanic children, the growing math gap results primarily from non-school forces that disadvantage their rates of learning during the summer break. For black children, however, both gaps grow only during the school year. Schooling also appears to disadvantage Asian students, nullifying some of their non-school advantage, and thus resulting in slower school-year growth than would be expected.

Results of this analysis offer two significant insights into the role of schooling in racial/ethnic achievement gaps. For one, it contradicts the conclusion of Heyns (1978) and Entwisle and Alexander (1992) that schools attenuate the black-white achievement gap. Indeed, the growing gaps in both reading and math between blacks and whites over the first two years of schooling appear to be the result of mainly school factors given that
results show no indication of growing gaps over the summer break. Thus, for black students, schooling appears to be part of the problem in generating disparities with whites.

The second contribution of this analysis is the disparate experiences of other racial/ethnic minority groups. It is clear from my findings that we cannot make the overarching statement that schools are a “part of the problem” or “part of the solution” in closing racial/ethnic achievement gaps. At the same time that schooling appears to disadvantage Asian students in first grade, reversing their advantage relative to whites in their non-school environments, schools also simultaneously attenuate the non-school disadvantages of Hispanic children. Certainly, schools appear to be vastly different experiences for students from different racial/ethnic backgrounds.

While the results from Chapter 4 suggested that, overall, schools tend to equalize students’ performance, the focus on race/ethnicity in this chapter highlights an exception to that general pattern. In terms of race/ethnicity, schooling tends to exacerbate the black-white gap while constraining the gap between Hispanics and whites. Schooling further appears to disadvantage Asian students relative to their non-school environments, but the overall effect of schooling on disparities between Asians and whites remains unclear after the first two years of schooling. Further examination of how Asian and white students continue to progress in subsequent grades would better inform our understanding of how schools impact differences between Asians and whites. The following chapter briefly examines the school experiences of black students as well as the
school and non-school experiences of Asian and Hispanic children to examine how well some of the dominant theoretical explanations address racial/ethnic achievement gaps under more rigorous examination.
CHAPTER 6

EVALUATING EXPLANATIONS OF RACIAL/ETHNIC ACHIEVEMENT DISPARITIES

Results presented in Chapter 5 indicate that schools disadvantage the learning of black and, to some extent, Asian students, while at the same time mitigating the non-school disadvantages experienced by Hispanic students in math. The education literature has extensively outlined many possible school and non-school factors generating racial/ethnic disparities. Due to data limitations and limitations in HLM,29 I do not examine all theoretical possibilities. Nonetheless, in this chapter, I evaluate the explanatory power of well-established school and non-school factors in the seasonal learning patterns of black, Asian and Hispanic children.

Do the types of schools black and Asian children attend explain their disadvantage at school?

Because school funding is tightly connected with local property tax in many states, racial/ethnic minorities who tend to be concentrated in high poverty areas are more likely to attend schools less funding available for educational resources. Indeed, previous research has indicated that racial/ethnic minority students are more likely to be concentrated in schools with fewer important resources, while school districts with high concentrations of white students have more available educational resources (Coleman et

29 The limitations of HLM are discussed in Chapter 7.
al 1966; Kozol 1991; NCES, COE 2000; Sutton 1991). As such, measures of the percentage of minority and poor students are utilized as indicators of “school quality” as it relates to the level of resources available to schools.

If minority segregated schools and high poverty schools are strong indicators of poorer school quality as has been argued, these measures may indeed explain black students’ disadvantage given that almost half of the black students in the ECLS-K data attend schools where over 75% of students are minority, while only 2% of black students attend schools where over 90% of students are white. Further, black students attend schools with average school poverty levels higher than any other racial/ethnic group. Thus, black children are clearly segregated in disadvantaged schools. Does this account for their slower rates of learning at school?

As shown in Table 6.1, attending a school with a high concentration of minority students does not appear to significantly affect students’ achievement during kindergarten (b=.060 for reading and .021 for math). However, by first grade, the negative effects are strong. Students’ who attend schools where over 75% of students are minority lose .208 reading points (p<.01) and .126 math points (p<.01) per month relative to students who attend schools with more diverse student populations. Additionally, students attending schools with very few minority students experience a significant advantage in learning to read (b=.121;p<.05). These effects are relatively very large so it comes as little surprise that taking these school characteristics into account explains virtually all of black students’ disadvantage at school during first grade. The coefficient for reading drops by

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30 Other scholars have indicated that race and class segregation at school may shape achievement in ways beyond resources. See, for example, Bellair and Roscigno (2000) or Kozol (1991).
31 The average school poverty level, as measured by percent of students on free or reduced lunch, of black students is almost a full standard deviation above average school poverty.
almost two-thirds and loses all indications of statistical significance (b= -.056).

However, a significant disadvantage in both reading and math during kindergarten persists. If we accept that high concentrations of minority students and students living in poverty are indicative of schools with fewer resources and lower quality, then these characteristics of schools may play a primary role in black students’ disadvantage at school, at least at older ages (see also Roscigno, 1998). This, however, still fails to explain why black students learn slower during their first year of formal schooling. Something other than the types of schools many black students attend disadvantages their learning, relative to white students, during kindergarten.\textsuperscript{32}

Asian students also experience disadvantage during first grade, but as shown in Table 6.1, this disadvantage does not result from the same school characteristics that explain black students’ school year disadvantage. A much smaller percentage of Asian students attend schools with a high concentration of minority students (25%) and, on average, they attend schools with students who have slightly higher than average socioeconomic status. Thus, it comes as little surprise that adding these measures to the model does little to explain their disadvantage in first grade. While the coefficient for reading loses its statistical significance, these school characteristics explain only about 20% of their disadvantage and leave a fairly large coefficient that remains borderline significant (b= -.182). Further, measures of racial concentration and school poverty level

\textsuperscript{32} Supplementary analyses I conducted examined another possible link, the role of “cultural mismatch” between students and their teachers. This theory contends that black students are evaluated less favorably by white teachers, and that because a disproportionate number of teachers are white, this mismatch is common for black students and plays a significant role in their disadvantage. Yet, while Downey and Pribesh (1999) found evidence that student-teacher racial matching explains some of black students disadvantage in high school, supplementary analyses in my study (not shown) indicate that being racially “mismatched” with teachers explains virtually none of the disadvantage black students experience in kindergarten or first grade.
explain very little of the effect on math. The coefficient declines only 7% and remains large in size and statistically significant (b = -.216; p < .01). From this, it is difficult to conclude that these factors play much role in the relative disadvantage Asian students experience at school.

While commonly utilized to explain Hispanic students’ disadvantage, language minority status has been linked in the literature to lower achievement levels. Asian students in the ECLS-K are more likely to speak a language other than English in the home (r =.379; p < .001), and this may explain some of their relative disadvantage during first grade. Not shown in table format, speaking a language other than English explains only approximately 4% of the disadvantage Asian students’ experience in first grade (b = -.217; p < .05). In math, the negative effect actually increases by over 20% suggesting that speaking a language other than English at home is related to advantages in learning math for Asian students (b = -.285; p < .001). These findings indicate that being a language minority student does not significantly hinder the learning of Asian students at school.

These results further reinforce the conclusion that schools are disparate experiences for students from differing racial/ethnic backgrounds. While proxy measures for school quality explain at least part of black students’ disadvantage at school, they explain virtually none of the experience of Asian students. Further, Hispanic students, although attending similar schools to black students in terms of racial concentrations and poverty levels, do not experience the disadvantage at school experienced by black students, suggesting that something, beyond the qualities of schools associated with student populations, is going on within schools that further disadvantages black students.
Table 6.1. Reading and Math Achievement Growth Rates During Kindergarten and First Grade by Race/Ethnicity and School Characteristics.

<table>
<thead>
<tr>
<th>Variables</th>
<th>READING</th>
<th></th>
<th></th>
<th>MATH</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kindergarten Growth</td>
<td>First Grade Growth</td>
<td>Kindergarten Growth</td>
<td>First Grade Growth</td>
<td>Kindergarten Growth</td>
<td>First Grade Growth</td>
<td>Kindergarten Growth</td>
</tr>
<tr>
<td>Black</td>
<td>-.176*** (.047)</td>
<td>-.181*** (.049)</td>
<td>-.160* (.073)</td>
<td>-.056 (.075)</td>
<td>-.185*** (.037)</td>
<td>-.167*** (.040)</td>
<td>-.057 (.055)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>.071 (.045)</td>
<td>.062 (.047)</td>
<td>-.107 (.068)</td>
<td>-.038 (.069)</td>
<td>.053 (.037)</td>
<td>.062 (.038)</td>
<td>.097 (.052)</td>
</tr>
<tr>
<td>Asian</td>
<td>.221** (.069)</td>
<td>.208** (.069)</td>
<td>-.227* (.104)</td>
<td>-.182 (.105)</td>
<td>-.010 (.056)</td>
<td>-.008 (.057)</td>
<td>-.233** (.081)</td>
</tr>
<tr>
<td>SES</td>
<td>.063** (.015)</td>
<td>.058** (.015)</td>
<td>.021 (.023)</td>
<td>.005 (.023)</td>
<td>.050*** (.012)</td>
<td>.042*** (.012)</td>
<td>-.001 (.017)</td>
</tr>
<tr>
<td>% Free/Reduced Lunch</td>
<td>- .001 (.001)</td>
<td>- .001 (.001)</td>
<td>- .003** (.001)</td>
<td>- .002** (.001)</td>
<td>- .002** (.001)</td>
<td>- .000 (.001)</td>
<td>- .000 (.001)</td>
</tr>
<tr>
<td>Minority Segregated (&gt;75%)</td>
<td>- .060 (.068)</td>
<td>- .060 (.068)</td>
<td>- .208** (.077)</td>
<td>- .208** (.077)</td>
<td>- .021 (.045)</td>
<td>- .021 (.045)</td>
<td>- .126** (.048)</td>
</tr>
<tr>
<td>White Segregated (&gt;90%)</td>
<td>- -.051 (.048)</td>
<td>- .051 (.048)</td>
<td>- .121* (.053)</td>
<td>- .121* (.053)</td>
<td>- .005 (.031)</td>
<td>- .005 (.031)</td>
<td>- .005 (.031)</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.552*** (.034)</td>
<td>1.560*** (.042)</td>
<td>2.635*** (.040)</td>
<td>2.595*** (.046)</td>
<td>1.354*** (.024)</td>
<td>1.336*** (.029)</td>
<td>1.551*** (.029)</td>
</tr>
</tbody>
</table>

Note: Model also includes controls for other racial/ethnic groups, full-day kindergarten, gender and age at kindergarten entry.
Do characteristics of students’ homes explain the relative non-school advantage of Asians and disadvantage of Hispanic students?

In teasing out some of the advantages and disadvantages of students’ non-school environments, the literature has pointed primarily to differences in family background and “cultural values”. Black and Hispanic children are more likely to live in a single-parent households and in homes with larger household size, and these factors are related to lower achievement levels (Glick 1994; Milne et al 1986; Phillips et al. 1998). Phillips et al (1998), in their analysis of the Children of the National Longitudinal Survey of Youth (CNLSY) data, additionally found that measures of children’s home environment (e.g., the physical environment of the home and the number of books in the home) also significantly explain achievement disparities. Further, explanations for the relative educational success of Asian American students has generally focused on the cultural characteristics of Asian American families, attributing success to Asian values and parental sacrifice (Sue and Okazaki 1990), having higher educational aspirations than other racial/ethnic groups (including whites) (Kao 1995; Peng & Wright 1994), and emphasized behavioral traits such as discipline, responsibility and respect for others (Schneider & Lee 1990). These factors have garnered substantial attention in the literature as being key to non-school advantage and disadvantage in achievement. In light of this, I examine how measures of these characteristics explain the relative disadvantage of Hispanic children and advantage of Asian children during the summer break. While some argue that family background is the primary mechanism through
which language minority status affects achievement levels, I include a measure of students’ home language to test the validity of this contention and control for possible effects of language status independent of family background.

Results of reading and math models including measures of children’s family and home environments are presented in Table 6.2. Despite previous research outlining a strong relationship between these characteristics and overall achievement, family background and measures of cultural differences explain relatively little of the non-school advantage of Asians and disadvantage of Hispanics during the summer between kindergarten and first grade. None of these factors, as measured here, have a significant effect on learning math skills over the summer break. Further, only socioeconomic status (b=.132; p<.05) and promoting educational skills at home (b=.130; p<.05) significantly boost reading skills over the summer.

Although these characteristics reduce the reading coefficient for Asian students to insignificance, they only explain 3% of the advantage Asian students experience during the summer break. The coefficient remains large and borderline significant, suggesting the other non-school factors may possibly advantage Asian students’ reading skills. Moreover, although the coefficient for math was not statistically significant in the prior model, note that the coefficient gets larger and approaches statistical significance once these factors are controlled. Thus, factors of family and culture, as measured here, do little to help us better understand why Asian students learn more than other students when they are not in school.
The lack of explanatory power of these characteristics is true for Hispanics’ disadvantage as well. Adjusting for the family background and other characteristics reduces the coefficient for math to insignificance, yet it only explains approximately 10% of the effect. The coefficient remains relatively large, and borderline significant. Thus, it is difficult to conclude that family background, as measured by the socioeconomic status of the family, number of parents in the household and number of siblings, is the primary force generating Hispanics students’ non-school disadvantage during the summer between kindergarten and first grade.
Table 6.2. Reading and Math Growth Rates During the Summer Between Kindergarten and First Grade by Race/Ethnicity, Family Background, Educational Values and Language Minority Status.

<table>
<thead>
<tr>
<th>Variables</th>
<th>READING</th>
<th>MATH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Summer Growth</td>
<td>Summer Growth</td>
</tr>
<tr>
<td>Black</td>
<td>-.013 (0.185)</td>
<td>.041 (0.162)</td>
</tr>
<tr>
<td></td>
<td>.093 (0.196)</td>
<td>-.025 (0.172)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>.049 (0.176)</td>
<td>-.298* (0.153)</td>
</tr>
<tr>
<td></td>
<td>.131 (0.189)</td>
<td>-.279 (0.164)</td>
</tr>
<tr>
<td>Asian</td>
<td>.568* (0.278)</td>
<td>.401 (0.242)</td>
</tr>
<tr>
<td></td>
<td>.553 (0.299)</td>
<td>.492 (0.261)</td>
</tr>
<tr>
<td>Family Background</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SES</td>
<td>-.132* (0.064)</td>
<td>- .045 (0.055)</td>
</tr>
<tr>
<td>One-parent household</td>
<td>-.165 (0.139)</td>
<td>-.067 (0.120)</td>
</tr>
<tr>
<td>Number of Siblings</td>
<td>-.034 (0.066)</td>
<td>.090 (0.057)</td>
</tr>
<tr>
<td>Educational Values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent Expectations</td>
<td>-.026 (0.077)</td>
<td>-.044 (0.067)</td>
</tr>
<tr>
<td>Promote Education Skills</td>
<td>-.130* (0.047)</td>
<td>.038 (0.041)</td>
</tr>
<tr>
<td>Parent Reads to Child</td>
<td>-.057 (0.069)</td>
<td>.021 (0.060)</td>
</tr>
<tr>
<td>Non-English Spoken at Home</td>
<td>-.013 (0.250)</td>
<td>-.126 (0.216)</td>
</tr>
<tr>
<td>Intercept</td>
<td>-.074 (0.093)</td>
<td>.587*** (0.083)</td>
</tr>
<tr>
<td></td>
<td>-.461 (0.249)</td>
<td>.367 (0.217)</td>
</tr>
</tbody>
</table>

Note: Model also includes controls for other racial/ethnic groups, full-day kindergarten, gender and age at kindergarten entry.

In this chapter, I have explored some of the more common school and non-school explanations for disparities in achievement. In light of the findings from this analysis, where school-year learning is effectively isolated from non-school learning, it is apparent that existing explanations of the sources of both school and non-school inequality are limited in their ability to explain why schooling inflates the black-white gap, why schooling, at minimum, moderates the non-school advantages of Asian students, or why
Hispanic students learn slower outside of school. My results clearly suggest that something other than family background or aspects of school quality is generating racial/ethnic inequality over the first two years of schooling. As stated previously, exploring other potential sources of inequality, particularly at schools where intervention can more easily be directed, should be a primary focus of future research.
For decades, scholars have dedicated great effort to understanding how schools influence racial/ethnic gaps in test scores. The literature has provided consistent evidence of the magnitude of disparities in reading and math as well as how they grow between kindergarten and 12\textsuperscript{th} grade. While there have been numerous attempts to test school and non-school explanations for the disparities, direct evidence of the role of schooling has remained elusive, mainly due to methodological complications in separating school effects from non-school effects. Most previous research has relied on measures of students’ yearly achievement gains, which are not able to separate periods during which students are exposed to schooling from when they are not exposed to schooling. Consequently, it is difficult to identify whether inequality is growing faster while children are exposed to school or out of school, and in result, the specific factors generating disparities.

Seasonal comparisons allow us to compare students’ learning during the school year, when students are exposed to both school and non-school environments, to learning that occurs outside of school. By separating the two, we are better able to isolate the non-school effect on learning, which then aids our understanding of how schooling affects learning. Nonetheless, while seasonal comparisons of learning rates is an effective tool
for estimating school year and summer learning rates, it is still limited in its ability to completely isolate the effect of schooling on learning, and in turn, racial/ethnic achievement gaps. In particular, even during the school year, students spend a significant amount of time in their non-school environments after the school day ends, on weekends, and when schools are closed for holidays, etc.\textsuperscript{33} Thus, differences in learning rates between the school year and summer may also result from non-school experiences (e.g., how much parents help their children with homework), or an interaction between the school and non-school environments (e.g., how involved parents are with their children’s schools) during the school year.\textsuperscript{34} Despite this limitation, however, seasonal comparisons offers a substantial improvement over year-long measures of achievement in the examination of school effects.

Building on the limitations of existing seasonal comparisons research, my study contributes to our understanding of racial/ethnic inequality by extending seasonal comparisons research with generalizable data, better measures and methods. Most importantly, the three primary aims of this study were to: (1) improve on previous seasonal comparisons research by offering better and more representative estimates of school year and summer learning between blacks and whites; (2) extend seasonal comparisons research to two other prominent racial/ethnic groups in the United States,

\textsuperscript{33} In similar reasoning, the effect of schooling may carry over into the summer break. For example, Downey et al (2003) find that socioeconomically advantaged children are more likely to receive a summer reading list from the kindergarten school, and thus schools may continue to affect children’s learning during the summer break. Importantly, however, Downey et al’s (2003) study found no relationship between such school practices and summer learning rates.

\textsuperscript{34} Supplemental analyses I conducted examined the effect of parental involvement in school activities such as school open-houses and parent-teacher conferences but found no significant effect of these measures of parental involvement on racial/ethnic achievement disparities.
Latinos and Asians; and (3) examine some of the well-established school and non-school explanations for racial/ethnic achievement disparities within the seasonal comparisons framework.

The recently released *ECLS-K* data from the NCES offers the opportunity to utilize seasonal comparisons methodology on a nationally representative sample. Although limitations in HLM³⁵ (Bryk and Raudenbush 2001) result in significant sample attrition for my analyses, the subsample utilized in this study remains very large and comparable to the original sample in terms of demographic characteristics. The one exception is the slightly higher average socioeconomic status of students in my subsample. My concerns over the possible significant effects of this difference, however, are alleviated by knowing that other scholars, utilizing a representative sample from the *ECLS-K*, have produced patterns generally consistent with those presented here (Downey et al. 2003; Fryer & Levitt 2002).

Drawing on more representative data, my findings support the general conclusion of previous work that schooling constrains overall disparities in test scores. Chapter 4 demonstrated that students learn significantly more while in school, and overall disparity between high and low performing students is reduced during the school year relative to summer. To this end, my expectation that schools constrain inequality, despite inequities within or between schools, is supported. The evidence further challenges the tenet that variation between schools represents differences in school effectiveness. My findings clearly indicate that much of between school variation is due to differences across student populations.

³⁵ HLM requires that there be no missing data in student or school characteristics. Thus, all cases with any missing data were deleted from the sample. See Chapter 4 for more detail.
The importance of this latter finding reaches beyond the theoretical, however, and questions the suitability of a key evaluation criteria in the *No Child Left Behind* (NCLB) legislation. While the NCLB will assess the effectiveness of schools based on the percentage of students meeting minimum proficiency standards, it may do better to evaluate the effectiveness of schools based upon how much they are able to *improve the non-school learning rates* of their students.\textsuperscript{36} As it currently stands, the effectiveness of schools that are doing a good job of boosting the achievement of disadvantaged students may be overlooked simply because they are unable to raise enough students above the proficiency threshold.

Why exactly might schools boost lower achieving students more than higher achieving students? One possibility is that disadvantaged students simply have more to gain from the formal educational environment. In other words, the difference in educational resources between their non-school environments and their school environments is greater than it is for higher achieving students, and thus they have more to gain. Another possibility is the actions of school personnel, particularly teachers, towards low-performing students. It is plausible that teachers dedicate more energies and resources towards students who are struggling than they do towards students who already exhibit strong cognitive skills, particularly at younger ages. Neither of these possibilities ignores the effective role of schooling for higher achieving students as evidenced by the finding that even high achieving students also learn significantly more while in school than while out. They simply highlight two possible explanations for why students who have fewer skills when they enter school gain more while at school.

\textsuperscript{36} While this is not the only measure of “effective schools” outlined in the NCLB legislation, it is a key indicator utilized in the evaluation of schools.
There is one major exception to this general pattern, however. Black children, although disadvantaged on average when they enter kindergarten, do not gain more during school than their more advantaged peers. Indeed, they learn significantly less than whites while at school. The evidence implicating schools in the growing black-white gap is unequivocal in the *ECLS-K* data. In both kindergarten and first grade, and in both reading and math, black students lose significant ground while they are at school, while losing none over the summer break. This finding, however, does not absolve the non-school environment of playing a role in the black-white achievement gap. Indeed, the mere fact that black students begin kindergarten at a disadvantage relative to whites suggests that non-school forces play at least some role in black children's initial disadvantage. Nonetheless, any skill disadvantage evident at the beginning of formal schooling is compounded further by significant disadvantages black children experience while at school. *During the first two years of school, growth in the black-white achievement gap occurs only while students are at school.* Thus, while previous research pointed towards family background as the central force driving black students' disadvantage relative to whites, my findings challenge this assertion and directly implicate schooling as the primary source of the black-white gap, at least during the first two years of schooling.

This finding directly challenges the conclusions of Heyns (1978) and Entwisle and Alexander (1992, 1994) that the black-white gap grows mainly as the result of non-school processes acting on students over the summer breaks. How do we explain the

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37 Fryer and Levitt (2002), in their analysis of the *ECLS-K*, suggest that the primary non-school factors associated with black children's initial disadvantage are SES, birth weight, mother's age at first birth and age at kindergarten entry. See Appendix B for further examination.
inconsistent patterns in the Atlanta and Baltimore samples compared to the \textit{ECLS-K} sample? The most probable explanation is rooted in the disproportionate number of disadvantaged black children in the Atlanta and Baltimore samples. Because these samples lacked the socioeconomic variation present in the U.S. population, race is likely confounded with the non-school disadvantages associated with low socioeconomic status, thus failing to capture race effects independent of SES. Simply put, the patterns evident in the \textit{ECLS-K} better capture how race affects the learning experiences of students in and out of school independent of socioeconomic background.

The relatively weak explanatory power of socioeconomic status in the black-white gap is somewhat surprising given the frequently replicated finding of a strong link between the two. One possible explanation for this seeming discrepancy lies in the fundamental argument for separating school year from summer learning. It is possible that previous research, by utilizing year long measures, captured school effects that are highly correlated with socioeconomic status, thus explaining more of the variation in test scores. By examining the non-school environment independently from the school year, many indirect effects of socioeconomic status are removed, thus reducing its explanatory power. Another possibility is the age of the \textit{ECLS-K} sample. Children in kindergarten and first grade, at the ages of 5 or 6, are probably much less likely to engage in activities and interactions, associated with socioeconomic status, that benefit their achievement. For example, in Lareau’s (2002) study, she found that higher socioeconomic status improved children’s intellectual and social development by having highly structured daily routines and interacting in various highly stimulating environments. It is possible that at the age of 5 or 6, children simply haven’t yet begun to participate in many organized
activities, such as sports or music, as they might by the time they are 8 or 9 years of age. If this is the case, then we might expect socioeconomic status hold more explanatory power in samples of older children.

Some scholars have argued that minority and poor students struggle during the early years of schooling due to a “mismatch” between their non-school and school environments (see, for example, Entwisle and Alexander 1993 or Hess and Holloway 1984) and that this may explain the lower achievement of black students in school. If this is a primary source of inequality between racial/ethnic minorities and their white peers, however, we would expect black and Hispanic children to struggle at school during kindergarten and first grade. The fact that my findings do not support this pattern suggests that other experiences at school, besides “culture shock”, are the cause of black students’ disadvantage.

These findings have significant implications on the direction of policy intended to reduce black-white inequality by suggesting that schools are the primary source generating disparities. As such, it is essential to identify the specific school factors disadvantaging black students relative to their white peers. My findings indicate that much of the school year disadvantage of black students is likely due to the kinds of schools they attend. Measures of racial segregation and concentration of student poverty, as they correlate highly with school environments and resources, explain almost two-thirds of black students' school-year disadvantage during first grade. This is the strongest evidence to date that inequalities across schools are a key component to black students’ achievement disadvantage and that “separate” is truly not “equal”. Yet, my findings cannot speak to the specific mechanisms at these schools that are responsible for the
disadvantage black students experience. In light of the power of my findings, it should be a high priority of future research to tease out the particular aspects of school environments that matter, within the seasonal comparisons framework. In particular, examining the role of educational resource disparities across schools (i.e. per-pupil expenditures, measures of teacher quality and the physical environment of schools), as well as how the educational learning environments differ across schools, is an important starting point for this research.

While my results implicate schools in the growing black-white gap, this pattern is not consistent across other racial/ethnic groups. In particular, although Hispanics are often pooled together with blacks into a single “minority” group, my results offer strong evidence that their experiences in and out of school are largely distinct. While their experiences prior to the beginning of formal schooling do result in a similar level of skill disadvantage when kindergarten begins, this is where their similarities end. Unlike black children, Hispanic children do not lose more ground, relative to whites, in reading over the first two years of schooling. Further, while the math gap does grow during this time, it does so as a result of a non-school disadvantages Hispanic students experience during the summer break. Schooling attenuates the disadvantage Hispanic students experience in math outside of school. Thus, despite attending schools that are similar to black students’, once inside school walls, Hispanic students’ experiences are largely different from their black peers.

The fact that Hispanic students are not losing ground relative to white students while at school is somewhat surprising given that previous research suggests their disadvantage to be similar to black children. However, Hispanic students’ non-school
disadvantage in math is more consistent with general expectations that non-school factors drive their disadvantage and schools constrain this disadvantage. Nonetheless, despite evidence from previous work in support of family background and language as the main non-school factors generating their disadvantage, these do not explain much of their summer losses, relative to whites, in math. This finding is particularly noteworthy given the lack of theory available to point us towards other possible explanatory factors. It compels scholars to reevaluate possible sources of non-school disadvantage for Hispanic children.

As suggested by previous literature, Asian American students’ non-school environment promotes higher educational achievement. They begin kindergarten with the highest average levels of achievement in both math and reading, and they also experience gains over the summer in reading and possibly in math as well. Thus, there is support for the hypothesis that Asian children generally experience educational advantages in their non-school environments. Yet, I find little evidence supporting the contention that these advantages are related to cultural differences promoting education. Nonetheless, home environments vary in meaningful ways possibly not captured by the measures I employed. More specifically, measures of cultural differences that I employed primarily captured values and beliefs and did not measure many of the possible actions or behaviors exhibited by parents that may influence achievement. For example, how much time parents spend helping their children with schoolwork, or how parents structure their children’s free time (e.g., how much time do children spend watching television versus reading or participating in organized activities). To this end, while I find little evidence supporting the tenet that Asian American parents’ values and beliefs
promote educational success more so than other racial/ethnic groups, I encourage a more thorough examination of home environments, particularly ethnographic work examining parenting behaviors and parent-child interactions, to better tease out the intricate ways non-school environments may vary for students from different racial/ethnic backgrounds.

My findings also suggest that the “model minority” thesis holds little merit. Given the large body of literature suggesting that Asian students’ behaviors and values are consistent with the culture of formal education, it is thus surprising Asian students are not advantaged while in school. Moreover, during first grade they experience such significant disadvantage that they are learning the slowest of the four racial/ethnic groups in both reading and math. This finding is particularly curious. While it is consistent with the contention that Asian Americans face significant discrimination in American institutions, it also may be explained within the cultural thesis. If, as the cultural thesis would argue, Asian educational values and practices are stronger than those in America, it is possible that the disadvantage Asian students experience in first grade results from a “mismatch” between Asian students’ skills and American reading and mathematics curriculum. In other words, Asian students may have such high reading and math skills at this age that the curriculum fails to challenge their skills and encourage growth similarly to students from other racial/ethnic backgrounds. Results of math analyses are consistent with this hypothesis. Asian students who do not speak English in the home, and thus are likely to be more recent immigrants to the United States, perform better on the math test and also gain more during the summer than Asian students who speak English at home. However, these results are not conclusive and cannot speak to the findings for reading. Thus, future research should examine the possibility that Asian
students are not being challenged in elementary American classrooms. Measuring students’ immigration status as well as interviewing parents and observing classrooms may be the most direct means of examining this argument.

In spite of the powerful role that attending racially segregated schools has on black students’ first grade learning, it means little to the disadvantage black students experience during kindergarten. Coupled with the patterns of learning for Asian students between kindergarten and first grade, these findings are fairly powerful evidence that kindergarten and first grade are academically distinct experiences. Elementary educators suggest that the substantive content of kindergarten is much less “academic” and “abstract” than first grade. If this is the case, why then does this difference result in such outcomes for students from differing racial/ethnic backgrounds? For example, why does racial segregation have such a significant impact on students’ rates of learning in first grade while having little affect in kindergarten? If kindergarten is truly less academic, why then do black students lose such a significant amount of skills relative to white students during the kindergarten school year? Examining the differences between kindergarten and first grade may certainly aid our understanding of the specific school experiences generating gaps in achievement.

While the ECLS-K data provides many opportunities to address some of these avenues for further study, extending the analysis of school and non-school factors that generate racial/ethnic inequalities will require particular attention to the issue of missing data. The best and most efficient method currently available for dealing with missing data is multiple imputation.38 While the use of multiple imputation in hierarchical models

is still limited, future research intending to explore the specific sources of school and non-school inequalities must accept the task of merging these complex analytical techniques in order to draw unbiased conclusions regarding the specific causes of racial/ethnic achievement inequality.

Further, while the ECLS-K data cannot speak to the effect of schooling on racial/ethnic achievement disparities at older ages, it is an important consideration. Between school differences, such as minority and poverty concentrations of students, decline at higher grade levels. Because much of black students’ school-year disadvantage at young ages appears related to between school differences, we might expect their disadvantage to decline at higher grade-levels. However, many other within-school factors believed to generate disadvantage, such as ability grouping and tracking, become more prominent in schools as students progress into higher grades. Further, work from scholars such as MacLeod (1987) and Ogbu (1994) suggests that disenfranchised students become increasingly disconnected from the educational system as they age. In this light, we might expect schools to become progressively more important in fueling racial/ethnic disparities during the middle and high school years, particularly for students who struggle at school in the early grades. To date, we know little about the relative roles of school and non-school environments at the high school level. Seasonal comparisons during the high school years would greatly enhance our understandings of the effect of schooling on racial/ethnic achievement inequality.
Conclusion

By examining the seasonal differences of learning rates in a representative sample of kindergarteners, my findings challenge many long-standing beliefs about racial/ethnic achievement gaps and the primary forces generating disparities. For one, socioeconomic status and other characteristics of family background may not play as vital a role as previously thought in generating disadvantage for black and Hispanic students over the school years. Particularly for black students, it appears that any effect of socioeconomic status is indirect, resulting from its high correlation with the types of schools students attend. This finding should encourage scholars to rethink the relative roles of families and schools in racial/ethnic achievement disparities and pay greater empirical attention to the specific school experiences of children from different racial/ethnic backgrounds. Scholars interested in residential racial segregation should also find these results equally important given the direct evidence they provide of the strong link between racial segregation and racial/ethnic inequality as generated through educational disadvantages beginning when children first enter school. More importantly, the results suggest that schools could be doing much more to constrain the disadvantages students experience in their non-school environments if we better equalize school environments.

My study also speaks to the promise of year-round schooling as an effective strategy to reduce educational inequality. As findings indicate that schools work to reduce overall levels of inequality, year-round schooling may indeed be a promising strategy for equalizing student achievement. Yet, at this time, year-round schooling is not a seemingly viable policy option for reducing the black-white gap. This does not,
however, discard the potential for its effectiveness if school mechanisms, such as inequality in school resources, and other school factors disadvantaging black students are adequately addressed.

Importantly, my study calls into question the widely-held belief that formal education in America is a meritocratic process, offering all the opportunity of attending a “common school” to acquire needed skills and succeed in the labor market. Particularly for black students, and possibly Asian students as well, this is not happening in the early elementary years. I believe the disadvantage black students experience at school during these early years is the most important finding of this study given the potential long-term consequences of this early set-back. As Entwisle and Alexander (1993) underscore in their recent work, “the elementary years, and especially first grade, constitute a special time for acquiring the basic skills of literacy and numeracy, and failing to acquire skills during this time leads to an almost insurmountable handicap” (p. 404). If this evaluation is correct, as educational credentials continue to be increasingly tied to economic well-being, my findings suggest that without intervention, the cumulative disadvantages blacks experience throughout the lifecourse will only worsen.

In light of the recent federal legislation placing great demands on schools to raise achievement and reduce disparities, results of my study are both encouraging and a cause for concern. It appears that the No Child Left Behind Act of 2002, if supported with necessary resources and implemented effectively, may work towards reducing disparities, particularly between black and white students. On the other hand, given that at least part of the problem for black students’ schooling disadvantage is related to racial segregation and the types of schools they attend, this legislation will do little and may also have the
unintended consequence of draining resources from schools that are already struggling, and thus exacerbate existing disadvantages of black students. Indeed, further research examining the specific sources of disadvantage will attest to the effectiveness of current legislation and future amendments aiming to further reduce achievement disparities between racial/ethnic groups.

The need for such research is unmistakable. Trends have shown that reducing racial/ethnic gaps in achievement test scores may do more for reducing racial/ethnic inequalities than any other measure. Yet, reduction in racial/ethnic achievement gaps has stalled in recent decades, at a time when attaining formal education is increasingly tied to economic stability. In this regard, the Bush administration’s legislative action is a welcomed intervention. However, without adequate evidence of the specific sources generating inequalities, such action may do more harm than good.
LIST OF REFERENCES


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APPENDIX A:

TABLE
Table. Descriptions, Means, and Standard Deviations for All Variables

<table>
<thead>
<tr>
<th>VARIABLE NAME</th>
<th>Description</th>
<th>METRIC</th>
<th>MEAN</th>
<th>SD</th>
<th>YEAR</th>
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<tr>
<td><strong>Reading IRT Scores</strong></td>
<td></td>
<td></td>
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<td>C1rrscal</td>
<td>Reading Achievement, Fall Kindergarten</td>
<td>0 – 92</td>
<td>23.03</td>
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<td>Reading Achievement, Spring Kindergarten</td>
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<td>10.2</td>
<td>1999</td>
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<td>39.65</td>
<td>12.7</td>
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<tr>
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<td>Reading Achievement, Spring First Grade</td>
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<td><strong>Math IRT Scores</strong></td>
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<td>1998</td>
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<td><strong>School and Non-School Exposure</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kindergarten Exposure</td>
<td>Time between start &amp; end of Kindergarten, in months</td>
<td>7.99 – 12.00</td>
<td>9.36</td>
<td>.32</td>
<td>1998 – 1999</td>
</tr>
<tr>
<td>Summer Exposure</td>
<td>Time between end of kindergarten and start of first grade, in months</td>
<td>0.00 – 3.98</td>
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<td>.30</td>
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</tr>
<tr>
<td>First Grade Exposure</td>
<td>Time between start and end of first grade, in months</td>
<td>8.19 – 11.08</td>
<td>9.36</td>
<td>.24</td>
<td>1999 - 2000</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Black</td>
<td>Black, non-Hispanic</td>
<td>0=no 1=yes</td>
<td>.12</td>
<td>.33</td>
<td>1999 - 2000</td>
</tr>
<tr>
<td>Asian</td>
<td>Asian</td>
<td>0=no 1=yes</td>
<td>.04</td>
<td>.20</td>
<td>1999 - 2000</td>
</tr>
<tr>
<td>Hispanic</td>
<td>Hispanic (race specified as white, non-white or not specified)</td>
<td>0=no 1=yes</td>
<td>.12</td>
<td>.32</td>
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</tr>
<tr>
<td>White</td>
<td>White, non-Hispanic</td>
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<td>.47</td>
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<td>Other Race</td>
<td>Native American, Pacific Islander or multi-racial</td>
<td>0=no 1=yes</td>
<td>.06</td>
<td>.23</td>
<td>1999 - 2000</td>
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</tbody>
</table>
Table (cont.). Descriptions, Means, and Standard Deviations for All Variables

<table>
<thead>
<tr>
<th><strong>Other Variables</strong></th>
<th>Description</th>
<th>Code</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Time Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half Day</td>
<td>Child in half-day kindergarten</td>
<td>0=no 1=yes</td>
<td>.43</td>
<td>.49</td>
<td>1998 - 1999</td>
</tr>
<tr>
<td>Full Day</td>
<td>Child in full-day kindergarten</td>
<td>0=no 1=yes</td>
<td>.57</td>
<td>.49</td>
<td>1998 - 1999</td>
</tr>
<tr>
<td>SES</td>
<td>Standardized composite of household income, parents’ education, and parents’ occupation status</td>
<td>-6.36 – 3.52</td>
<td>0.00</td>
<td>1.00</td>
<td>1998 - 1999</td>
</tr>
<tr>
<td>Female</td>
<td>Gender of student</td>
<td>0=male 1=female</td>
<td>.50</td>
<td>.50</td>
<td>1998 - 1999</td>
</tr>
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<td>Two-parent</td>
<td>Child lives in 2-parent home</td>
<td>0=no 1=yes</td>
<td>.79</td>
<td>.41</td>
<td>1998 - 1999</td>
</tr>
<tr>
<td>Number of Siblings</td>
<td>Number of students’ siblings</td>
<td>0=0 siblings 1=1 sibling 2=2-3 siblings 3=4+ siblings</td>
<td>1.26</td>
<td>.78</td>
<td>1998 - 1999</td>
</tr>
<tr>
<td>Parent Expectations</td>
<td>Highest degree parent expects of child</td>
<td>0=less than coll. 1=college degree 2=grad. degree</td>
<td>1.03</td>
<td>.70</td>
<td>1998 - 1999</td>
</tr>
<tr>
<td>Parent Values</td>
<td>Value parent places on knowing numbers and letters at beginning of kindergarten</td>
<td>0=not important 4=very important</td>
<td>3.13</td>
<td>1.07</td>
<td>1998 - 1999</td>
</tr>
<tr>
<td>Parent Reads</td>
<td>Parent reads to child</td>
<td>0=not at all 3=every day</td>
<td>2.29</td>
<td>.76</td>
<td>1998 - 1999</td>
</tr>
<tr>
<td><strong>School Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minority Segregated</td>
<td>Over 75% minority children in school</td>
<td>0=no 1=yes</td>
<td>.16</td>
<td>.37</td>
<td>1998 - 1999</td>
</tr>
<tr>
<td>White Segregated</td>
<td>Over 90% white students in a school</td>
<td>0=no 1=yes</td>
<td>.36</td>
<td>.48</td>
<td>1998 - 1999</td>
</tr>
<tr>
<td>School Poverty</td>
<td>Standardized percentage of students on free or reduced lunch</td>
<td>-1.23 – 2.10</td>
<td>0.0</td>
<td>1.00</td>
<td>1998 - 1999</td>
</tr>
</tbody>
</table>
APPENDIX B:

ACHIEVEMENT GAPS WHEN CHILDREN ENTER KINDERGARTE
Figure B.1 shows average scores on reading and math tests taken during the fall of kindergarten, broken down by racial/ethnic group. Performance on this test, although taken after the kindergarten school year began, initially suggests that children from different racial/ethnic backgrounds begin formal schooling with varying levels of reading and math skills. The chart indicates that Asian and white students have higher reading skills than blacks or Hispanics early in the kindergarten school year. For example, Asian students are over 2 points ahead of white students on the reading test and 6 points ahead of both black and Hispanic students at this time. Although not quite as large, the pattern for math is consistent across racial/ethnic groups. Asian children appear to begin schooling at an advantage in math as well, with white students close behind and black and Hispanic students quite a bit behind.

Figure B.1. Fall Kindergarten Reading and Math Test Scores by Race/Ethnicity
Consistent with descriptive patterns, the multivariate model indicates that white and Asian students score highest on both reading and math achievement on the first day of kindergarten. All results are presented in Table B.1. While the coefficients for Asian children are fairly large in both reading ($b=1.127$) and math ($b=.881$), they are not significant, indicating that their higher average raw scores when they begin formal schooling are not significantly different than those of white students. Hispanic students are performing the lowest in both areas, and black students are only slightly ahead of Hispanic children. Differences between white, black and Hispanic children are large and significant with black students scoring over 2 points less than whites and Asians in reading ($b=-2.185; p<.001$), and Hispanic students another full point behind blacks ($b=-3.217; p<.001$). In math, both black and Hispanic children are over 3 points behind white and Asian children at the beginning of the kindergarten school year.

Previous literature suggests that much of this disadvantage is due to difference in family background, including socioeconomic status, parent structure and number of siblings. Also shown in Table B.1, I find that these characteristics of families are significantly related to learning reading and math. Further, results indicate that black students’ disadvantage in reading when they enter school virtually disappears once family background factors are taken into account. Family background explains over 80% of the black-white achievement gap in reading at the beginning of schooling. It does not, however, play nearly as strong of a role in the gap in math achievement. For math, family characteristics explain less than half of the disadvantage black students experience before schooling begins. A large, and significant gap remains, attributable to other sources of inequality.
Cultural difference theory has also suggested that part of black students’ disadvantage is rooted in lower educational values of their families and less educational environments in the home. Results of my analyses do not support this contention. Indeed, when these characteristics are added to the model, the negative coefficients for reading and math get larger, indicating that black families’ educational expectations, values and home activities actually buffer some other disadvantages they experience before kindergarten.

Socioeconomic status and other measures of family background are not as central to Hispanic children’s disadvantage before schooling begins as they are to black children’s. Disadvantages associated with SES, parent structure and number of siblings only explains 34-44% of Hispanic children’s lower levels of reading and math, respectively, relative to whites. Even controlling for these factors, Hispanic children are still at a significant disadvantage at the beginning of kindergarten in both reading (b= -.1.802;p<.001) and math (b= -.2.144;p<.001). Taking into account home language, along with measures of educational expectations, values and how often parents’ read to their children, does little to add to our understanding of Hispanic students’ disadvantage before schooling. Even after controlling for these other primary factors proposed in previous literature, the coefficients remain large and statistically significant indicating that other factors play a central role in disadvantaging Hispanic students before formal schooling begins.

For Asian children, these factors do not at all explain their relative advantage at the beginning of kindergarten. Indeed, the story goes in the opposite direction. Controlling for family background factors, measures of cultural differences and home
language extends Asian children’s advantage in both reading and math. With the addition of these measures, the reading coefficient increases by almost two-thirds and becomes highly significant, resulting in almost a 2 point advantage for Asian children when they enter school ($b=1.866; p<.01$). The effect of these characteristics is not as powerful for math skills, but still results in over a 1 point advantage and is statistically significant ($b=1.144; p<.05$).

These findings have mixed implications for existing theory and research about achievement gaps when children begin formal schooling. In regards to the black-white gap, existing theory seemed to be on the right track contending that family background plays a dominant role in the disadvantage black students experience before kindergarten, at least in learning to read. However, given these findings, existing theory offers little insight into why Hispanic children have, on average, lower skills when they begin kindergarten or why Asian children have higher skills on average. Addressing these two holes in theoretical reasoning is an important next step in our understanding of racial/ethnic disparities in achievement.
Table B.1. Reading and Math Growth Rates at the Beginning of Kindergarten by Race/Ethnicity, Family Background, Educational Values and Language Minority Status.

<table>
<thead>
<tr>
<th>Variables</th>
<th>READING</th>
<th>MATH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Score on First Day of Kindergarten</td>
<td>Score on First Day of Kindergarten</td>
</tr>
<tr>
<td>Black</td>
<td>-2.185*** (.390)</td>
<td>-3.066*** (.319)</td>
</tr>
<tr>
<td>Black</td>
<td>-.388 (.371)</td>
<td>-.388 (.371)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>-3.217*** (.378)</td>
<td>-3.267*** (.308)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>-1.802*** (.356)</td>
<td>-2.144*** (.292)</td>
</tr>
<tr>
<td>Asian</td>
<td>1.127 (.580)</td>
<td>.881 (.473)</td>
</tr>
<tr>
<td>Asian</td>
<td>1.242** (.549)</td>
<td>.959* (.450)</td>
</tr>
<tr>
<td>Female</td>
<td>1.213*** (.206)</td>
<td>.036 (.168)</td>
</tr>
<tr>
<td>Female</td>
<td>1.235*** (.199)</td>
<td>.067 (.163)</td>
</tr>
<tr>
<td>Age at Kindergarten Entry</td>
<td>.256*** (.026)</td>
<td>.381*** (.021)</td>
</tr>
<tr>
<td>Age at Kindergarten Entry</td>
<td>.265*** (.025)</td>
<td>.385*** (.020)</td>
</tr>
<tr>
<td>Age at Kindergarten Entry</td>
<td>.246*** (.024)</td>
<td>.371*** (.020)</td>
</tr>
<tr>
<td><strong>Family Background</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SES</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>SES</td>
<td>2.903*** (.118)</td>
<td>2.736*** (.125)</td>
</tr>
<tr>
<td>One-parent household</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>One-parent household</td>
<td>-.713* (.281)</td>
<td>-.748** (.277)</td>
</tr>
<tr>
<td>Number of Siblings</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Number of Siblings</td>
<td>-1.214*** (.132)</td>
<td>-1.990*** (.131)</td>
</tr>
<tr>
<td><strong>Educational Values</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent Expectations</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Parent Expectations</td>
<td>.542*** (.155)</td>
<td>-.658*** (.128)</td>
</tr>
<tr>
<td>Promote Education Skills</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Promote Education Skills</td>
<td>1.104*** (.096)</td>
<td>-.289* (.113)</td>
</tr>
<tr>
<td>Parent Reads to Child</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Parent Reads to Child</td>
<td>-.860*** (.137)</td>
<td>-.298*** (.137)</td>
</tr>
<tr>
<td>Non-English Spoken at Home</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Interception</td>
<td>19.913*** (.228)</td>
<td>18.320*** (.186)</td>
</tr>
<tr>
<td>Intercept</td>
<td>21.227*** (.256)</td>
<td>18.320*** (.186)</td>
</tr>
<tr>
<td>Intercept</td>
<td>15.248*** (.308)</td>
<td>18.756*** (.210)</td>
</tr>
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</table>

Note: Model also includes controls for other racial/ethnic groups, full-day kindergarten, gender and age at kindergarten entry.