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Family and Contextual Socioeconomic Effects Across Seasons: When Do They Matter for the Achievement Growth of Young Children?

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Family and Contextual Socioeconomic Effects Across Seasons: When Do They Matter for the Achievement Growth of Young Children?

James G. Benson and Geoffrey D. Borman

The skills that young children possess when they enter elementary school and the amount that they learn while in elementary school matter a great deal for subsequent academic outcomes and experiences. Differences in early-elementary learning outcomes typically become differences in high school graduation and college attendance rates, and ultimately adult status (Entwisle & Alexander, 1999; Kerckhoff, 1993). During the primary school years, seemingly small student-to-student achievement differences accrue across seasons, resulting in substantial differences as students prepare to enter high school. These differences are most pronounced between poor students and their more affluent counterparts and between minority and White students.

By the time primary school students in the United States are ready to enter high school, socially disadvantaged students lag substantially behind their more advantaged counterparts in fundamental reading and mathematics skills. Among U.S. eighth graders in 2005, only 57% of students eligible for free lunch were reading at or above the basic level, whereas 81% of those not eligible for free lunch were exceeding this level (U.S. Department of Education, 2005b). For mathematics, the gap was slightly wider, with even fewer (51%) of free lunch–eligible students at or above the basic level and 79% of non-eligible students exceeding this level (U.S. Department of Education, 2005a). Similar gaps existed between White students and Hispanic students, and even wider gaps were present between White and African American students. Although the presence of these gaps is common knowledge among education researchers, their source has been the subject of several theories and considerable debate. Disagreement has extended to questions of when, where, and how these gaps emerge.

The majority of theoretical perspectives on achievement gaps have led to research agendas focusing on processes taking place during the school year. Researchers have inquired into socially based disparities in school resources (Hedges, Laine, & Greenwald, 1994; Kozol, 1991); socially based differences in family-school relationships (Lareau, 1989); correspondence between instructional and disciplinary regimes within schools and the social-class composition of schools (Bowles & Gintis, 1976); patterns of participation in ability groups and tracks (Oakes, 1985; Useem, 1991); and differences in the technological resources available to students (Dreeben & Gamoran, 1986).

Other researchers have focused on processes taking place at times other than the school year and in places other than school. Beginning with the observation that participation in formal schooling varies decisively across seasons, seasonal researchers have achieved a reaccounting of socially related achievement inequalities and advocated a fundamental reappraisal of the relationship between families and schools. In particular, they have concluded that the processes by which young students from socially disadvantaged families and neighborhoods often fall alarmingly behind in their academic development occur, in large part if not entirely, during the summer season, when schools are typically not in session (Downey, von Hippel, & Broh, 2004; Entwisle, Alexander, & Olson, 1997; Heyns, 1978).

Seasonal researchers have reconceptualized early childhood learning for disadvantaged children as a seasonally varying process in which the families and communities of such children do not possess the resources necessary to continue academic learning when school is not in session. This seasonal perspective differs fundamentally from a more pessimistic view in which families of low socioeconomic status (SES) and their communities are seen as impeding the process of academic learning during the school year. Unfortunately, this more pessimistic view followed somewhat rationally from studies such as the Coleman report (Coleman et al., 1966). However, like many education studies, the Coleman report relied on annual rather than semiannual testing data in working to disentangle the relative contributions of schools and families to achievement growth. More recently, seasonal researchers using data from semiannual tests have concluded that students' participation in formal schooling produces a much more egalitarian distribution of achievement rates than does the immersion of students in their non-school environments (Downey et al., 2004; Entwisle et al., 1997; Heyns, 1978). Seasonal researchers have coupled this seasonal reaccounting of socially based learning gaps with a reappraisal of the levels of effort and engagement of lower SES students and their families. If lower status students achieve at roughly the same pace as their more fortunate counterparts during the school year, it follows naturally that they exert much more effort in school than previously credited.

The seasonal perspective has served as an important ideological counterweight to pessimism about the educability of students from lower SES families, and as an empirical counterweight to studies noting the limited role of schools in altering patterns of achievement inequality across social groups (Coleman et al., 1966). But there may also be a danger in this perspective. If seasonal researchers underestimate the achievement inequality occurring during the school year, they may discourage researchers and policymakers from pursuing strategies for its amelioration. We find two key reasons to be skeptical of the most emphatic claims made by seasonal researchers. First, theoretical and empirical disagreements exist within the field of seasonal research. For example, Heyns (1978) found significant school-season achievement disparities when comparing students from families of different income levels and concluded that social background remained salient during the school year. By contrast, Entwisle et al. (1997) did not find significant socially based school-year differences in achievement and asserted that social background was largely irrelevant to achievement during the school year.

The second reason for our skepticism about an absence of school-season learning disparities has to do with the samples from which these conclusions were drawn. In particular, White students in the Beginning School Study (BSS), from which Entwisle et al. drew their conclusions, were not representative of White students in the overall population of elementary school students in the United States (Phillips, Crouse, & Ralph, 1998). Only 15% of White students' parents in the BSS had completed college, and 35% possessed a 10^{th}-grade education or less (Entwisle et al., 1997). This truncation of the BSS sample has likely produced downwardly biased results concerning the effects of family SES on school-year achievement. In contrast, Heyns (1978) assigned a higher priority to obtaining a socioeconomically diverse sample, and her analysis identified a substantial degree of school-season achievement stratification.

We took on the task of resolving the disagreement between seasonal researchers by carefully examining socioeconomic effects on achievement growth during the kindergarten and first-grade school years and the summer season between them. In contrast to Entwisle et al.

(1997) we found substantial achievement inequalities across socioeconomic groups during each of the school years in our study. In the case of reading, the socially based inequalities that accrued during the school year were consistently larger than those that accrued during the summer season. In addition to analyzing seasonal variations in the effects of family SES, we analyzed the effects of race/ethnicity, social contexts, and minority racial/ethnic composition across seasons. The primary data for our inquiry came from the National Center for Education Statistics (NCES)–sponsored Early Childhood Longitudinal Study–Kindergarten Cohort (ECLS-K). For the purpose of capturing the social contexts of neighborhoods for students in the ECLS-K sample, we drew neighborhood social characteristics data from Census 2000 files and linked these data to our ECLS-K sample via students' home zip codes. To separate the effects of family background factors from the effects of social contexts, we used four sets of multilevel growth models. Child and family characteristics made up the individual level, and school and neighborhood social contexts made up the organizational level in these models of reading and math achievement.

BACKGROUND

Differences Among Seasonal Researchers Regarding School-Year Inequalities

Seasonal researchers have agreed on several key points. First, they have predicted and found substantial seasonal differences in reading and mathematics learning rates for all students. Second, they have hypothesized that family SES is more salient and exerts a stronger influence on learning rates during the summer than during the school year. Several key studies using semiannual testing have found larger effect sizes for family SES during the summer season than during the school season (Downey et al., 2004; Entwisle et al., 1997; Heyns, 1978). Several other studies have confirmed a pattern of socially stratified rates of achievement growth during the summer season (Burkam, Ready, Lee, & Logerfo, 2004; Cooper, Nye, Charlton, Lindsay, & Greathouse, 1996).

Despite the considerable agreement among seasonal researchers, the two researchers who have conducted their own surveys have disagreed as to whether family SES is salient for students during the school year. The pioneer of seasonal learning research, Barbara Heyns, views family socioeconomic resources as salient throughout the year but affected by the countervailing influence of school: "The socioeconomic background and general family conditions of children exert an influence on the achievement of children continuously, whether or not schools are in session" (Heyns, 1978, p. 186). In her Atlanta-based study, Heyns found significant differences in school-year achievement by family social background, especially among White students. For Black students, she found much smaller and mostly non-significant differences in school-year growth rates across social groups. However, Black students differed a great deal in their school-year growth rates when compared to White students. Heyns' perspective was that the best schools tended to balance out some of the disadvantages associated with low-SES families, while not completely overcoming them (Heyns, 1978).

The *faucet theory*,[1] advanced by the Entwisle and Alexander team of researchers who carried out the Baltimore-based BSS, reflects a more radical seasonal-learning perspective. In its pure form, the faucet theory suggests that family SES does not exert a significant effect on the learning patterns of young children during the school season: “Home resources do not ‘add on’ to school resources in winter, because poor children do as well as those who are well off. Only in summer do home resources come into play” (Entwisle et al., 1997, p. 38). The Entwisle team concluded that school-year learning rates were almost entirely unaffected by social background: “In fact, in periods when school is open, disadvantaged children in Baltimore learn as much as their more advantaged counterparts do. . . . Only when school is closed does Baltimore children’s achievement vary by socioeconomic status level” (Entwisle et al., 1997, p. 23).

Entwisle et al. (1997) based their conclusions primarily on their empirical investigation of a sample constrained both socially and geographically. As noted earlier, the relative homogeneity of family social backgrounds within the sample likely limited the observed, socially based disparities in achievement. As a result, estimates of learning disparities were likely downwardly biased, even when considering only the population of students within metropolitan Baltimore. Attempts to generalize from the BSS survey to the broader population of students within the U.S. would also underestimate the social dispersion of achievement.

Until recently, data limitations have prevented researchers from evaluating this crucial disagreement regarding the salience of family factors during the school year. However, the ECLS-K, the first national data set for elementary school children, makes it possible to examine seasonal learning patterns for a nationally representative sample of students. Since the fielding of the ECLS-K by NCES, one study has examined seasonal differences in the effects of family SES. Downey et al. (2004) found that family SES was positively associated with rates of school-season learning in reading but that the relationship was even stronger during the summer season. In framing their research study, Downey et al. added their own seasonal argument to that of Heyns, asserting that even though schools may be unfair in their allocation of learning resources, they still serve as “equalizers” because schools, as a whole, are *fairer* than non-school learning environments in their distribution of learning resources. Thus, the research agenda of Downey et al. was to determine “whether schooling increases or decreases the inequality that occurs when school is not in session” (Downey et al., 2004, p. 616). Based on their findings that preschool and summer learning rates were more widely dispersed according to family SES than school-season rates, the Downey team concluded that schools were equalizers.

We make a different core argument. First, we acknowledge that family SES is associated with less dispersion among school-season learning rates than among preschool and summer rates. However, because no one is considering abolishing school, and because school remains in session for at least three-quarters of the calendar year, we see a need to compare the sums, not simply the rates, of socially induced school-season and summer-season learning inequalities. We entertain the possibility that school environments may be less unequal than non-school environments and yet still account for a larger share of socially based achievement inequality. Specifically, because summer session lasts less than 3 months per year,[2] summer-season learning

[1] The term *faucet theory* derives from the proposition that the school resource “faucet” is turned on during the school year and turned off during the summer (Entwisle et al., 1997).

[2] Summer averaged 2.6 months in length in our ECLS-K sample.

would need to be a great deal more unequal than school-season learning in order to contribute more to overall achievement inequality.

Applying this perspective to the findings of Downey et al. (2004) produces the conclusion that the totality of socially induced learning inequalities was roughly equal between the school and summer seasons. However, summer setback research using the ECLS-K has pointed to an issue regarding the Downey et al. analysis that may have resulted in the underestimation of family SES effects during the school year. In their study of summer-season learning inequalities, Burkam et al. (2004) noted non-linearities within the ECLS-K data in the relationship between family SES and summer achievement. They pointed out that the effects of family SES were not linear when looking across quintiles of students from low- to high-SES families. In particular, effects on achievement seemed to concentrate among the highest and lowest SES groups. In light of these observed non-linearities, the choice by Downey et al. to use a continuous SES measure may have created problems in correctly estimating the true effects of family SES. In addition, the use of a continuous SES measure presented difficulties in interpreting the observed effects. If, as noted by Burkam et al., lower middle and upper middle levels of family SES were relatively unimportant during the summer season, the use of a continuous SES indicator may have also obscured this phenomenon during the school season.

Racial Inequalities

Racial Inequalities in Achievement

National high school surveys[3] have consistently revealed a gap on the order of one standard deviation between the composite achievement scores of Black and White students. While this gap has narrowed over time, the composite gap in the NELS:88 data remained at the substantial amount of 0.8 standard deviations (Hedges & Nowell, 1998). Researchers have devoted a great deal of consideration to exactly when and how the Black-White gap emerges (Jencks & Phillips, 1998a). With few exceptions, researchers have noted consistent disparities in achievement test scores between Black and White students at school entry (Phillips et al., 1998). The picture of the gap that emerges after school entry is more complex, and the sizes of gaps vary by specific subject. In a study that used all of the national high school surveys along with results from the National Assessment of Educational Progress (NAEP), Phillips et al. (1998) attributed half of the Black-White gap in high school tests to occurrences after the beginning of school but before high school. To capture the portion of the gap that accrued during elementary school, her research team controlled for test scores at school entry. Black students who entered elementary school with the same scores as White students tended to fall behind White students on reading and vocabulary measures but tended to keep up in mathematics. These findings suggest that researchers should be attuned to the emergence of Black-White achievement gaps during elementary school, especially in the area of reading skills.

[3] We refer here to the 1965 Equality of Educational Opportunity survey (EEO:65); the National Longitudinal Study of the High School Class of 1972 (NLS-72); the 1980 base year senior cohort and the 1982 follow-up of the 1980 sophomore cohort of High School and Beyond (HSB:80 and HSB:82); and the 1992 second follow-up of the National Educational Longitudinal Study of the Eighth Grade Class of 1988 (NELS:88/92).

Racial Inequalities in Seasonal Research

Seasonal research has not advanced a unified perspective on racial inequalities in achievement growth, but has generally confirmed the emergence of substantial Black-White achievement gaps over the course of primary school. Heyns (1978) found that race mattered in both seasons, with lower SES Black students—especially the very poor—learning less than their White counterparts during the summer season. During the school year, higher SES Black students learned at a slower pace than similarly advantaged White students. The Entwisle and Alexander research team also noted the emergence of Black-White gaps among students in the BSS data and examined several hypotheses regarding the causes of these gaps (Entwisle & Alexander, 1992; Entwisle et al., 1997; Entwisle, Alexander, & Olson, 2000). Using data from the ECLS-K, Downey et al. (2004) identified a substantial Black-White gap in school-season reading growth. Summer-season research has produced mixed findings on racial gaps in achievement. Cooper et al. (1996) found that learning rates for Black and White students slowed similarly during the summer. However, drawing their sample from the ECLS-K, Burkam et al. (2004) found disparities between Black and White students in summer mathematics growth and general knowledge, and between Hispanic and White students in general knowledge.[4] Taken together, these findings suggest that racial/ethnic gaps in learning may occur in all seasons.

Social Contexts

Social Contexts in Neighborhoods and Schools

Researchers who have reviewed and refined social theory on the effects of neighborhoods and schools have conceptualized social contexts as present among groups of people bounded by geography—such as neighborhood boundaries—or by organizational location—such as attendance at the same school. Geographic bounding brings together fairly large[5] and potentially diverse groups of individuals. Delineating boundaries have included school catchment areas, census tracts, and zip code tabulation areas (Jencks & Mayer, 1990). The conceptualization of neighborhoods and schools as geographic areas including all members within them differs from the notion of a social network, which groups more specific sets of people who regularly interact with each other (Wasserman & Faust, 1994). Even poor neighborhoods provide a range of potential relationships (Jencks & Phillips, 1998a). When working at the neighborhood or school level of aggregation, the researcher cannot know if all of a person's important and immediate social relations are contained within his or her neighborhood or school. Some residents may regularly engage in activities outside the geographic bounds of their neighborhoods, whereas others may focus on relations within their immediate area. Such variations in contacts within and across neighborhoods pose potential problems for the interpretation of findings from neighborhood and school composition studies.

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[4] However, using the same ECLS-K data source, Downey et al. (2004) found a positive but nonsignificant advantage for Black students during the summer season; Downey et al. did not examine general knowledge as an outcome.

[5] The number of people in a census tract varies from 1,500 to 8,000 people; the average size is approximately 4,000 people. Census zip code tabulation areas (ZCTAs) often include more than one census tract, and thus they tend to exceed tracts in size and vary more in size. On average, 8,600 individuals reside in a ZCTA; among all ZCTAs, the number of residents varies from zero to 113,600. In the sample for this study, the number of residents in a ZCTA varied from 58 to 101,571, averaging 26,465 persons.

Despite these challenges, neighborhood and school contextual research has proceeded according to a set of reasonable assumptions. Within geographic areas with a fair degree of socioeconomic homogeneity, processes of social interaction and access to social resources take on patterns that influence the lives of individuals and families. Depending on the qualities and content of these patterns, contexts can positively or negatively influence individual development. Empirical findings from this body of research have tended to support this set of assumptions. Researchers have found that under certain conditions—and in ways that can vary from person to person, group to group, and place to place—social contexts can exert significant influences on the actions and development of individuals within them, independent of individuals' immediate family environs (Brooks-Gunn, Duncan, & Aber, 1997; Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993; Jencks & Mayer, 1990).

Contextual Effects and Early Childhood Learning

The source of contextual effects, as they relate to the cognitive development of young children, has been conceptualized as consisting of parental actions relevant to other parents and children in a neighborhood. Affluent parents are seen as promoting good parenting among other parents, and as exerting a degree of social control over children other than their own by discouraging undesirable behavior (Brooks-Gunn et al., 1993). This *collective socialization* perspective emphasizes the positive role modeling provided by more affluent neighbors. For this reason, research informed by this perspective tends to include variables intended to capture the positive effects of socially advantaged neighbors or classmates.

An alternative conceptualization suggests that *institutional resources*, especially the human resources provided by middle-class service personnel, form the crux of important resources present in a context. Concern for capturing the scope of institutional resources available to residents has often taken the form of measuring the proportions of disadvantaged residents in neighborhoods in order to capture their degree of social isolation (Wilson, 1987). Within this approach, large proportions of disadvantaged residents are seen as limiting the amount of economic support available for hiring well-qualified teachers, maintaining storefront businesses, attracting quality health care facilities, and encouraging respectful policing strategies. From this example, it becomes clear that a measure indicating the presence of disadvantaged residents within a bounded context can, in reality, also indicate something about the *absence* of another group. For this reason, analyses that rely on separate measures of contextual advantage and disadvantage have tended to produce smaller coefficients than those relying on one or the other. However, such analyses should provide a clearer picture of the source of observed contextual effects. Contextual inquiries have also used the notion of social contagion, most often when studying peer relationships and their effects on adolescents. However, social theorists have tended to discount the relevance of peer effects when assessing contextual effects pertaining to young children (Brooks-Gunn et al., 1997).

Findings From Neighborhood and School Context Studies

Findings from quasi-experimental studies have identified some significant and modestly sized effects of context on the cognitive test scores of young children. Brooks-Gunn et al. (1993) found substantial positive effects associated with the proportion of higher income residents (those making $30,000 or more per year) in a neighborhood. Using the Stanford-Binet measure of IQ[6] administered to children at 36 months of age, the Brooks-Gunn research team found that a one standard deviation increase in the proportion of "affluent" neighbors was associated with an increase of one-quarter of a standard deviation in individual IQ test scores. The authors found no significant negative effects associated with the proportion of low-income neighbors (those making less than $10,000 per year). They found some evidence that Black children did worse in communities with large percentages of affluent residents, but no evidence that poor children, as a whole, were hurt disproportionately by living in neighborhoods with high concentrations of poor people. The multisample study (Brooks-Gunn et al., 1997) of which this study was a part created something of a consensus that neighborhoods matter for children's cognitive development. However, a more recent experimental evaluation of the Moving to Opportunity[7] experiment found no consistent evidence of significant effects associated with moving students and their families to less poor neighborhoods (Sonbonmatsu, Kling, Duncan, & Brooks-Gunn, 2006).

Jencks and Mayer's (1990) reappraisal of data from the Coleman report (1966) found that mean school SES was positively associated with achievement across core subjects during the sixth grade. They estimated the effect of moving from a poor school to a middle-class school to be approximately one-sixth of a standard deviation, and this effect held for Black and White students. Results from this study should be treated carefully, as Coleman relied on student-reported SES measures and may have inadequately controlled for prior achievement. On the other hand, Coleman used a weak measure of school SES: the proportion of students' families with an encyclopedia in the home. These measurement limitations also applied to Coleman's data for high school student achievement and school SES. For high school students, the Coleman data support the conclusion that White students did not benefit from increases in mean school SES but Black students did. More recently, high school researchers using better measures of family SES and school context have tended not to find an effect of school social context on achievement growth (Gamoran, 1987). If neighborhoods and/or school social contexts do indeed exert an effect on achievement growth, we find it most likely that these effects would appear in studies of young children.

Findings on Contexts in Seasonal Research

Heyns (1978) noted significant differences in the effects of poor and non-poor schools in her sample of sixth and seventh graders from the Atlanta public school system.[8] She found less social dispersion of school-season learning rates among students in schools with majorities of non-poor students, as well as an interaction between family income and school context. The

[6] The Stanford-Binet IQ Test was the most commonly administered test of cognitive ability at the time. Form L-M, third edition, was used.

[7] The Moving to Opportunity experiment randomly assigned students and their families to a special voucher condition, a Section 8 voucher condition, and a control condition (the latter resulted in participants' remaining in housing projects). The evaluation included children aged 6–20 and was carried out in multiple cities. See Sonbonmatsu et al. (2006) for details.

[8] Heyns referred to these schools as *low SES* and *high SES*, but the distinction between the two was based exclusively on whether the school had 45% or more of its students enrolled in the free and reduced-price lunch program. If the school met this criterion, it was deemed low SES; all other schools were considered high SES.

reading skills of lower income[9] White students grew at a considerably faster pace when attending non-poor schools. Black students in non-poor schools also appeared to learn at faster rates than those in poor schools, but these differences—when comparing students from equal income groups—were not significant. Heyns cautiously concluded that the non-poor schools in her sample appeared to be doing a better job of equalizing learning growth for students from different social backgrounds.

Entwisle et al. (1997) found very little evidence of school contextual effects in the BSS data. Like Heyns, they used the schools' meal subsidy rate as an indicator of school social context. To capture the effect of school social context, they computed partial correlations—net of family SES—between their contextual indicator and achievement growth, both for subjects and for each of the 10 seasons (over 5 years) in their survey. These analyses revealed only one instance (out of 10 possible) of a contextual school effect during the school year. The authors concluded that school year achievement gains were independent of the socioeconomic composition of schools (Entwisle et al., 1997). Paradoxically, regarding the effects of school contexts, the authors found a cross-season effect of school meal-subsidy rate. For reading growth, the school meal-subsidy rate proved more consistently significant than neighborhood poverty rate in relationship to summer-season reading growth. Regarding neighborhood contexts, Entwisle et al. found that neighborhood median income was positively related to reading and math achievement growth during the summer season, net of family SES. Similarly, neighborhood family poverty rates were negatively related to achievement growth during the summer season. These effects were fairly consistent across each of the three summers analyzed, although they did not occur in all summers. Entwisle et al. concluded that neighborhood social contexts exerted a consistent significant effect on summer-season learning growth. Neighborhood contexts, however, were judged not salient during the school season (Entwisle et al., 1997).

RESEARCH AGENDA

Our consideration of family background and social contextual effects constituted the two stages of this research project. In the first stage, we analyzed seasonal variations in the effects of family SES and race/ethnicity on achievement. In the second stage, we assessed the contribution of neighborhood and school social contexts to achievement growth and achievement inequalities. Within this framework, we addressed four main research questions:

1. How did the effects of family SES on achievement vary across seasons?

2. How was race/ethnicity related to achievement across seasons?

3. When and to what degree did social contexts—in neighborhoods and schools—affect achievement and achievement inequalities?

[9] Heyns used two low-income categories: (a) *low-income students* came from households with incomes of between $4,000 and $7,999 per year; (b) *extremely low-income students* came from families with incomes of less than $4,000 per year (Heyns, 1977, page 56).

4. When and to what degree did the minority composition of schools and neighborhoods affect achievement?

Effect of Family SES Across Seasons

One of the main assertions of seasonal researchers has been that schooling attenuates the effect of family SES on achievement. Before addressing this hypothesis, we first assessed the influence of family SES on achievement at school entry. For this and subsequent questions, we used the arithmetic difference in the test scores of students from high- and low-SES families as an indicator of the social learning gap. We asked two initial questions: What was the magnitude of the social learning gap at school entry? What was magnitude of the mid-region social gap—the distance between students from low-middle and high-middle SES families at school entry? Prior research has found that family SES positively influences cognitive development prior to school entry. Thus, we hypothesized that we would find considerable social stratification in achievement at school entry.

Before addressing school-year learning inequalities, we assessed summer-season inequalities. What was the magnitude of the summer-season social learning gap? Then we turned to social stratification during school seasons. Did social learning gaps appear during kindergarten and first grade, and if so, what were their magnitudes? Could we conclude that family SES was unrelated to achievement growth during the school year, as predicted by the faucet theory? Finally, in order to evaluate the theory of schools as equalizers, we compared the magnitude and totality of social learning gaps across seasons. First, was the *magnitude,* or rate, of the social learning gap larger during the summer or the school season? Second, was the *totality* of the social learning gap larger during the summer or the school season? In other words, after summing the monthly learning gaps over the duration of the seasons in which they occurred, was the total for the summer season larger than that for the school season? Did our findings support the faucet theory or the schools-as-equalizers theory? Did we see a need to revise either or both of these theories? Also, how did the total of the school-season social learning gaps compare to the social gap at school entry?

Racial Inequalities in Achievement

To distinguish gaps caused by social disparities between minority and majority students from gaps related to other dimensions of disadvantage experienced by minority students, we assessed racial/ethnic achievement inequalities net of family SES. We assessed racial/ethnic inequalities in achievement at school entry, during the summer, and during the school year. Researchers have noted consistent disparities in the achievement test scores of Black and White students at school entry (Phillips et al., 1998). Some of the studies on which this conclusion is based were fielded during the 1970s and 1980s, and thus the ECLS-K provided an opportunity to reappraise the Black-White gap with a more contemporary sample of children.

We hypothesized the presence of racial/ethnic gaps at school entry and assessed the magnitude of these gaps while taking into account the considerable socioeconomic disparities among African American, Hispanic, and White students. In other words, we sought to determine the size of the Black-White and Hispanic-White gaps at school entry after taking account of family SES. Next, we asked whether African American and Hispanic students differed from White students in summer-season achievement growth. What were the magnitudes of the Black-White and Hispanic-White summer-season achievement gaps? How large were the total racial/ethnic gaps during the summer season? Then, we assessed the contribution of school-season processes to racial/ethnic gaps in achievement. What were the magnitudes of the Black-White and Hispanic-White learning gaps during kindergarten and first grade? How large were the total race/ethnic gaps during the school seasons? Looking across seasons, how did the total summer-season gaps compare to the total school-season gaps? Next, and of particular concern, did racial/ethnic gaps widen once school began? Previous research has attributed half of the Black-White gap to occurrences after the beginning of school and has noted that when controlling on test scores at school entry, Black elementary school students have tended to fall behind White students on reading and vocabulary measures (Phillips et al., 1998). We hypothesized that Black and Hispanic students would lag behind White students in reading achievement once school began, and asked which seasons contributed the most to the widening of this gap.

Social Contexts, Minority Composition, and Seasonal Disparities

The second stage of our research agenda focused on the relationships between social contexts, the minority racial/ethnic composition of neighborhoods and schools, and achievement inequalities across seasons. First, we assessed the size of contextual effects at school entry. As noted earlier, prior research has consistently found that advantaged social contexts positively influence early childhood test scores (Brooks-Gunn et al., 1993). In keeping with extant research, we expected to find that the positive effect on achievement scores—the contextual advantage—associated with high-SES neighborhoods was larger than the negative effect on achievement scores—the contextual disadvantage—associated with low-SES neighborhoods. We compared advantaged and disadvantaged contexts to middle-SES contexts and asked three questions: How large was the contextual advantage? How large was the contextual disadvantage? Was the contextual advantage larger than the contextual disadvantage?

Next, we asked whether differences in neighborhood social contexts explained the social gaps in achievement at school entry. Did the socioeconomic context of students' neighborhoods[10] explain away a portion of the observed social gap at school entry? Or, given the propensity of families to live in neighborhoods reflecting their own SES, did neighborhood socioeconomic contexts tend to exacerbate family-based achievement inequality? Next, we asked how neighborhood socioeconomic contexts affected summer-season achievement growth. Could we observe a contextual advantage or disadvantage during the summer season? When neighborhood contexts influenced learning during the summer season, did they explain away social gaps, or did they tend to exacerbate family-based achievement inequality? Subsequently, we assessed the influence of school socioeconomic context on achievement during school seasons. Was there a contextual advantage for students attending high-SES schools? Was there a contextual disadvantage for students attending low-SES schools? What were the magnitudes of

[10] An assumption here was that during the period of this study students either were continuing to live in the same neighborhood in which they had lived prior to school entry or were living in a neighborhood with similar characteristics.

these compositional effects? Finally, we compared contextual effects across seasons. What were the total contextual effects during the school and summer seasons? How did the sizes of these totals compare to each other, and how did they compare to totals for the family-based learning gaps?

We asked similar questions about the racial/ethnic composition of neighborhoods and schools. Did segregation of families into neighborhoods with high concentrations of minority families create a segregation disadvantage for students growing up in these neighborhoods? Did accounting for the minority composition of neighborhoods explain away a portion of the observed racial/ethnic gaps in achievement at school entry? Was there a segregation disadvantage for students during the summer season, and if so, did it explain away or exacerbate racial/ethnic gaps during the summer season? During the school season, was there a segregation disadvantage for students located in high-minority schools? Did this disadvantage explain away any of the observed racial/ethnic gaps in school-year achievement?

METHOD

Data

The sample for our analysis includes 4,178 students, each of whom was attending one of 292 schools and living in one of 699 neighborhoods during the period of our study, which spanned from the beginning of kindergarten until the end of first grade. Data on student test scores, demographic characteristics, and family background came from the ECLS-K, administered by the National Center for Educational Statistics (NCES, 2002). The ECLS-K provides nationally representative data on children in the U.S. in kindergarten and for subsequent time points through fifth grade. The most intensive sampling took place during the kindergarten and first-grade years. The data collection conducted during the fall of first grade (hereafter *fall-first-grade* or *FFG*) included a survey design enhancement aimed at allowing researchers to “measure the extent of summer learning loss and the factors that contribute to such loss and to better disentangle school and home effects on children’s learning” (NCES, 2002). In the fall of 1999, survey administrators administered test instruments to all students from the kindergarten wave attending a random subsample of 30% of the schools sampled during the kindergarten year. Twenty-seven percent of base-year survey students attended the schools included in this subsample. Because NCES randomly sampled schools rather than students for the FFG data collection, this subsample includes sufficient numbers of students within schools for analysis of school effects. Our sample includes an average of 14 students per school. This FFG subsample served as the foundation of the analytic sample.

In order to measure the effects of specific school and neighborhood contexts with the least amount of measurement error, we sequentially eliminated cases from the FFG subsample. In keeping with other contextual studies, we removed students who changed schools or neighborhoods during the study period. We began with the full FFG subsample—5,470 students. We eliminated 938 students because they changed schools between the beginning of kindergarten and the end of first grade, and 128 students because they changed neighborhoods between the fall of first grade and the spring of first grade.[11] Next, to ensure a minimum level of achievement data for each student in the analytic sample, for both reading and math, we eliminated 130 students who did not have at least one test score available in each subject. Finally we eliminated an additional 96 cases from our analytic sample because they had no family background data available from either year. Because item nonresponse rates were low and data tended to be missing for all background variables at once, we did not see a benefit to multiply imputing background data. Rather, when background data were missing from the kindergarten rounds of parental interviews, we imputed data from parallel questions in the first-grade interviews. This process allowed us to preserve many cases in the data set that otherwise would have been eliminated.

To examine the effects of neighborhood contexts, we drew data from the 2000 census small area files. These data, comprised of answers to questions in the "long form" of the 2000 decennial census, provide a rich assortment of variables concerning the demographic and socioeconomic characteristics of neighborhoods. Because of the inclusive sweep of long-form data collection, these data are collected with less measurement error than the microdata collected between decennial censuses. The collection of the census data, which pertain to neighborhood characteristics during 1999, coincided with the kindergarten and first-grade years of the ECLS survey. To capture the characteristics of students' neighborhoods, we linked the census data to the ECLS data using the zip code of each student's home address. When a student's zip code was not available, we linked census information from the student's school zip code area as the best approximation of the student's neighborhood characteristics.

Measures

We adopted a three-level focus for our study, and employed within-student measures of achievement and learning time, as well as student- and contextual-level measures of background and context. Our within-student measures included six variables that captured the exact amount of time spent in school and summer prior to each assessment point, as well as achievement test scores at each time point.[12] We designed our student-level predictors to capture social background and family conditions at school entry, or as close to this time point as possible, given survey schedules and the availability of data. For most students, this meant that family and demographic characteristics were ascertained by spring (1999) of the kindergarten school year. For those cases with missing family data during kindergarten, data were imputed from the fall of first grade (preferably) or, in a small percentage of cases, spring of first grade.

We also treated contextual characteristics as stable during the period of the study. Table 1 contains means and standard deviations for all of our measures. Below, we discuss our methods

[11] NCES did not provide students' home zip codes during kindergarten, and thus it was impossible to check whether students changed homes during kindergarten.

[12] Our growth-modeling strategy did not require us to have a test score for each student at each time point; however, our strategy did require that we know the scheduling of students' tests so that achievement growth could be accurately apportioned between periods. Thus, when a test score was missing, we computed the date at which a student would have been tested, based on the test dates for other students in the school. This strategy made sense, given that test administrators tested students in the same schools on the same days.

for developing each of the measures, proceeding from those included in the lowest to those included in the highest levels of analysis.

Within-Student Measures

To accurately assess the amount of learning taking place each season, it was necessary to compensate for misalignment between the survey administrators' testing dates and the beginning and ending dates of school years. To illustrate, "Time in kindergarten before Test 1" (Table 1) indicates that the average student spent 2.2 months in kindergarten prior to the first assessment. To ignore this misalignment would have caused us to overestimate achievement levels at school entry and to underestimate achievement growth during kindergarten. To correct all misalignments, we used information indicating the exact assessment dates and information from the school administrator reports indicating the exact beginning and ending dates of the first-grade school year. NCES did not query school administrators during kindergarten as to the exact beginning and ending dates of their school years. Under the reasonable assumption that these dates did not change significantly between the 2 years, we imputed the dates from first grade to kindergarten. For schools in which school administrators failed to report a beginning or ending date for first grade, we imputed the average beginning and ending dates for similar schools.[13]

To measure achievement, we relied on information from one-on-one child assessments conducted with the sampled children during the fall of 1998, spring of 1999, fall of 2000, and spring of 2001. These assessments included cognitive, psychomotor, and physical components. The reading assessments included questions designed to measure basic reading skills (i.e., print familiarity, letter recognition, beginning and ending sounds, rhyming sounds, word recognition), vocabulary (receptive vocabulary), and reading comprehension skills (i.e., listening comprehension, words in context). Comprehension items were targeted to measure skills in initial understanding, interpretation, personal reflection, and critical stance. The ECLS-K database provided achievement outcomes expressed as both scale scores and criterion-referenced measures of students' skills. We used the scale score measures—derived using an item response theory (IRT) model—in order to model achievement growth in both reading and math.

Student-Level Covariates

The student-level predictors in our analysis facilitated within- and across-season comparisons of learning growth for students from different social backgrounds and allowed us to distinguish between socioeconomic, racial/ethnic, and family structure effects. Covariates indicating student age and repeat status (i.e., whether the student was repeating kindergarten during the 1999 school year) functioned as control variables. The full panel of student-level covariates included the child's family SES, race/ethnicity, family structure, family size, repeat status, and age at kindergarten entry.

We used the measure of family SES computed by NCES as an average of component variables indicating the guardian parents' levels of education, occupational statuses, and total

[13] To estimate dates for similar schools, we computed average beginning and ending dates for schools in each state by school sector (public or private).

household income (NCES, 2002). From this continuous measure of SES, NCES constructed five equal-sized quintiles of students within the original ECLS-K sample. We used these quintiles as provided in the ECLS-K database. Thus, the SES quintiles used in our analysis reflected the nationally representative quintiles in the original ECLS sample, prior to sample attrition.

Our race/ethnicity indicators were constructed from parent-reported race/ethnicity information, which included the following eight categories: White non-Hispanic; Black non-Hispanic; Hispanic; Asian; Pacific Islander; American Indian; Alaska Native; and multiracial. We classified students into five categories: African American, Hispanic, Asian-Pacific Islander, Native American (including Alaskan natives), and White. Students listed as multiracial were assigned to the race of their mother.

To statistically control for characteristics of the child's family, we initially coded whether each student came from a biological two-parent family, an alternative (adoptive or foster) two-parent family, or a single-parent family. Preliminary analyses indicated very few differences in the effects associated with single- and alternative two-parent families, and thus we chose not to distinguish between these two family configurations in our models. Instead, we compared biological two-parent families with all others. Because parents must spread resources among all children in their families, we included the number of siblings as a measure of resource demand within families. To account for school readiness, we included a measure of students' age at the beginning of school during the fall of 1998. This date also functioned as Point 0 for our study, which spanned the period from this point to the date of the fourth assessment, administered (on average) 8.2 months into the first grade. For most students, Point 0 was also their age at school entry. However, for 4% of students, this time point represented the beginning of their second pass through kindergarten. Thus, we also included a covariate indicating whether a student was a kindergarten repeater as of fall 1998. Inclusion of this covariate served as a control for students' adjustment to schooling and facilitated distinguishing between age and adjustment effects in our models.

School and Neighborhood Contexts and Compositions

To facilitate comparisons across schools and neighborhoods, we coded our contextual measures using identical procedures. Because detailed occupational data were not available from Census 2000 at the zip code level,[14] we relied on income and education data to construct our measures of school and neighborhood social contexts. We began by determining the median income (in dollars) for each school and neighborhood in our study. After computing the natural log of each unit's median income, we converted these figures to *z*-scores. Next, we ascertained the mean years of education for adults in each school and neighborhood. Within schools, we computed the mean years of education based on available categorical educational attainment data[15] for each student's parents (or parent), and then converted these means to *z*-scores. Within neighborhoods, we computed the mean years of education from categorical attainment data for

[14] At the zip code level of aggregation, the Bureau of the Census provides only a six-category division of occupational sectors, each of which contains occupations of widely varying status.

[15] NCES categorized parents' educational attainment according to nine categories. Within two-parent families, attainment data were sought, and frequently obtained, for both parents. We converted these available data to a continuous measure of years of education, on a scale of 0 to 20 years.

all male and female adults over the age of 25.[16] Next, we computed continuous measures of school and neighborhood SES as the arithmetic averages of the two component *z*-scores. Finally, using these continuous measures, we divided the 292 schools and 699 neighborhoods into equal-sized socioeconomic quintiles. Preliminary analyses yielded two fundamental insights: (a) the relationship between socioeconomic contexts and achievement was not linear; and (b) the effects of socioeconomic contexts were concentrated at the tails of the distributions. For these reasons, we used categorical measures of socioeconomic contexts and collapsed the middle three categories into one for our regression analysis.[17]

To account for the minority composition of schools and neighborhoods, we again constructed identical measures for the two contexts. We summed the numbers of students from all minority groups within schools, and the numbers of minority residents within neighborhoods, and divided these figures by the unit populations. In essence, these measures captured the percentages of students and residents other than non-Hispanic Whites. In our school and neighborhood measures as in our individual-level measures, Hispanic Whites were considered Hispanic.

Program Participation Measures

Our measures of program participation reflect seasonal researchers' emphasis on the importance of exposure to schooling (Entwisle et al., 1997; Heyns, 1978). This line of research has tended to focus on the effectiveness of summer school programs for boosting achievement and attenuating socially induced achievement inequalities (Cooper et al., 1996), but it has also considered school-year enhancements such as full-day kindergarten (Lee, Burkam, Ready, Honigman, & Meisels, 2006). Our analysis includes summer school and full-day kindergarten measures. We included these measures in the analysis because participation in these programs correlates with family SES, and we wanted to assess whether program participation explained any observed contextual effects.

Our program participation measures were designed to capture increased academic training. With regard to summer school, researchers using ECLS-K data have tended to find negative but non-significant effects of summer school enrollment (Burkam et al., 2004; Downey et al., 2004). Downey et al. found a statistically significant negative effect of summer school enrollment on summer mathematics learning. These results may reflect issues of selection into summer school programs and were obtained without controls for the academic content of the programs. Our measure of academic summer school captured exposure to academic material during the summer season, as reported by parents during the FFG survey. When parents indicated that their children had attended a summer school program that included both reading and math instruction, we coded our dichotomous measure as one; for all other cases, we coded this measure as zero. With regard to the school year, researchers using ECLS-K data have found positive effects of full-day kindergarten programs (Lee et al., 2006). We coded a dichotomous

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[16] The census provided attainment data, by gender, for 16 categories of attainment; we converted each category to an appropriate continuous value before computing the mean years of education within each neighborhood.

[17] Alternate analyses (not included) using four categorical SES variables (and a middle-SES excluded category) did not produce any significant differences for schools and neighborhoods in the three middle SES categories.

measure as one when a school provided full-day kindergarten classes to a majority of its students, as indicated by both the ECLS-K field management data report and individual student reports.[18]

Three-Level Modeling Strategy

Level 1 of our modeling strategy accounted for substantial season-to-season variation in achievement growth among early childhood learners. Preliminary analyses made clear the necessity of accommodating not only school-summer differences, but also kindergarten–first grade differences in achievement growth.[19] Thus, the piecewise character of our modeling strategy allowed for separate estimation of growth parameters for each of the three seasons. In the Level 1 models, the intercept represented achievement at school entry, and three additional parameters estimated growth rates during kindergarten, summer, and first grade. Our Level 1 equations for reading and math were as follows:

$$Y_{ijt} = \pi_{0ij} + \pi_{1ij}(K_{ijt}) + \pi_{2ij}(S_{ijt}) + \pi_{3ij}(F_{ijt}) + e$$

Because of the necessity of estimating four parameters from only four test scores, we constrained the value of the error term to equal the average amount of measurement error as indicated in the NCES assessment validation report (Rock & Pollack, 2002).[20]

Level 2 of our modeling strategy captured the effects of social and demographic variation among students on initial achievement and subsequent achievement growth. Because of the necessity of measuring achievement for four periods (Level 1), we used four identical[21] Level 2 models in each of our subanalyses. The full list of Level 2 variables included categorical variables indicating the quintiles of each student's family SES (with the middle quintile serving as the excluded category); four categorical variables indicating the student's race/ethnicity; a categorical variable indicating whether the student was living in a biological two-parent family; a continuous variable indicating the number of siblings in the student's family; a categorical

[18] The great majority of schools were homogeneous in the length of their kindergarten offerings, with about 10% offering both half-day and full-day classes.

[19] Preliminary models indicated that we could not reliably estimate simple growth parameters for the school and summer seasons only due to the considerable variation in school-year learning rates between kindergarten and first grade, for both reading and math.

[20] For each of reading and math, we computed an average of the measurement error variance across the four test administrations. Measurement error variances were computed as one minus the reliability of the test, multiplied by the total variance of the test. Test reliabilities were provided by Rock and Pollack (2002). Measurement error varied slightly across seasons within tests. For reading, the error ranged from 5.15 points for the fall 1998 test to 6.42 points for the fall 1999 test. For math, the error ranged from 4.04 points for the fall 1998 test to 5.54 points for the fall 1999 test. For each test, we computed an average of the errors on the four tests, weighted by the number of students taking the test in each season. This process resulted in an average reading error of 5.8943 and an average math error of 4.9187. Within HLM 6.02, we constrained the value of sigma squared to equal these two values, respectively, in the reading and math analyses.

[21] The two exceptions to the identical nature of our Level 2 models were (a) the accounting for summer school attendance during the summer season; and (b) the accounting for full-day kindergarten attendance during the kindergarten season, which by necessity took place at different levels in the neighborhood and school models.

variable indicating the gender of the student; a continuous variable indicating the age of the student at the beginning of the 1999 school year (fall of 1998); and a categorical variable indicating whether the student was repeating kindergarten as of the beginning of the 1998 school year. The full Level 2 model explaining variation among students in kindergarten growth rates (for both reading and math) was as follows:

$$\pi_{1ij} = \beta_{10j} + \beta_{1,1-4j}SESQUINTS_{ij} + \beta_{1,5-8j}RACE_{ij} + \beta_{19}2BIOPAR_{ij}$$
$$+\beta_{110}NUMSIBS_{ij} + \beta_{111}AGE + \beta_{112jt}GENDER_{ij} + \beta_{113}REPEAT_{ij} + r_{ij}$$

In this Level 2 equation, β_{10j} represented the school average growth rate during kindergarten. Each subsequent beta parameter captured alterations to the school average growth rates associated with particular student characteristics. Thus, SESQUINTS represented the vector of four family SES quintile categories, and β_{11} through β_{14} captured deviations associated with each of these quintiles as compared to the excluded category (middle-quintile SES); RACE represented the vector of four categorical variables for student race/ethnicity, and β_{15} through β_{18} captured differences in achievement growth associated with each race/ethnicity category as compared to White race/ethnicity; 2BIOPAR represented the dichotomous variable for presence of a biological two-parent family, and β_{19} captured the effect associated with this family formation (as compared to all other family formations); NUMSIBS represented the number of siblings in a student's household, and β_{110} captured the effect of adding each additional sibling to a student's family; AGE represented the student's age in months at the beginning of the 1999 school year, and β_{111} captured the effect associated with each one month deviation from the mean months of age at this time;[22] and REPEAT indicated whether the student was repeating kindergarten as of the beginning of the 1999 school year, and β_{113} captured the deviation from the school average growth rate associated with a student having repeated kindergarten. The Level 2 error term, r_{ij}, represented the student-specific error term for each student *i* in school *j*.

The third level of our modeling strategy accomplished two main objectives. First, even though our first set of models did not attempt to explain variation in achievement across schools and neighborhoods, inclusion of random parameters at Level 3 facilitated an accurate accounting of school- and neighborhood-based variations in mean achievement. The presence of stochastic parameters at Level 3 (a) accounted for the clustered nature of data within specific schools and neighborhoods, (b) allowed for an accurate decomposition of variance between the individual and contextual levels, and (c) reduced the possibility of bias in our parameter estimates at both levels. Second, for the models that assessed the relationship between school and neighborhood social contexts and achievement, we entered contextual predictors in the Level 3 equations. The Level 3 equations served as *random intercept* models (Raudenbush & Bryk, 2002), in which separate Level 3 equations predicted the school-average intercept for achievement at school entry, β_{10}, and each of the school-average growth parameters, $\beta_{20,30,40}$, for achievement growth

[22] In each Level 2 model, we centered AGE around its grand mean (66.5 months) at the beginning of the 1999 school year.

in the subsequent seasons. The Level 3 equation, which modeled school-to-school variation in the kindergarten growth parameter, was as follows:

$$\beta_{10j} = \gamma_{100} + \gamma_{101}SES\_LOW_j + \gamma_{102}SES\_HIGH_j + \gamma_{103}PCTMIN_j + \gamma_{104}FDKIND_j + \mu_{10j}$$

The intercept, γ_{100}, represented the average kindergarten season growth rate for all schools in the sample. The random parameter, μ_{10j}, represented the deviation of school *j* from the school mean growth rate. In the first set of models, this was the only Level 3 parameter accompanying the intercept. In the second set of models, the categorical variable SES_LOW indicated whether a school was located in the bottom socioeconomic quintile of schools, and γ_{101} captured the average achievement decrement (or increment) associated with a school's location in this quintile. Similarly, SES_HIGH indicated whether a school was located in the top socioeconomic quintile of schools, and γ_{102} captured the average achievement increment (or decrement) associated with a school's location in this quintile. PCTMIN was a continuous variable indicating the percentage of minority students in a school, and γ_{103} estimated the deviation from the school mean growth rate associated with each one percent increase in the minority composition of a school. Finally, the dichotomous variable FDKIND indicated whether the school employed full-day kindergarten classes, and γ_{104} captured the fixed effect of full-day kindergarten classes on kindergarten achievement growth.

RESULTS

Descriptive Results for Students, Schools, and Neighborhoods

Table 1 displays the mean student achievement levels at each of the four time points for this study, along with the means for student demographic and social background characteristics. Columns 2 and 3 compare mean characteristics for the full sample and the analytic "non-mover" sample of students who did not change neighborhoods or schools during the study period. The reading and math scale score means demonstrate that reading and math scale scores more than doubled during the study period. Standard deviations also increased, in reading more than math, indicating increasing dispersion among students as the study progressed. Two-tailed *t*-test comparisons of mean achievement scores across samples revealed that students who remained in the analytic sample had slightly higher math scores than students in the full sample.

Because we preserved the socioeconomic quintiles computed by NCES using the full sample of surveyed students, our analytic sample had fewer low-SES students (15.9% versus 18.5%); more upper middle-SES students (22.2% versus 20.6%); and more high-SES students (22.8% versus 21.1%) than the full sample. The analytic sample had fewer Hispanic students (14.7% versus 16.7%) and more White students (60.3% versus 57.4%) than the full sample. Students in the analytic sample were more likely to be from intact families and less likely to be in single-parent families. Differences between the two samples reflect the tendency of low-SES students and their families to be more geographically mobile than middle- and upper SES students and their families. If unobserved student characteristics differed between the two samples, they likely differed in a manner that put low-SES students in our analytic sample at an advantage relative to low-SES students in the full sample. Consequently, our analytic sample provided a stronger test for the occurrence of socially based learning disparities than the full sample would have.

Table 2 provides an overview of the social backgrounds of (a) students in each of the five SES quintiles and (b) schools and neighborhoods in each of the three contextual categories. Column 4 reveals that students' parents differed greatly in their educational attainments, with low-SES parents having, on average, 10.5 years of education, compared to 16.5 years for high-SES parents. Median family income also increased dramatically from $12,000 per year for low-SES households to $85,000 for high-SES households. There was substantial overlap between the low-SES and minority categories, with 71.4% of low-SES students coming from minority groups. In contrast, only 23.3% of high-SES students came from minority groups.

Schools closely resembled the patterns of stratification present at the student (household) level. The average levels of parental educational attainment were much lower in low-SES schools (11.5 years) than in high-SES schools (15.6 years). Income stratification in schools was also very similar to that at the household level, with household incomes at low-SES schools averaging $17,000 per year as compared with $85,300 at high-SES schools. Low-SES schools were largely attended by minority students (80.5%), whereas high-SES schools enrolled relatively small percentages of minority students (22.7%).

Neighborhoods reflected slightly lower levels of inequality and segregation than schools. The average level of adult education was 12.5 years in low-SES neighborhoods and 15.5 years in high-SES neighborhoods, a range of 3 years as compared with 4 years among schools and 6 years among households. Average incomes also differed less among neighborhoods than among households and schools, with low-SES neighborhoods having median incomes of $36,700 compared with $90,000 for high-SES neighborhoods. Further, low-SES neighborhoods were less concentrated in terms of minority group membership, with only 61% of low-SES neighborhood residents coming from minority groups, as compared with 81% for schools. The somewhat more moderate inequality and segregation among neighborhoods, as compared with schools, likely reflect the fairly large geographical unit of analysis employed in this study. Our neighborhood measures relied on information at the zip code level, and zip code areas include larger populations and more socioeconomic diversity than census tract areas. Taken together, however, these descriptive results portray a great deal of social stratification among households, schools, and neighborhoods.

Reading Achievement: Students Nested Within Neighborhoods

Table 3 presents four models of reading growth covering each of the four seasons in this study, for students nested within their home neighborhoods. Each of the models for initial status achievement revealed a large social gap at school entry. The magnitude of this gap in Model 1 (9.4 points) amounted to one full standard deviation and dropped slightly to 0.9 standard deviations after introduction of the family-level control variables (Model 2). The magnitude of the gap between lower- and upper-middle SES students (3.1 points) amounted to .33 standard deviations. Turning to the summer season before considering contextual effects, we found that, on average, students did not grow in reading achievement during the summer season. However, a 0.5-point social learning gap was present during the summer season. Over the course of an average summer season (2.6 months), this monthly gap summed to 1.4 points. To make sense of this difference in real-world terms, we used results from the unconditional reading achievement model[23] to compute a school-year monthly growth rate for reading achievement. Averaging the two school-year growth rates produced a school-season growth average of 2.1 points. Applying this yardstick to the results noted above, we found that the social gap at school entry amounted to 4.5 months of school-year learning, and the summer social gap amounted to 0.6 months of school-year learning.

When examining racial/ethnic gaps in achievement at school entry and during the summer season, we found only one instance of a significant disadvantage for minority students. After controlling for social background (Model 2), we did not find a significant Black-White gap in reading achievement at school entry. The Hispanic-White gap (-1.2 points) equaled 0.6 months of school-year reading growth, which was much smaller than the social gap at school entry, but equal to the summer social gap. During the summer season, African American students learned at a *faster* pace than White students (0.25 points/month) when controlling for family SES, and Hispanic students did not learn at a significantly different pace from White students.

Neighborhood context exerted considerable influence on reading achievement at school entry but did not explain away the social gap attributed to family SES. The contextual advantage at school entry for students growing up in high-SES neighborhoods stood at 2.1 points, or one month of school-year reading growth. The contextual disadvantage for students growing up in low-SES neighborhoods (0.9 points) was considerably smaller than the contextual advantage and amounted to only 0.4 months of school-year growth. Comparing from Model 2 to Model 3, we noted only very small reductions in the coefficients for the family SES variables and a negligible reduction in the social gap. Thus, we concluded that, given the propensity of families to live in neighborhoods reflecting their own socioeconomic status, contextual advantages and disadvantages tended to exacerbate the social gap in reading achievement observed at the family level (Model 2).

Advantaged social context influenced reading achievement during the summer season. Model 3 indicates a contextual advantage of 0.3 points per month for students living in high-SES neighborhoods, but no contextual disadvantage for students residing in low-SES neighborhoods. The contextual advantage summed to 0.33 months of school-season reading growth. Accounting for social context explained one-quarter of the social advantage for students in high-SES families, indicating that some of the advantage attributed to high-SES families in Model 3 was a consequence of the neighborhoods in which these families tended to live. However, low-SES neighborhoods did not significantly affect summer-season reading achievement and did not explain away any of the disadvantage for students growing up in low-SES families. Thus, after accounting for neighborhood social contexts, the social gap in summer-season reading achievement remained. High-SES neighborhoods provided a contextual advantage, which boosted reading achievement for students fortunate enough to live in them.

In contrast to our findings on neighborhood social contexts, neighborhood minority composition did not influence achievement at school entry or during the summer season. This

[23] This model (not shown) did not include any predictor variables, and provided the raw beginning score and seasonal growth rates as follows: 19.410; 1.669 points per month in kindergarten; -0.016 points per month in summer; and 2.527 points per month in first grade.

finding was obtained while accounting for neighborhood social context and thus suggests that there was nothing in particular about segregated neighborhoods that placed students at a learning disadvantage, once the social context of these neighborhoods was taken into account.

Reading Achievement: Students Nested Within Schools

Table 4 presents four reading achievement models identical to those in Table 3, with students nested in their schools rather than their home neighborhoods. Social gaps in reading achievement appeared during kindergarten and first grade, driven largely by the disadvantages experienced by students growing up in low-SES families. During kindergarten, the uncontrolled model (Model 1) indicated a social gap of 0.3 points per month, and this gap dropped to 0.2 points per month after controlling for family and demographic factors in Model 2. This gap summed to 1.9 points over the course of an average school year, or 0.9 months of school-year reading growth. Although the magnitude of this kindergarten social gap was smaller than the summer-season social gap (0.5 points per month), it summed to a 40% larger figure: 1.9 versus 1.4 scale score points. The magnitude of the social gap during first grade was similar in size: 0.2 points per month after controlling for family and demographic factors. This monthly gap summed to 1.6 points over the course of an average school year, or 0.8 months of school-year reading achievement. This total for the first-grade social gap was also larger than that for the summer-season social gap. These comparisons of totals across seasons support the claim that, once school began, more than half the total amount of stratification in reading achievement took place during school seasons.

Substantial racial/ethnic gaps in reading achievement appeared during kindergarten and first grade. Black-White gaps were present during kindergarten and first grade, whereas a Hispanic-White gap was most apparent during kindergarten. The magnitude of the Black-White gap during kindergarten and first grade was 0.2 points per month, and this monthly gap summed to 2.0 scale score points, or 0.9 months of school-year reading growth, over the course of an average school year. During kindergarten, the smaller Hispanic-White gap (0.1 points per month) summed to 0.6 months of school-year reading growth. For first grade, our models provided mixed findings on the Hispanic-White gap. In general, we relied on the students-within-schools models for results pertaining to the school year, and in most cases these results did not differ significantly from results obtained in the students-within-neighborhoods models. In the case of Hispanic students in first grade, however, the students-within-neighborhoods models (Table 3) identified a significant Hispanic-White gap of 0.1 points per month. Thus, we do not conclude that a Hispanic-White gap was absent during first grade. Rather, we found that Hispanic-White gaps were smaller than Black-White gaps in both kindergarten and first grade.

School social contexts exerted a strong influence on reading achievement during kindergarten and first grade. In kindergarten, the relationship between school social context and reading achievement took on an unexpected pattern, with both low-SES and high-SES contexts negatively influencing achievement growth relative to middle-SES context. Model 3 indicated a non-significant but sizable contextual disadvantage in low-SES schools (-0.1 points per month) and a significant contextual disadvantage in high-SES schools (-0.2 points per month). After accounting for the substantial impact of full-day kindergarten programs (Model 4), we found a significant and substantially sized contextual disadvantage of -0.16 points for students located in low-SES schools. Model 4 indicated that, even after controlling for full-day kindergarten programs and school minority composition, high-SES contexts slowed reading growth relative to middle-SES contexts. In other words, a contextual reading gap did not emerge during kindergarten: students in low- and high-SES contexts learned to read at approximately the same rates. During first grade, contextual effects took on a more familiar pattern. Model 3 indicated a sizable but non-significant negative effect for low-SES school context (-0.1 points per month) and a large significant positive effect for high-SES school context (0.2 points per month). After accounting for minority school composition in Model 4, the low-SES coefficient shrank to a negligible size, indicating that minority school composition accounted for the negative effect of low-SES noted in Model 3. However, accounting for minority school composition did not alter the substantial benefit (0.2 points per month) for students attending high-SES schools. Combining information from the low- and high-SES coefficients yielded a monthly contextual gap of 0.2 points, which summed to 0.8 months of reading growth over the course of first grade.

Minority school composition created a substantial segregation disadvantage for students in high-minority schools during first grade. Model 4 includes the coefficient for percent minority (-0.003), which indicated a monthly segregation disadvantage of 0.15 points for students attending schools one standard deviation above the mean minority composition (77%). This segregation disadvantage summed to 0.66 months of reading growth over the course of first grade. Accounting for varying minority concentrations across schools served to substantially diminish the size of the coefficient for African American family SES (from -0.19 to -0.11) and push it considerably below the level of statistical significance. This result suggests that the first-grade reading disadvantage for Black students was a consequence of location in schools with large concentrations of minority students, rather than rearing in African American families.

Our account of contextual and compositional effects on reading achievement has focused on the influence of neighborhoods prior to school entry and during the summer season, and the influence of schools during kindergarten and first grade. Regarding reading achievement at school entry, this focus rests on the simple logic that schools could not possibly have influenced achievement prior to students' entry into them. The observed statistical "effects" of low-SES and high-SES schools on achievement at school entry reflect the prior influence of neighborhood social contexts and the strong correlation between neighborhood and school social contexts.

Our focus on neighborhood social contexts during the summer season and school contexts during the school season reflects the foundational hypothesis of seasonal learning theory that when school is in session, it supersedes the influence of other contexts. To examine this hypothesis, we compared across students-within-neighborhoods and students-within-schools models in Tables 3 and 4 and examined the influences of social context and minority composition. Out of the set of three comparisons (low-SES, high-SES, minority composition) across three seasons (kindergarten, summer, and first grade), we found three instances of significant disagreement between the neighborhood and school models, and each was consistent with the hypothesis (just noted) that neighborhoods were most salient during the summer and school was most salient during the school year. In kindergarten, the students-within-schools model (Table 4) indicated a negative effect of -0.15 points per month for students in low-SES schools, whereas the students-within-neighborhoods model (Table 3) did not indicate a decrement for students located in low-SES neighborhoods. In summer, the students-within-neighborhoods model indicated a contextual advantage of 0.3 points per month for students residing in high-SES neighborhoods, whereas the students-within-schools model indicated only a positive but non-significant contextual advantage for students attending high-SES schools. In first grade, the students-within schools models indicated a contextual advantage of 0.2 points per month for students attending high-SES schools, whereas the students-within-neighborhoods model found no advantage for students residing in high-SES neighborhoods. For the remaining six cases of agreement between the neighborhood and school models, strong correlations between contexts likely produced the similar observed effects. Only a cross-classification of neighborhood and school contexts could conclusively determine which context was more salient in each season. However, given the pattern of disagreements noted above, we find it reasonable to conclude that neighborhood contexts were most influential prior to school entry and during the summer, and school contexts were most influential during school seasons.

Math Achievement: Students Nested Within Neighborhoods

Table 5 presents four models predicting math growth for students nested within neighborhoods. Model 1 demonstrated that social disparities among students' families contributed to a substantial social gap in math achievement at school entry. Even after controlling for family and demographic factors in Model 2, the magnitude of the social gap amounted to 7.2 scale score points, representing one standard deviation in achievement or 5 months of school-year math achievement growth. The magnitude of the gap between lower- and upper-middle SES groups (2.8 points) represented 0.4 standard deviation units or almost 2 months of school-year math learning. In contrast, we did not find a social gap in math achievement during the summer season.

Racial/ethnic gaps in math achievement were present at school entry but not during the summer season. The Hispanic-White gap was the largest of the racial/ethnic gaps at school entry, with Hispanic students entering school 1.8 points, or 0.7 school-year months, behind White students. The smaller Black-White gap at school entry (0.7 points) amounted to 0.5 months of school-year math achievement. However, similar racial/ethnic gaps did not continue during the summer season for Hispanic of African American students.

As indicated in Model 3, neighborhood social contexts influenced math achievement at school entry and during the summer season. At school entry, high-SES neighborhoods created a contextual advantage of 1.5 points (1 month), and low-SES neighborhoods created a slightly smaller contextual disadvantage of 1.2 points (0.8 months). As in the reading results, these contextual effects did not explain away the social gap between students growing up in high- and low-SES families. However, accounting for neighborhood social context did reduce the size of the African American coefficient, making it non-significant and explaining away a portion of the Black-White gap in math at school entry. During the summer season, neighborhood social contexts continued to influence math achievement in similar ways. Students in high-SES neighborhoods benefited from a contextual advantage of 0.3 points per month, whereas students in low-SES neighborhood suffered a contextual disadvantage of 0.3 points, making for a monthly contextual gap of 0.6 points. Over the course of the summer, this contextual gap summed to a full month of school-year mathematics growth. Given the connection between family and neighborhood SES, this contextual gap likely exacerbated the social gap in math achievement present at school entry. In contrast, minority neighborhood composition did not affect math achievement prior to school entry or during the summer season. Thus, although neighborhood social context exerted clear and consistent effects prior to school entry and during the summer season, neighborhood minority composition did not appear to affect math achievement.

Math Achievement: Students Nested Within Schools

Table 6 presents four math achievement models identical to those in Table 5, with students nested in their schools rather than their home neighborhoods. A substantial social gap in math achievement appeared in kindergarten but not in first grade. Model 2 indicates a social gap of 0.16 points per month during kindergarten. This monthly gap summed to 1.5 points, or one month of school-year math growth, over the course of an average kindergarten school year. During first grade, the social gap amounted to a negligible 0.05 points per month. Surprisingly, high-SES students learned at a significantly slower pace (0.08 points) than middle-SES students. After the beginning of school, kindergarten was clearly the season in which family social background exerted the largest influence on math achievement.

Substantial Black-White and Hispanic-White gaps emerged during kindergarten. African-American students learned math at a rate 0.2 points per month slower than White students. The magnitude of the Hispanic-White gap was smaller, with Hispanic students learning at a rate 0.1 points per month slower than White students. The monthly Black-White gap summed to 1.3 months of school-year growth, and the Hispanic-White gap summed to 0.8 months of school-year growth. Both of these substantial gaps stand in stark contrast to the summer season, in which African American and Hispanic students learned math at the same rate as White students. In first grade, however, racial/ethnic gaps in math achievement did not emerge. African American and Hispanic students learned math at the same rate as White students during first grade, when holding constant the social backgrounds of students' families.

Social context and social composition did not consistently influence math achievement during the school year. During kindergarten, neither context nor composition significantly influenced math achievement; this result held while controlling for full-day kindergarten in Model 4. In first grade, we observed the unexpected result that students in high-SES schools learned math at a slower pace (0.1 points per month) than middle- and low-SES students. Upon further examination, we found that private schools accounted for the majority of this effect.[24] We find it plausible that private schools—attended largely by high-SES students—did not emphasize math achievement during first grade. Low-SES contexts did not contribute to a contextual disadvantage, and high-minority schools did not create a segregation disadvantage for math achievement during first grade. Social context was most important for math achievement at school entry and during the summer, whereas minority social composition appeared largely irrelevant to math achievement.

[24] This result was obtained through regression analysis (not included) using variables indicating school sector. Including predictors for Catholic and private (non-Catholic) schools produced the following coefficients for the first-grade slope: high-SES school (-0.079; 0.061); private school (-0.156; 0.052); Catholic school (-0.085; 0.058).

DISCUSSION

The large and persistent achievement gaps between poor minority students and middle-class White students are enduring national problems. These gaps tend to separate advantaged and disadvantaged students when they begin their formal schooling, and evidence suggests that the gaps expand as students proceed through school (Entwisle & Alexander, 1996; Phillips et al., 1998).What are the causes of these gaps, and what processes may account for their apparent widening? Differences in home resources, parenting practices, and the availability and quality of preschool are some of the factors that appear to contribute to early achievement differences between poor minority and middle-class White children (Jencks & Phillips, 1998b).The widening of achievement gaps as students proceed through school would seem to implicate schools and lend support to the contentions of researchers such as Bowles and Gintis (1976) that schools magnify existing inequities by reinforcing outside sources of disadvantage.

However, based on recent analyses of the ECLS-K data, Downey et al. (2004) suggested that schools might instead be viewed as the “great equalizer” due to the more equal educational outcomes the authors noted during the school year as compared to the out-of-school summer months. This perspective is supported by the work of earlier seasonal learning researchers, including Karl Alexander and Doris Entwisle, who suggested that the widening of the gaps is explained not by differential school-year learning rates, but rather by summer learning differences. Specifically, Entwisle and Alexander (1996) indicated that the significant achievement difference between disadvantaged and advantaged students that developed from elementary to middle school was almost entirely attributable to differences in gains made during summer vacations.

Effect of Family SES Across Seasons

Nowhere was the effect of family SES more apparent than in students’ achievement levels at school entry. In both reading and math, students from low-SES families entered school roughly one standard deviation behind their counterparts from high-SES families. In real-world terms, these differences amounted to 4.5 months of school-year reading growth and 5 months of school-year math growth, and demonstrate that low-SES students began school at a substantial disadvantage relative to all of their peers. Dispersion also occurred among students in middle-SES families, and students from lower middle SES families began school at a considerable disadvantage relative to peers from upper middle and high-SES families. While these gaps are striking, they reflect the accumulation of inequalities over the entire 5.5-year (average) life spans of students prior to elementary school. We find it entirely plausible that, for these same students, the gaps that accumulated during the entirety of elementary school equaled or exceeded the gaps at school entry.

When we compared rates of achievement growth across the school and summer seasons, we found that they varied for all students, with students from all socioeconomic groups learning at slower rates—in both reading and math—during the summer season. However, rates of achievement growth did not slow equally for all students during the summer. In keeping with the findings of previous seasonal researchers, our findings indicate that summer reading growth rates for students from low-SES families dropped below zero, indicating that these students were losing ground during the summer months. On the other hand, students from high-SES families continued to grow in reading achievement during the summer, albeit at a much slower pace than during the school year.

When we compared the sizes of socially based inequalities during the school and summer seasons, we found that the school season outweighed the summer season in importance for both reading and math. As noted above in the results of our reading subanalyses, low-SES students fell behind their middle-SES counterparts by 0.5 months (of school-year reading growth) during kindergarten, 0.6 months during summer, and 0.8 months during first grade. Whether comparing kindergarten or first grade to the summer season, the conclusion is the same: the total socioeconomic gap in reading achievement was greater during the school year than during the summer. For math, our appraisal is similar. After the start of kindergarten, low-SES students fell farthest behind high-SES students during kindergarten (1.0 months). During the summer and first grade, our analysis revealed only one socioeconomic disparity in math growth at the student level: students from high-SES families learned math at a somewhat *slower* pace than their peers during first grade. When examining the total social gaps once school had begun, the school season made larger average contributions in reading and math.

Racial Inequalities in Achievement

African American students did not begin school behind White students in reading or math, but they quickly fell behind after school started, entirely as a consequence of processes taking place during the school season. On the other hand, Hispanic students began school somewhat behind White students in reading and math, lagged behind White students during kindergarten, but learned at rates roughly equal to White students during first grade. With Hispanic students as with African American students, the summer season did not contribute to gaps with White students.

The sizes of the Black-White gaps that emerged in reading after school entry were at least as large as the social gaps noted above. African American students fell 2 months behind White students in reading over the course of kindergarten and first grade, and 1 month behind in math. Hispanic students fell behind White students in reading and math during kindergarten, although the Hispanic-White reading gap was smaller than the Black-White gap. In first grade, Hispanic students grew in reading achievement at a rate equal to that of White students, whereas African American students continued to fall behind. Consistent with the pattern of a disappearing social gap in math during first grade, African American and Hispanic students learned math at rates equal to White students in first grade. Because of the concentration of African American and Hispanic students in low-SES families, the racial/ethnic gaps must be added on to social gaps in order to arrive at the total learning disadvantages for many of these minority students.

Social Contexts, Minority Composition, and Seasonal Disparities

The effects of social contexts were most apparent at school entry, when low-SES neighborhoods were associated with a considerable disadvantage, and high-SES neighborhoods were associated with a considerable advantage in reading and math. These contextual effects at school entry did not explain away the family-based social learning gaps. Given the strong relationship between family and neighborhood SES, these effects contributed to double disadvantages (family and neighborhood) for many low-SES students and double advantages for many high-SES students. The total (high-minus-low) contextual gaps at school entry were much smaller than the social gaps, but still contributed substantially to overall learning gaps (1.4 months in reading; 1.8 months in math).

After school began, contextual effects appeared consistently during the summer season. For reading, high-SES neighborhoods provided a contextual advantage, whereas low-SES neighborhoods did not produce a statistically significant disadvantage. The size of the contextual advantage for high-SES neighborhoods was larger than the advantage for students growing up in high-SES families (both relative to middle SES), resulting in a total summer gain of 0.33 months for students in these neighborhoods. For math, social context influenced learning during the summer even when family SES did not. The magnitude of the summer season contextual gap for math was a full month of school-year math growth.

After controlling for school and neighborhood social contexts, racial composition was almost entirely irrelevant to achievement growth during the period of our study, except during first grade for reading. For students in schools with minority compositions one standard deviation above the mean, reading growth rates were 0.66 months slower over the course of the school year. Unlike the contextual effects noted above, this compositional effect explained away at least half of the Black-White gap in first-grade reading, thus making the coefficient for African American nonsignificant. This finding reinforces previous research (e.g., Coleman et al., 1966) that has concluded that the segregation of African American students into high-minority schools hinders their achievement.

CONCLUSIONS

Our study of social composition, inequality, and educational outcomes during the early elementary school years helps address a relatively large void in the literature. Indeed, Duncan and Raudenbush (2001) have stated that “research on the organization of preschool and elementary school would lead into exciting and as yet unexplored territory” (p. 368). Models of educational outcomes and compositional effects have been confined mainly to the secondary school years because these years are closer to the time when status attainment and social stratification are manifested (Entwisle & Alexander, 1999). Yet, as Entwisle and Alexander pointed out, the social context in which children’s early development occurs is crucial to understanding the trajectories that take them to their adult social positions. The research reported here brings together the observations of educational psychologists, including Bloom (1976),who have cited the dynamic cognitive changes that young children experience during the transition to formal schooling, and the work of others, notably Entwisle and Alexander, who have applied sociological theory to the problem of determining how important early learning outcomes are shaped by school context.

We find more support for Heyns’ (1978) balancing view of schools and families than for the faucet theory of Entwisle et al. (1997).Our analyses of the ECLS-K data clearly indicated that school-year differences in achievement growth, especially in the area of reading, contribute substantially to social disparities in early childhood learning. Furthermore, and in departure from previous seasonal learning research, we found that socially induced school-year learning gaps cumulated such that they exceeded socially induced summer-season learning gaps in size.

Consequently, we believe that the most effective way to reduce stratification in early childhood learning is to look for ways in which schools can be managed so as to reduce, and eliminate when possible, the persistent social disparities in school-year learning rates. Also, of course, effective preschool opportunities that reduce the large gaps in school readiness are central to reducing inequality.

Regarding the effects of social contexts, we found that they exert a substantial effect on school readiness. These effects were largely independent of family SES effects, and given the prevalent linkages between family and neighborhood SES, they make it likely that many low-SES students entered school with a double disadvantage in learning, while many high-SES students entered school with a double advantage. Finally, our findings on the strength of high- and low-SES contextual effects are consistent with the neighborhood effects literature. We suggest that more research is needed on the positive effects of advantaged social environments and the ways in which these advantages are transferred to educational opportunities and outcomes.

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Table 1
Table of Means and Standard Deviations for Full and Analytic Samples

	Full sample (*N* = 5,470)		Analytic (non-mover) sample (*n* = 4,178)	
	Mean	SD	Mean	SD
Individual-level variables				
Fall kindergarten reading scale score	23.467	9.143	23.608	9.074
Spring kindergarten reading scale score	33.676	11.426	33.887	11.266
Fall first-grade reading scale score	38.803	12.971	39.017	12.785
Spring first-grade reading scale score	55.898	14.143	56.218	13.967
Fall kindergarten math scale score	19.808	7.381	20.178**	7.374
Spring kindergarten math scale score	27.809	8.975	28.396***	8.892
Fall first-grade math scale score	32.772	9.566	33.177**	9.456
Spring first-grade math scale score	43.432	9.264	43.846**	9.089
Low SES	0.185		0.159***	
Lower middle SES	0.185		0.189	
Middle SES	0.193		0.202	
Upper middle SES	0.206		0.222*	
High SES	0.211		0.228**	
White	0.574		0.603***	
African American	0.152		0.144	
Hispanic	0.167		0.147**	
Asian or Pacific Islander	0.077		0.078	
Native American	0.025		0.027	
Gender (male = 1)	0.508		0.506	
Biological two-parent family	0.628		0.670***	
Nontraditional two-parent family	0.120		0.126	
Single-parent family	0.252		0.205***	
Number of siblings	1.466	1.180	1.472	1.189
Age (in months) at school entry	66.414	4.483	66.464	4.417
Repeated kindergarten	0.041		0.040	
Academic summer school	0.077		0.078	
Time in kindergarten before Test 1	2.222	0.522	2.212	0.523
Time in kindergarten before Test 2	8.370	0.549	8.347**	0.538
Total time in kindergarten	9.410	0.338	9.398*	0.349
Time in summer break	2.590	0.338	2.602*	0.349
Time in first grade before Test 3	1.459	0.541	1.399***	0.510
Time in first grade, Test 3 to Test 4	8.318	0.596	8.219***	0.555
*School-level variables (*n *= 292)*				
Low SES			0.199	
Middle SES			0.602	
High SES			0.199	
Percent minority			41.325	36.065
Full-day kindergarten			0.575	

	Full sample (N = 5,470)	Analytic (non-mover) sample (n = 4,178)
*Neighborhood-level variables (*n *= 699)*		
Low SES	0.200	
Middle SES	0.600	
High SES	0.200	
Percent minority	33.848	30.346

***T-test (two-tailed) or χ^2 test significant at $\alpha < 0.001$. **T-test (two-tailed) or χ^2 test significant at $\alpha < 0.01$.
*T-test (two-tailed) or χ^2 test significant at $\alpha < 0.05$.

Table 2
Average Socioeconomic and Racial/Ethnic Characteristics for Individuals, Schools, and Neighborhoods (Standard Deviations in Parentheses)

	n	SES	Parental education (years)	Median family income (dollars)	Percent minority
Individuals					
Low SES	665	-0.989	10.546	12,000	0.714
		(0.506)	(1.506)	(9,984)	
Lower middle SES	788	-0.4693	12.084	30,000	0.461
		(0.095)	(0.875)	(17,447)	
Middle SES	846	-0.131	13.254	40,000	0.371
		(0.107)	(0.928)	(31,951)	
Upper middle SES	926	0.321	14.272	55,000	0.307
		(0.162)	(1.109)	(46,961)	
High SES	953	1.148	16.536	85,000	0.233
		(0.415)	(1.504)	(83,213)	
Schools					
Low SES	58	-1.353	11.461	17,114	80.552
		(0.268)	(0.707)	(5,037)	(27.665)
Middle SES	176	0.000	13.376	40,838	34.522
		(0.461)	0.817	(12,376)	(32.392)
High SES	58	1.354	15.606	85,319	22.743
		(0.430)	0.860	(28,951)	(24.365)
Neighborhoods					
Low SES	140	-1.278	12.492	36,767	61.036
		(0.565)	(1.667)	(49,202)	(34.649)
Middle SES	419	0.000	13.788	53,963	29.696
		(0.389)	(1.551)	(40,026)	(27.037)
High SES	140	1.280	15.460	90,030	19.087
		(0.425)	(1.580)	55,582	(14.476)

Table 3

*Three-Level Models of Reading Achievement Growth for Students Nested Within Neighborhoods: By Season, From the Beginning of Kindergarten to the End of First Grade (*n *= 4,178 Students; 699 Neighborhoods)*

	Model 1		Model 2		Model 3		Model 4	
Variable name	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Initial status (intercept)	18.964***	(0.289)	20.077***	(0.394)	19.793***	(0.400)	19.628***	*(0.400)*
Neighborhood SES – low					**-0.892***	(0.421)	**-1.089***	*(0.421)*
Neighborhood SES – high					**2.112*****	(0.418)	**2.182*****	*(0.418)*
Percent minority							0.010	*(0.008)*
Low SES	**-3.696*****	(0.356)	**-3.211*****	(0.360)	**-3.111*****	(0.368)	**-3.064*****	*(0.369)*
Lower middle SES	**-1.329****	(0.393)	**-1.192****	(0.381)	**-1.064****	(0.379)	**-1.029****	*(0.381)*
Upper middle SES	**2.058*****	(0.409)	**1.911*****	(0.402)	**1.826*****	(0.408)	**1.822*****	*(0.409)*
High SES	**5.664*****	(0.487)	**5.377*****	(0.476)	**5.180*****	(0.519)	**5.108*****	*(0.520)*
African American			0.239	(0.420)	0.445	(0.412)	0.156	*(0.478)*
Hispanic			**-1.248***	(0.484)	**-1.053***	(0.464)	**-1.320****	*(0.492)*
Asian or Pacific Islander			**2.650****	(0.797)	**2.293****	(0.776)	**2.114****	*(0.739)*
Native American			**-3.371*****	(0.694)	**-3.069*****	(0.651)	**-3.465*****	*(0.720)*
Biological two-parent family			1.402***	(0.272)	1.186***	(0.267)	1.188***	*(0.267)*
Number of siblings			-0.892***	(0.119)	-0.818***	(0.116)	-0.822***	*(0.116)*
Gender (male = 1)			-1.656***	(0.259)	-1.665***	(0.256)	-1.665***	*(0.256)*
Age at kindergarten entry			0.351***	(0.036)	0.342***	(0.035)	0.347***	*(0.035)*
Repeated kindergarten			0.507	(0.691)	0.810	(0.675)	0.753	*(0.680)*
Kindergarten slope	1.722***	(0.039)	1.793***	(0.054)	1.823***	(0.056)	1.733***	*(0.063)*
Neighborhood SES – low					0.003	(0.060)	0.024	*(0.062)*
Neighborhood SES – high					**-0.212*****	(0.058)	**-0.189****	*(0.058)*
Percent minority							-0.002	*(0.001)*
Full-day kindergarten (Level 2)							**0.200*****	*(0.042)*
Low SES	**-0.204****	(0.056)	**-0.129***	(0.058)	**-0.131***	(0.059)	**-0.131***	*(0.059)*
Lower middle SES	0.068	(0.053)	-0.047	(0.054)	-0.056	(0.054)	-0.057	*(0.054)*
Upper middle SES	0.015	(0.052)	0.003	(0.052)	0.019	(0.053)	0.019	*(0.052)*
High SES	0.084	(0.051)	0.057	(0.051)	0.102	(0.052)	0.094	*(0.052)*
African American			**-0.179****	(0.052)	**-0.193*****	(0.053)	**-0.191*****	*(0.058)*
Hispanic			**-0.110***	(0.056)	**-0.120***	(0.056)	**-0.091***	*(0.057)*
Asian or Pacific Islander			0.036	(0.079)	0.040	(0.078)	0.059	*(0.078)*
Native American			-0.060	(0.076)	-0.069	(0.082)	-0.060	*(0.083)*
Biological two-parent family			0.104**	(0.034)	0.118**	(0.034)	0.120**	*(0.034)*
Number of siblings			-0.023	(0.014)	-0.025	(0.014)	-0.022	*(0.014)*
Gender (male = 1)			-0.113**	(0.034)	-0.112**	(0.034)	-0.106**	*(0.034)*

Variable name	Model 1 Coefficient	Model 1 SE	Model 2 Coefficient	Model 2 SE	Model 3 Coefficient	Model 3 SE	Model 4 Coefficient	Model 4 SE
Age at kindergarten entry			0.006	(0.004)	0.006	(0.004)	0.005	*(0.004)*
Repeated kindergarten			-0.359***	(0.082)	-0.372***	(0.082)	-0.388***	*(0.082)*
Summer slope	-0.067	(0.082)	-0.050	(0.108)	-0.083	(0.110)	-0.130	*(0.109)*
Neighborhood SES – low					-0.048	(0.123)	-0.111	*(0.136)*
Neighborhood SES – high					**0.267***	(0.126)	**0.295***	*(0.126)*
Percent minority							0.002	*(0.002)*
Low SES	**-0.249***	(0.116)	**-0.264***	(0.122)	**-0.251***	(0.122)	**-0.244***	*(0.123)*
Lower middle SES	0.042	(0.110)	0.038	(0.111)	0.051	(0.111)	0.057	*(0.111)*
Upper middle SES	0.186	(0.109)	0.184	(0.107)	0.160	(0.107)	0.161	*(0.109)*
High SES	**0.254***	(0.114)	**0.257***	(0.113)	**0.197***	(0.113)	**0.190***	*(0.116)*
African American			**0.250***	(0.112)	**0.272***	(0.114)	**0.223***	*(0.127)*
Hispanic			0.127	(0.130)	0.149	(0.130)	0.111	*(0.136)*
Asian or Pacific Islander			**0.508****	(0.166)	**0.513****	(0.164)	**0.480****	*(0.168)*
Native American			**-0.281***	(0.127)	**-0.226***	(0.148)	-0.280	*(0.166)*
Biological two-parent family			0.033	(0.079)	0.021	(0.080)	0.019	*(0.080)*
Number of siblings			-0.057	(0.080)	-0.055	(0.030)	-0.055	*(0.030)*
Gender (male = 1)			-0.071	(0.075)	-0.073	(0.074)	-0.074	*(0.075)*
Age at kindergarten entry			0.020**	(0.009)	0.021**	(0.008)	0.022*	*(0.009)*
Repeated kindergarten			-0.244	(0.184)	-0.243	(0.182)	-0.268	*(0.182)*
Academic summer school							0.099	*(0.110)*
First-grade slope	2.575***	(0.042)	2.627***	(0.058)	2.625***	(0.058)	2.687***	*(0.062)*
Neighborhood SES – low					-0.052	(0.066)	0.031	*(0.073)*
Neighborhood SES – high					0.036	(0.065)	0.007	*(0.065)*
Percent minority							**-0.003****	*(0.001)*
Low SES	**-0.301**	(0.063)	**-0.248*****	(0.064)	**-0.242*****	(0.064)	**-0.248*****	*(0.065)*
Lower middle SES	-0.064	(0.054)	-0.050	(0.053)	-0.046	(0.053)	-0.051	*(0.053)*
Upper middle SES	0.057	(0.055)	0.043	(0.055)	0.041	(0.055)	0.041	*(0.056)*
High SES	-0.000	(0.061)	-0.026	(0.061)	-0.033	(0.062)	-0.025	*(0.063)*
African American			**-0.278*****	(0.065)	**-0.272*****	(0.066)	**-0.200****	*(0.070)*
Hispanic			**-0.140***	(0.062)	-0.122+	(0.062)	-0.058	*(0.065)*
Asian or Pacific Islander			-0.227*	(0.080)	-0.232*	(0.079)	-0.182*	*(0.081)*
Native American			-0.074	(0.125)	-0.067	(0.131)	-0.018	*(0.128)*
Biological two-parent family			0.048	(0.039)	0.049	(0.040)	0.050	*(0.040)*
Number of siblings			0.014	(0.016)	0.014	(0.016)	0.016	*(0.016)*
Gender (male = 1)			-0.028	(0.036)	-0.028	(0.036)	-0.028	*(0.036)*

	Model 1		Model 2		Model 3		Model 4	
Variable name	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Age at kindergarten entry			-0.017***	(0.004)	-0.016**	(0.004)	-0.017***	*(0.004)*
Repeated kindergarten			-0.164	(0.112)	-0.193	(0.110)	-0.172	*(0.110)*
Random effects	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2
Level 1and 2 variance (*df*)		(2885)		(2876)		(2231)		*(2231)*
Initial status	56.407	16082.4***	53.468	16103.7***	49.950	15069.0***	49.984	*15125.4****
Kindergarten slope	0.653	10265.9***	0.638	10397.6***	0.638	11062.3***	0.635	*11028.9****
Summer slope	2.310	6579.3***	2.286	6564.7***	2.283	6589.7***	2.282	*6596.0****
First-grade slope	1.021	15184.0***	1.010	15278.3***	0.997	14902.3***	0.999	*15044.4****
Level 3 variance (*df*)		(659)		(659)		(94)		*(94)*
Initial status	7.706	1142.6***	4.792	1027.2***	1.827	119.9*	1.764	*117.1**
Kindergarten slope	0.103	1079.7***	0.100	1081.4***	0.096	163.4***	0.086	*115.1****
Summer slope	0.302	948.4***	0.292	941.8***	0.290	148.2***	0.282	*147.1****
First-grade slope	*0.116*	*1055.6****	*0.104*	*1014.1****	*0.109*	*182.1****	*0.102*	*168.8****

Note. All coefficients and standard errors computed using HLM 6.02.
****P*-value < 0.001. ***P*-value < 0.01. **P*-value < 0.05. +*P*-value = 0.05.

Table 4

*Three-Level Models of Reading Achievement Growth for Students Nested Within Schools: By Season, From the Beginning of Kindergarten to the End of First Grade (*n *= 4,178 Students/292 Schools)*

	Model 1		Model 2		Model 3		Model 4	
Variable name	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Initial status (intercept)	18.687***	(0.297)	19.830***	(0.383)	19.598***	(0.409)	19.748***	*(0.434)*
School SES – low					-1.681**	(0.473)	-1.466**	*(0.555)*
School SES – high					2.402***	(0.458)	2.315***	*(0.461)*
Percent minority							-0.005	*(0.008)*
Low SES	**-3.424*** **	(0.352)	**-3.018*** **	(0.368)	**-2.732*** **	(0.380)	**-2.736*** **	*(0.380)*
Lower middle SES	**-1.011***	(0.392)	**-0.946***	(0.381)	**-0.851***	(0.378)	**-0.842***	*(0.377)*
Upper middle SES	**1.864*** **	(0.405)	**1.748*** **	(0.401)	**1.639*** **	(0.398)	**1.641*** **	*(0.398)*
High SES	**5.138*** **	(0.513)	**4.957*** **	(0.503)	**4.200*** **	(0.506)	**4.209*** **	*(0.506)*
African American			0.234	(0.460)	0.654	(0.490)	0.776	*(0.543)*
Hispanic			**-1.248***	(0.488)	**-1.039***	(0.468)	**-0.947***	*(0.545)*
Asian or Pacific Islander			**2.362** **	(0.800)	**2.119** **	(0.770)	**2.219** **	*(0.761)*
Native American			**-3.093*** **	(0.742)	**-2.315** **	(0.721)	**-2.207** **	*(0.758)*
Biological two-parent family			1.378***	(0.290)	1.208***	(0.285)	1.202***	*(0.284)*
Number of siblings			-0.838***	(0.118)	-0.775***	(0.116)	-0.776***	*(0.116)*
Gender (male = 1)			-1.595***	(0.258)	-1.609***	(0.256)	-1.610***	*(0.257)*
Age at kindergarten entry			0.340***	(0.038)	0.327***	(0.037)	0.326***	*(0.037)*
Repeated kindergarten			0.672	(0.691)	0.933	(0.654)	0.956	*(0.656)*
Kindergarten slope	1.681***	(0.045)	1.752***	(0.056)	1.806***	(0.060)	1.680***	*(0.067)*
School SES – low					-0.117	(0.069)	**-0.157***	*(0.072)*
School SES – high					**-0.214** **	(0.073)	**-0.190***	*(0.072)*
Percent minority							0.001	*(0.001)*
Full-day kindergarten							0.171**	*(0.049)*
Low SES	**-0.188** **	(0.056)	**-0.121***	(0.057)	**-0.116***	(0.058)	-0.113	*(0.058)*
Lower middle SES	-0.052	(0.054)	-0.034	(0.054)	-0.040	(0.054)	-0.041	*(0.054)*
Upper middle SES	0.038	(0.054)	0.028	(0.054)	0.022	(0.053)	0.021	*(0.053)*
High SES	**0.110***	(0.052)	0.084	(0.053)	**0.122***	(0.054)	**0.119***	*(0.054)*
African American			**-0.206*** **	(0.056)	**-0.212*** **	(0.057)	**-0.255*** **	*(0.064)*
Hispanic			**-0.127***	(0.056)	**-0.121***	(0.055)	**-0.138***	*(0.059)*
Asian or Pacific Islander			-0.003	(0.082)	0.008	(0.081)	-0.012	*(0.084)*
Native American			-0.039	(0.081)	-0.033	(0.083)	-0.081	*(0.088)*
Biological two-parent family			0.105**	(0.035)	0.113**	(0.035)	0.116**	*(0.035)*
Number of siblings			-0.012	(0.014)	-0.012	(0.014)	-0.012	*(0.014)*

Variable name	Model 1 Coefficient	Model 1 SE	Model 2 Coefficient	Model 2 SE	Model 3 Coefficient	Model 3 SE	Model 4 Coefficient	Model 4 SE
Gender (male = 1)			-0.122***	(0.034)	-0.124**	(0.034)	-0.123***	*(0.034)*
Age at kindergarten entry			0.004	(0.004)	0.004	(0.004)	0.004	*(0.004)*
Repeated kindergarten			-0.332***	(0.086)	-0.332***	(0.084)	-0.346***	*(0.083)*
Summer slope	-0.060	(0.083)	-0.027	(0.108)	-0.058	(0.110)	0.011	*(0.115)*
School SES – low					-0.052	0.147	0.049	*(0.160)*
School SES – high					0.193	0.134	0.167	*(0.134)*
Percent minority							-0.003	*(0.002)*
Low SES	**-0.248***	(0.121)	**-0.274***	(0.125)	**-0.258***	(0.125)	**-0.263***	*(0.126)*
Lower middle SES	0.052	(0.109)	0.040	(0.110)	0.044	(0.110)	0.046	*(0.110)*
Upper middle SES	0.157	(0.106)	0.158	(0.104)	0.142	(0.106)	0.147	*(0.106)*
High SES	0.203	(0.112)	0.217	(0.111)	0.168	(0.118)	0.175	*(0.118)*
African American			**0.244***	(0.119)	**0.274***	(0.122)	**0.359****	*(0.133)*
Hispanic			0.151	(0.133)	0.175	(0.129)	0.258	*(0.141)*
Asian or Pacific Islander			**0.487****	(0.153)	**0.492****	(0.150)	**0.573*****	*(0.155)*
Native American			-0.254	(0.135)	-0.190	(0.150)	-0.146	*(0.164)*
Biological two-parent family			0.016	(0.078)	0.009	(0.078)	0.004	*(0.079)*
Number of siblings			-0.054	(0.031)	-0.051	(0.031)	-0.052	*(0.031)*
Gender (male = 1)			-0.075	(0.073)	-0.074	(0.073)	-0.072	*(0.074)*
Age at kindergarten entry			0.018*	(0.008)	0.017*	(0.008)	0.016*	*(0.008)*
Repeated kindergarten			-0.243	(0.172)	-0.221	(0.173)	-0.223	*(0.172)*
Academic summer school							0.105	*(0.105)*
First-grade slope	**2.588*****	(0.044)	**2.627*****	(0.057)	**2.616*****	(0.059)	**2.729*****	*(0.067)*
School SES – low					-0.143	(0.079)	0.006	*(0.088)*
School SES – high					**0.232***	(0.084)	**0.192***	*(0.082)*
Percent minority							**-0.004*****	*(0.001)*
Low SES	**-0.262*****	(0.062)	**-0.227****	(0.064)	**-0.206****	(0.065)	**-0.209****	*(0.065)*
Lower middle SES	**-0.074**	(0.052)	-0.063	(0.051)	-0.046	(0.051)	-0.046	*(0.051)*
Upper middle SES	**0.028**	(0.052)	0.020	(0.051)	0.000	(0.051)	0.002	*(0.051)*
High SES	**-0.037**	(0.062)	-0.055	(0.062)	-0.081	(0.061)	-0.077	*(0.061)*
African American			**-0.202****	(0.067)	**-0.193****	(0.067)	-0.112	*(0.067)*
Hispanic			-0.100	(0.064)	-0.072	(0.064)	0.004	*(0.064)*
Asian or Pacific Islander			-0.145	(0.075)	-0.128	(0.073)	-0.053	*(0.073)*
Native American			-0.022	(0.128)	0.038	(0.124)	0.120	*(0.124)*
Biological two-parent family			0.037	(0.039)	0.033	(0.039)	0.031	*(0.039)*
Number of siblings			0.004	(0.015)	0.003	(0.014)	0.003	*(0.014)*

Variable name	Model 1 Coefficient	Model 1 SE	Model 2 Coefficient	Model 2 SE	Model 3 Coefficient	Model 3 SE	Model 4 Coefficient	Model 4 SE
Gender (male = 1)			-0.008	(0.036)	-0.008	(0.036)	-0.005	*(0.036)*
Age at kindergarten entry			-0.014	(0.005)	-0.013	(0.004)	-0.014**	*(0.004)*
Repeated kindergarten					-0.259*	(0.101)	-0.252*	*(0.101)*
Random effects	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2
Level 1and 2 variance (*df*)		(3262)		(3253)		(2985)		*(2985)*
Initial status	55.537	15970.6***	52.463	15655.3***	50.782***	14479.8	50.791***	*14548.3*
Kindergarten slope	0.611	9909.5***	0.596	10026.7***	0.578***	9986.9	0.578***	*10020.5*
Summer slope	2.266	6485.2***	2.242	6473.6***	2.237***	6586.6	2.235***	*6590.6*
First-grade slope	0.945	13708.7***	0.938	13710.9***	0.917***	13233.8	0.917***	*13275.8*
Level 3 variance (*df*)		(285)		(285)		(84)		*(84)*
Initial status	8.020	701.2***	5.594	585.5***	2.896***	135.1	2.857***	*135.7*
Kindergarten slope	0.142	819.8***	0.142	829.0***	0.143***	185.7	0.126***	*168.8*
Summer slope	0.336	542.2***	0.328	535.7***	0.334***	177.3	0.325***	*175.4*
First-grade slope	*0.191*	*904.2****	*0.177*	*861.0****	*0.146****	*209.0*	*0.139****	*205.2*

Note. All coefficients and standard errors computed using HLM 6.02.

****P*-value < 0.001. ***P*-value < 0.01. **P*-value < 0.05.

Table 5

*Three-Level Models of Mathematics Achievement Growth for Students Nested Within Neighborhoods: By Season, From the Beginning of Kindergarten to the End of First Grade (*n *= 4,178 Students; 699 Neighborhoods)*

	Model 1		Model 2		Model 3		Model 4	
Variable name	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Initial status (intercept)	16.772***	(0.236)	17.425***	(0.310)	17.266***	(0.306)	17.172***	*(0.316)*
Neighborhood SES – low					**-1.213****	(0.337)	**-1.350*****	*(0.362)*
Neighborhood SES – high					**1.478*****	(0.350)	**1.545*****	*(0.351)*
Percent minority							0.006	*(0.006)*
Low SES	**-3.637*****	(0.315)	**-3.022*****	(0.320)	**-2.866*****	(0.329)	**-2.850*****	*(0.328)*
Lower middle SES	**-1.003****	(0.312)	**-0.847****	(0.301)	**-0.758***	(0.302)	**-0.740***	*(0.304)*
Upper middle SES	**1.481*****	(0.330)	**1.296*****	(0.312)	**1.209*****	(0.315)	**1.205*****	*(0.315)*
High SES	**4.493*****	(0.378)	**4.177*****	(0.364)	**3.931*****	(0.370)	**3.891*****	*(0.368)*
African American			**-0.691***	(0.328)	-0.504	(0.321)	-0.660	*(0.362)*
Hispanic			**-1.812*****	(0.319)	**-1.483*****	(0.307)	**-1.640*****	*(0.351)*
Asian or Pacific Islander			0.486	(0.477)	0.360	(0.472)	0.272	*(0.472)*
Native American			**-2.352****	(0.750)	**-2.366****	(0.638)	**-2.538****	*(0.678)*
Biological two-parent family			1.247***	(0.210)	1.118***	(0.208)	1.113***	*(0.209)*
Number of siblings			-0.581***	(0.088)	-0.552***	(0.086)	-0.554***	*(0.086)*
Gender (male = 1)			-0.481*	(0.201)	-0.478*	(0.199)	-0.483*	*(0.200)*
Age at kindergarten entry			0.433***	(0.026)	0.430***	(0.026)	0.432***	*(0.026)*
Repeated kindergarten			-1.336*	(0.574)	-1.229*	(0.580)	-1.247*	*(0.578)*
Kindergarten slope	1.366***	(0.030)	1.369***	(0.040)	1.370***	(0.044)	1.340***	*(0.048)*
Neighborhood SES – low					0.083	(0.045)	**0.101***	*(0.047)*
Neighborhood SES – high					-0.060	(0.045)	-0.055	*(0.046)*
Percent minority							-0.001	*(0.001)*
Full-day kindergarten							0.078**	*(0.026)*
Low SES	**-0.167*****	(0.041)	**-0.127****	(0.043)	**-0.133****	(0.043)	**-0.134****	*(0.043)*
Lower middle SES	**-0.082***	(0.041)	-0.069	(0.040)	-0.075	(0.040)	-0.076	*(0.040)*
Upper middle SES	**0.028**	(0.041)	0.022	(0.040)	0.024	(0.040)	0.024	*(0.040)*
High SES	**0.066**	(0.045)	0.048	(0.044)	0.060	(0.044)	0.058	*(0.044)*
African American			**-0.222*****	(0.043)	**-0.229*****	(0.044)	**-0.220*****	*(0.048)*
Hispanic			**-0.115****	(0.044)	**-0.132****	(0.044)	**-0.110***	*(0.046)*
Asian or Pacific Islander			-0.033	(0.052)	-0.039	(0.051)	-0.026	*(0.052)*
Native American			-0.087	(0.081)	-0.089	(0.076)	-0.077	*(0.078)*
Biological two-parent family			0.041	(0.029)	0.048	(0.029)	0.049	*(0.029)*
Number of siblings			0.012	(0.012)	0.012	(0.012)	0.013	*(0.011)*

	Model 1		Model 2		Model 3		Model 4	
Variable name	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Gender (male = 1)			0.016	(0.028)	0.017	(0.028)	0.020	*(0.028)*
Age at kindergarten entry			0.001	(0.003)	0.001	(0.003)	0.001	*(0.003)*
Repeated kindergarten			-0.157*	(0.074)	-0.160*	(0.075)	-0.166*	*(0.075)*
Summer slope	0.442***	(0.078)	0.341***	(0.107)	0.325***	(0.107)	0.348***	*(0.116)*
Neighborhood SES – low					**-0.279***	(0.120)	**-0.252***	*(0.128)*
Neighborhood SES – high					**0.271***	(0.112)	**0.269***	*(0.114)*
Percent minority							-0.001	*(0.002)*
Low SES	-0.054	(0.118)	-0.061	(0.116)	0.020	(0.118)	0.018	*(0.118)*
Lower middle SES	0.066	(0.104)	0.063	(0.103)	0.090	(0.104)	0.090	*(0.105)*
Upper middle SES	-0.087	(0.098)	-0.094	(0.098)	-0.109	(0.098)	-0.110	*(0.098)*
High SES	0.165	(0.109)	0.157	(0.110)	0.096	(0.109)	0.098	*(0.110)*
African American			0.054	(0.113)	0.088	(0.113)	0.165	*(0.122)*
Hispanic			0.021	(0.116)	0.021	(0.114)	0.107	*(0.118)*
Asian or Pacific Islander			0.258	(0.139)	0.242	(0.139)	0.262	*(0.144)*
Native American			**-0.374***	(0.186)	-0.280	(0.188)	-0.253	*(0.192)*
Biological two-parent family			0.020	(0.077)	0.009	(0.076)	0.007	*(0.075)*
Number of siblings			0.026	(0.028)	0.028	(0.028)	0.028	*(0.028)*
Gender (male = 1)			0.086	(0.069)	0.088	(0.069)	0.091	*(0.069)*
Age at kindergarten entry			0.014	(0.009)	0.014	(0.009)	0.014	*(0.009)*
Repeated kindergarten			-0.274	(0.167)	-0.287	(0.167)	-0.273	*(0.166)*
Academic summer school							-0.154	*(0.101)*
First-grade slope	1.564***	(0.029)	1.566***	(0.041)	1.571***	(0.042)	1.594***	*(0.044)*
Neighborhood SES – low					0.044	(0.047)	0.074	*(0.045)*
Neighborhood SES – high					**-0.082***	(0.039)	**-0.094***	*(0.040)*
Percent minority							-0.001	*(0.001)*
Low SES	-0.012	(0.042)	-0.017	(0.044)	-0.026	(0.045)	-0.027	*(0.044)*
Lower middle SES	0.020	(0.039)	0.020	(0.039)	0.014	(0.039)	0.012	*(0.039)*
Upper middle SES	0.056	(0.037)	0.058	(0.037)	0.065	(0.037)	0.065	*(0.037)*
High SES	**-0.105****	(0.039)	**-0.099***	(0.039)	**-0.080***	(0.039)	**-0.077***	*(0.039)*
African American			-0.063	(0.041)	-0.071	(0.042)	-0.045	*(0.046)*
Hispanic			0.032	(0.043)	0.021	(0.043)	0.047	*(0.044)*
Asian or Pacific Islander			**-0.214*****	(0.047)	**-0.214*****	(0.046)	**-0.195*****	*(0.048)*
Native American			-0.025	(0.090)	-0.039	(0.097)	-0.008	*(0.102)*
Biological two-parent family			-0.020	(0.028)	-0.013	(0.028)	-0.012	*(0.028)*
Number of siblings			0.012	(0.011)	0.011	(0.011)	0.011	*(0.011)*

	Model 1		Model 2		Model 3		Model 4	
Variable name	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Gender (male = 1)			0.036	(0.025)	0.038	(0.025)	0.038	*(0.025)*
Age at kindergarten entry			-0.020***	(0.003)	-0.020***	(0.003)	-0.021***	*(0.003)*
Repeated kindergarten			-0.047	(0.069)	-0.049	(0.069)	-0.042	*(0.069)*
Random Effects	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2
Level 1and 2 variance (*df*)		(3016)		(3007)		(2356)		*(2356)*
Initial status	34.358	14402.5***	31.400	13766.8***	30.355	13951.8***	30.354	*13967.3***
Kindergarten slope	0.360	8284.1***	0.355	8327.0***	0.355	9113.9***	0.354	*9050.3****
Summer slope	2.297	7572.6***	2.295	7555.0***	2.256	7539.9***	2.259	*7556.2****
First-grade slope	0.381	9546.9***	0.373	9448.2***	0.372	9465.2***	0.372	*9491.1****
Level 3 variance (*df*)		(667)		(667)		(40)		*(39)*
Initial status	5.476	1175.0***	3.130	1021.1***	0.946	37.8	0.987	*37.9*
Kindergarten slope	0.055	987.5***	0.053	973.8***	0.051	87.5***	0.047	*83.6****
Summer slope	0.300	946.9***	0.286	930.1***	0.320	74.9***	0.313	*75.2****
First-grade slope	*0.042*	*951.9****	*0.039*	*934.2****	*0.039*	*80.8****	*0.037*	*78.6****

Note. All coefficients and standard errors computed using HLM 6.02.
****P*-value < 0.001. ***P*-value < 0.01. **P*-value < 0.05.

Table 6

*Three-Level Models of Mathematics Achievement Growth for Students Nested Within Schools: By Season, From the Beginning of Kindergarten to the End of First Grade (*n *= 4,178 Students/292 Schools)*

	Model 1		Model 2		Model 3		Model 4	
Variable name	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Initial status (intercept)	16.570***	(0.244)	17.291***	(0.323)	17.122***	(0.338)	17.182***	*(0.360)*
School SES – low					**-1.752*****	(0.325)	**-1.664*****	*(0.396)*
School SES – high					**2.034*****	(0.374)	**2.004*****	*(0.371)*
Percent minority							-0.003	*(0.006)*
Low SES	**-3.406*****	(0.311)	**-2.836*****	(0.326)	**-2.414*****	(0.336)	**-2.420*****	*(0.336)*
Lower middle SES	**-0.863****	(0.306)	**-0.740***	(0.298)	**-0.602***	(0.297)	**-0.600***	*(0.297)*
Upper middle SES	**1.327*****	(0.311)	**1.177*****	(0.294)	**0.966****	(0.290)	**0.967****	*(0.290)*
High SES	**4.108*****	(0.385)	**3.870*****	(0.366)	**3.266*****	(0.365)	**3.279*****	*(0.365)*
African American			**-0.848***	(0.352)	-0.456	(0.366)	-0.329	*(0.408)*
Hispanic			**-1.900*****	(0.311)	**-1.482*****	(0.312)	**-1.387*****	*(0.361)*
Asian or Pacific Islander			0.231	(0.479)	0.316	(0.482)	0.432	*(0.514)*
Native American			-2.220**	(0.820)	-1.659*	(0.651)	-1.541*	*(0.660)*
Biological two-parent family			1.245***	(0.209)	1.133***	(0.206)	1.126***	*(0.206)*
Number of siblings			-0.553***	(0.087)	-0.524***	(0.089)	-0.525***	*(0.089)*
Gender (male = 1)			-0.449*	(0.201)	-0.448*	(0.202)	-0.446*	*(0.201)*
Age at kindergarten entry			0.426***	(0.028)	0.420***	(0.028)	0.418***	*(0.028)*
Repeated kindergarten			-1.247*	(0.585)	-1.194	(0.634)	-1.169	*(0.634)*
Kindergarten slope	1.355***	(0.032)	1.356***	(0.042)	1.371***	(0.045)	1.320***	*(0.050)*
School SES – low					-0.044	(0.053)	-0.050	*(0.060)*
School SES – high					-0.064	(0.056)	-0.059	*(0.056)*
Percent minority							0.000	*(0.001)*
Full-day kindergarten							0.084**	*(0.032)*
Low SES	**-0.148****	(0.043)	**-0.122****	(0.044)	**-0.128****	(0.046)	**-0.128****	*(0.046)*
Lower middle SES	-0.071	(0.041)	-0.062	(0.041)	-0.060	(0.041)	-0.061	*(0.041)*
Upper middle SES	0.021	(0.038)	0.018	(0.037)	0.023	(0.037)	0.023	*(0.037)*
High SES	0.060	(0.045)	0.047	(0.044)	0.068	(0.044)	0.067	*(0.044)*
African American			**-0.208*****	(0.046)	**-0.204*****	(0.046)	**-0.223*****	*(0.049)*
Hispanic			**-0.118****	(0.045)	**-0.117***	(0.046)	**-0.124***	*(0.049)*
Asian or Pacific Islander			-0.034	(0.051)	-0.034	(0.052)	-0.043	*(0.055)*
Native American			-0.067	(0.089)	-0.049	(0.091)	-0.069	*(0.090)*
Biological two-parent family			0.033	(0.029)	0.036	(0.029)	0.038	*(0.029)*
Number of siblings			0.016	(0.011)	0.017	(0.011)	0.018	*(0.011)*

	Model 1		Model 2		Model 3		Model 4	
Variable name	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Gender (male = 1)			0.015	(0.027)	0.013	(0.027)	0.014	*(0.027)*
Age at kindergarten entry			-0.001	(0.003)	-0.001	(0.003)	-0.001	*(0.003)*
Repeated kindergarten			-0.113	(0.071)	-0.116	(0.070)	-0.126	*(0.071)*
Summer slope	0.452***	(0.081)	0.371***	(0.108)	0.336**	(0.111)	0.398**	*(0.125)*
School SES – low					0.017	(0.136)	0.090	*(0.151)*
School SES – high					0.263*	(0.126)	0.242	*(0.128)*
Percent minority							-0.002	*(0.002)*
Low SES	-0.075	(0.112)	-0.080	(0.112)	-0.063	(0.114)	-0.065	*(0.115)*
Lower middle SES	0.056	(0.106)	0.052	(0.106)	0.058	(0.106)	0.059	*(0.106)*
Upper middle SES	-0.098	(0.095)	-0.103	(0.096)	-0.136	(0.096)	-0.135	*(0.096)*
High SES	0.162	(0.111)	0.160	(0.111)	0.084	(0.113)	0.086	*(0.114)*
African American			0.026	(0.115)	0.038	(0.122)	0.120	*(0.134)*
Hispanic			0.028	(0.118)	0.021	(0.118)	0.096	*(0.130)*
Asian or Pacific Islander			0.234	(0.132)	0.234	(0.132)	0.312*	*(0.148)*
Native American			-0.376	(0.208)	**-0.412***	(0.203)	-0.329	*(0.208)*
Biological two-parent family			0.011	(0.077)	0.001	(0.077)	-0.001	*(0.077)*
Number of siblings			0.025	(0.028)	0.023	(0.028)	0.023	*(0.028)*
Gender (male = 1)			0.083	(0.065)	0.084	(0.065)	0.089	*(0.065)*
Age at kindergarten entry			0.016	(0.008)	0.017*	(0.009)	0.016	*(0.009)*
Repeated kindergarten			-0.321	(0.174)	-0.344*	(0.174)	-0.332	*(0.173)*
Academic summer school							-0.117	*(0.107)*
First-grade slope	1.578***	(0.031)	1.574***	(0.043)	1.592***	(0.044)	1.628***	*(0.049)*
School SES – low					0.023	(0.057)	0.073	*(0.061)*
School SES – high					**-0.104***	(0.045)	**-0.116***	*(0.045)*
Percent minority							-0.001	*(0.001)*
Low SES	-0.028	(0.041)	-0.032	(0.044)	-0.040	(0.044)	-0.041	*(0.044)*
Lower middle SES	0.004	(0.039)	0.006	(0.039)	0.000	(0.040)	0.000	*(0.040)*
Upper middle SES	0.060	(0.035)	0.062	(0.035)	0.069	(0.035)	0.070	*(0.035)*
High SES	**-0.088**	(0.039)	**-0.084***	(0.038)	-0.062	(0.040)	-0.062	*(0.040)*
African American			-0.042	(0.043)	-0.054	(0.043)	-0.024	*(0.048)*
Hispanic			0.039	(0.044)	0.030	(0.044)	0.057	*(0.045)*
Asian or Pacific Islander			-0.185**	(0.046)	-0.188***	(0.046)	-0.161***	*(0.049)*
Native American			-0.075	(0.108)	-0.089	(0.111)	-0.059	*(0.115)*
Biological two-parent family			-0.016	(0.029)	-0.012	(0.029)	-0.014	*(0.029)*
Number of siblings			0.008	(0.011)	0.008	(0.011)	0.008	*(0.011)*

Variable name	Model 1 Coefficient	SE	Model 2 Coefficient	SE	Model 3 Coefficient	SE	Model 4 Coefficient	SE
Gender (male = 1)			0.037	(0.024)	0.037	(0.024)	0.038	*(0.024)*
Age at kindergarten entry			-0.020***	(0.003)	-0.020***	(0.003)	-0.021***	*(0.003)*
Repeated kindergarten			-0.044	(0.065)	-0.037	(0.065)	-0.034	*(0.065)*
Random effects	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2
Level 1and 2 variance (*df*)		(3398)		(3389)		(3120)		*(3120)*
Initial status	34.372	14745.8***	31.260	13841.1***	30.493	13269.2***	30.489	*13309.3****
Kindergarten slope	0.346	8333.1***	0.342	8499.7***	0.338	8615.9***	0.337	*8572.0****
Summer slope	2.268	7504.0***	2.264	7491.9***	2.254	7444.0***	2.256	*7450.5****
First-grade slope	0.366	9124.5***	0.359	9033.3***	0.351	8888.1***	0.351	*8895.2****
Level 3 variance (*df*)		(288)		(287)		(61)		*(59)*
Initial status	5.101	716.8***	3.084	562.8***	1.340	76.5	1.340	*75.7*
Kindergarten slope	0.070	714.0***	0.065	699.5***	0.260	148.1***	0.260	*149.3****
Summer slope	0.331	597.5***	0.320	584.1***	0.556	137.4***	0.556	*139.3****
First-grade slope	*0.058*	*707.0****	*0.055*	*689.3****	*0.251*	*161.4****	*0.251*	*153.9****

Note. All coefficients and standard errors computed using HLM 6.02.
***P-value < 0.001. **P-value < 0.01. *P-value < 0.05.