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When and Where Does Achievement Inequality Grow? Ecology, the City and Social Disorganization

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Author :

Odis Johnson, Jr.
University of
Maryland

When and Where Does Achievement Inequality Grow? Ecology, the City and Social Disorganization[1]

ODIS JOHNSON, JR., PhD.

University of Maryland
African American Studies & Maryland Population Research Center
1139 Taliaferro Hall
College Park, MD 20742
ojohnson@umd.edu
301.405.1158

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ABSTRACT

Children growing up in central cities are less likely to excel in the critical areas of math and reading from the start of their educational careers, lessening their future chances of finishing high school, attending college, and becoming gainfully employed. Earlier studies within urban contexts concluded that much of the racial inequality in children's test performance resulted from what low income African American children did not learn while school was in recess. In contrast, recent examinations of national samples show racial differences in test-scores grow most while school is in session. To understand how the ecology of neighborhoods and cities might explain the differences among earlier and recent studies, I assess the growth of racial, social-class, and residential test-score gaps within school and non-school contexts using a full and city sample of children from the Early Childhood Longitudinal Study. Residential gaps are examined with indicators of neighborhood social disorganization. I find that changes in the relative size of race and social class gaps for children nationally show no pattern related to the context in which they arise, that social-class test gaps in the city are greater than racial inequality in all contexts, and that neighborhood social disorganization often appears as the greatest social dimension of test-score inequality. I conclude with a discussion of the study's implications for research and policy making.

INTRODUCTION

Inequality in children's test performance continues to be a troubling reality. Urban African-American fourth graders have trailed their white counterparts by 31 points on the National Assessment of Educational Progress (NAEP) math tests since 2004. In contrast, the math gap between urban Hispanics and whites increased to 25 points in 2007 (U.S. Dept. of Education 2008). Differences in children's test performance according to the socioeconomic status (SES) of families are just as concerning. There is a 24-point gap in math scores between 4th grade children that are eligible for free lunch and those who are not (NCES 2011). Yet, perhaps the largest test-score gap ever documented in NAEP math has been between children living in the inner-city and the urban fringe, which had eclipsed the size of the social class and race test-score gaps, for all age groups, in every year those data were collected (Shaughnessy, Nelson and Norris 1998).

While we have ample evidence about these disparities, uncertainty remains within research as to *when* and *in which context* they are likely to develop. Do they develop when children are engaged in schooling, as they learn outside of school, or in both situations? The importance of this question is underscored by policymakers' attempts to hold schools and teachers accountable for group differences in test performance (Kane and Staiger 2003). If achievement inequality arises while children are away from school—before they enter kindergarten or during the summer recess—then No Child Left Behind (NCLB) mandates also hold school personnel accountable for learning that occurs at a time and place beyond their reach. While this conundrum has been discussed in other investigations of school versus non-school achievement differences (see Downey, von Hippel and Broh 2004; and Condron 2009), this study extends from a related federal policy challenge: achieving a similar performance standard for all schools, irrespective of their location, will be arduous if inequalities in the non-school contexts of city children are greater than those found in other residential areas, and consequential to their learning.

Pursuant to this possibility, I bring the dimension of residential stratification to bear on an understanding of how achievement inequality differs between school and non-school contexts, relying on an innovative methodological approach and data from the Early Childhood Longitudinal Study, Kindergarten cohort (ECLS-K). First, I examine racial/ethnic, social class and gender inequality in math and reading across four contexts: two in which learning occurs outside of the NCLB context (i.e. before children enter kindergarten and the following summer recess) and two school contexts (i.e. kindergarten and first grade). Growth in test-score inequality is therefore separated and contrasted in a natural experimental framework, between children's school and non-school contexts. Second, I estimate achievement differences for a subset of children that reside in central cities to explain inconsistencies in the findings of earlier and more recent examinations of test-score inequality. Third, I use a multilevel statistical methodology to examine relationships between children's residential features and achievement within school and non-school contexts, and again within central cities. This study's results contrast those of previous investigations by finding that changes in the relative size of the race and social class gaps show no pattern related to the context in which they arise, while also revealing that race and social class differences are often eclipsed by residential disparities in children's test performances. The largest of these residential test-score gaps extend from the neighborhood's social disorganization.

INEQUALITY IN SCHOOL AND NON-SCHOOL CONTEXTS: AN UNSETTLED ISSUE

Few public trusts are more important than the one we place in our schools to educate future generations. Despite this important mission, whether schools decrease (Mann 1952), increase (Collins 1977) or leave unchanged (Parsons 1959; Bourdieu 1977) the cognitive disparities that may exist among status groups, as they matriculate through the U.S. educational system, remains a primary question of stratification theory. Engaging this question appropriately, however, starts with researchers' acknowledgement that schools are not the only places in which children's academic performance is shaped. On this point, sociologist H.G. Duncan (1928) observed long ago that the constellation of environments in which a person has membership constitutes his or her personal ecology. Contemporary thought about human ecology situates academic growth within a network of environments, including among others, the family, neighborhood and policy environments (Bronfenbrenner, Moen, and Garbarino 1984; Johnson 2012a). In line with this ecosystems perspective, researchers now estimate educational differences that emerge while children learn in schools, apart from what they do or do not learn outside of them. After three decades, this approach has generated some tentative conclusions about the nature of social stratification in school and non-school contexts.

SOCIAL CLASS, NON-SCHOOL CONTEXTS AND "FAUCET THEORY"

The first conclusion drawn from this research is that social class differences have a greater impact in non-school contexts, and explain much of the black-white test-score gap (Heyns 1978; Entwisle and Alexander 1992). One of the earliest studies supporting this conclusion follows sixth- and seventh-grade students in the Atlanta public schools for two academic years and one intervening summer (Heyns 1978). Affluent and white students achieved higher test-scores in word recognition than their poor and African American counterparts during the school year and the summer, with the school-year difference being much smaller. Hence, much of the test-gap was due to the inequitable academic growth occurring over the summer.

The research of Entwisle and Alexander (1992) tells a similar story. The authors find that starting in first grade, the test performance levels of white and African American youths in Baltimore schools are nearly identical. After two years however, there is about a half-standard deviation difference between the two groups favoring white children. The disparity was not caused by differences in school-time growth; African Americans and low SES students tended to gain as much or more than relatively advantaged students while in school. Rather, most of the racial difference in test performance was due to the influence of children's SES during the summer. In characterizing this pattern Entwisle and Alexander (1992) propose the "faucet theory"; that the influence of children's social background characteristics "turn off" when they are in school and "turn on" like a faucet as they experience other contexts within their ecosystem (Entwisle and Alexander 1992).

The findings of these investigations were reaffirmed in studies that followed. One such study presents a comprehensive meta-analysis of seasonal learning research and finds that during the summer, middle class students gained in reading and math while low-income students lost (Cooper et al. 1996). Another study using ECLS-K data concluded that schools were Horace Mann's "great equalizers", since reading and math losses according to social class occurred only in the summer context (Downey, von Hippel and Broh 2004). Other studies add that the way children spend their out-of-school time often differs according to the family's social class (Burkham et al. 2004), cultural logics of child rearing (Laureau 2003) and neighborhood qualities (Wimer 2005). Lareau (2003) argues that the summer learning experiences of lower income and underrepresented children resemble the "accomplishment of natural growth" rather than a more formal development called "concerted cultivation". Consisting of structured enrichment activities, concerted cultivation is thought to enhance the achievement of higher income children, who Lareau (2003) reports, are more frequently involved in such activities.

RACIAL STRATIFICATION IN THE SCHOOL CONTEXT

The second conclusion drawn from these studies is that racial stratification is more apparent in the school context. For instance, Lee et al., (2004) report that pre-existing disparities in math grow for Hispanics in first grade, and in first grade for Hispanic and African American children in reading. Using the same data, Reardon (2003) reports a significant loss in math for Hispanics, and that the reading and math gap for African American children increases during kindergarten.

The thought that schools contribute to achievement disparities is reinforced by studies that have minimized the possibility that racial differences are due to what children lose, retain or learn during the summer recess. Downey, von Hippel and Broh (2004), and Benson and Borman (2010) did not find any significant growth in the African American-white or Hispanic-white math gap during the summer, while Lee et al. (2004) report no cognitive losses or gains during the summer recess after considering social background characteristics. These findings imply that more of the racial inequality in math and reading develops while children are actively engaged in school, and that there may be fewer racial disparities in a society without schools.

Unanimity among researchers on the nature of social class and racial stratification within school and non-school contexts and by extension, the social function of schooling, remains allusive however. For one reason, other studies have called into question the conclusions of previous research by using a measure of SES that is categorical instead of continuous, as Downey, von Hippel and Broh (2004) use. The first of these studies reports that the African American growth rate in math trails that of whites during the summer but exceeds the shortfall encumbered by low SES children (Burkham et al. 2004). In the second study, Condron (2009) estimates race and within-social class differences in first grade reading and math while considering the influence of non-school and school factors. His analysis shows that the gap between children in the lowest and highest SES category is more similar in size to the black-white gap, after considering school factors, than is implied when one uses a continuous SES measure. However, Condron (2009) and Burkham and his colleagues report racial and social class differences for only one context. The lone analysis that estimates within-social class differences across school and non-school contexts produces modest and inconsistent differences in the relative size of the black-white and SES gaps in both contexts (Benson and Borman 2010).

NEIGHBORHOODS, SOCIAL DISORGANIZATION AND THE CITY

While addressing the inconsistencies of existing literature is an additional contribution of this study, adding city location and neighborhood social disorganization as elements of residential stratification to the estimation of social class, race/ethnic and race-gender disparities in school and non-school contexts is the primary one. As Wilson (1998) observes, the issue of achievement inequality remains unsettled because "measures of the environment remain incomplete" (p. 507). This study makes several other theoretical and methodological contributions to the literature by highlighting the dimension of residential stratification.

First, by adding aspects of residential stratification, I determine if the conflicting findings of existing studies is due to the different geographic origins of the study samples. The data analyzed by Heyns (1978) and Entwisle et al., (1992) are collected in the large urban cities of Atlanta and Baltimore, respectively. It is possible that the summer learning losses reported in these studies are due to the lower quality of children's urban neighborhoods. The studies of Downey, von Hippel and Broh (2004) and Benson and Borman (2010), which report no initial gap or summer loss, use the ECLS-K, a nationally representative sample, whose participants, Lee and Burkham (2002) contend, are seldom located in disadvantaged areas (p. 74).

Despite Lee and Burkham's observation, there are several ways in which children's city residency may inform the stratification of learning-readiness and educational experiences, as well as the differences between earlier and later examinations of context-specific achievement disparities. For starters, central cities are qualitatively different than other environments. They are areas of greater population density, and diminished personal space (Park, Burgess, and McKenzie 1925), with fewer places than in the suburbs for children to play and engage in out-of-school enrichment activities (Celano and Neuman 2001). Consequently, crowding has been found negatively related to young children's vocabulary development before they begin schooling (Chase-Lansdale and Gordon 1996; Chase-Lansdale et al. 1997; Klebanov et al. 1997). Also, city children are often served by large school systems that seem to perform lower than their suburban counterparts. On this point, evaluations of the Gautreaux Housing Mobility Demonstration have noted that parents of children that moved within the city were less likely than movers to the suburbs to report higher educational standards, more academic rigor, and teachers that provided greater educational support in their schools (Kaufman and Rosenbaum 1992). While this study cannot address the impact of all of these dimensions of city living, it bounds these unobserved city characteristics by juxtaposing the test-score trends of city children with the performance trajectories of a nationally representative sample of children.

Second, not only do I account for children's residency in central cities in this study, I also explore the social organization of children's residential areas, because it also varies according to the seasons. The occurrence of seasonal events (e.g. block socials, festivals, organized youth activities and local markets) and crime during the summer suggest that the nature of a neighborhood's social organization, and consequently its effects too, may increase in relevance in the summer. In addition, peer and mentoring relationships that form in school among children and staff from different neighborhoods are likely to wane in the summer when they are in recess (Jencks and Mayer 1990). The aforementioned seasonal variation in the social organization of children's ecosystem results in periods when they may have greater exposure to an "ecological curriculum", than at other times of the year when they are exposed to institutional curricula.

A third reason is that if children's educational performance depends on their interaction with their environment, then inequalities at the neighborhood level may be most detectable when they are estimated while children are in non-school contexts. Only a few studies inform this possibility. Those using data from the Infant Health and Development Program report that the vocabulary of children, before they reach school age, is lower in ethnically/racially diverse neighborhoods, especially for white children (Chase-Lansdale, Gordon, Brooks-Gunn, and Klebanov 1997; Klebanov, Brooks-Gunn, Chase-Lansdale, and Gordon 1997). Another study reports that the economic segregation of zip code areas is the most salient social background determinant of math and reading performance gaps during the summer, and that racial segregation is unrelated to test-scores (Benson and Borman 2010).

Fourth, research reports that neighborhood demographics and its social disorganization are related to children's learning. Researchers have noted that macroeconomic changes have created areas of concentrated poverty (Wilson 1996) and affluence (Massey 1996) within metropolitan areas that are associated with heightened SES differences in achievement. Still others note that racial segregation has negative (Card and Rothstein 2007), or at best, varied consequences for African American learners (Johnson 2010), and for Hispanic and Filipino children (Pong and Hoa 2007).

Research has also revealed a neighborhood's level of violence and crime accompanies the cultivation of modest aspirations among African American boys (Harding 2010); lower levels of educational behavior (Nash 2002); while, parent perceptions of safety, social disorder, and crime have been found negatively related to participation in non-school learning activities (Wimer 2005), educational outcomes (Woolley and Grogan-Kaylor 2006; Madyun and Lee 2007) and, lower vocabulary scores for African American first graders (Caughy et al. 2006).

Furthermore, sociologists have argued that joblessness as a way of life inhibits the creation of healthy norms within the neighborhood context. Joblessness therefore is thought to indicate an area's precarious social organization, in addition to its SES (Wilson 1996). Neighborhood joblessness is thought to bear on achievement through the lowered availability of role models (Wilson 1996), adults with knowledge of how to effectively sponsor children's educational development (O'Connor 2000), and a lack of consistent daily routines that support children's activities (Connell, Spencer, and Aber 1994). These hypotheses have received only modest support in research. Neighborhood joblessness has been found negatively related to the education of African Americans in only one study, and it does not consider young children's learning (Halpern-Felsher et al. 1997). To date, no analysis has related neighborhoods' social disorganization to achievement growth across school and non-school contexts.

Nonetheless, researchers have suggested caution be used when estimating neighborhood effects in general, and especially for young populations. One concern extends from the fact that the reason families choose to reside in a particular neighborhood may be related to their children's educational success, leaving open the possibility that neighborhood estimates will mistakenly reflect parental choices. The second concern notes that young children experience neighborhoods less directly than adolescents (Shonkoff and Phillips 2000). The greater degree in which rearing strategies are adopted by parents in response to neighborhood conditions, the more likely family-level variables may become artificially inflated at the expense of neighborhood variables. However, studies that explore these issues find little evidence of family selection bias (Foster and McLanahan 1996; Duncan, Connell, and Klebanov 1997; Harding 2003), while another shows that the consequences of having lived in disadvantaged contexts persist even after considering children's selection into and out of neighborhoods (Sharkey, Sampson, and Raudenbush 2008).

RESEARCH DESIGN AND METHODS

Extending from the substance of the literature review, I seek in this study to explore the following questions:

a. In which context does more racial/ethnic, social class and gender inequality in reading and math develop?

b. Do gaps in learning exist between neighborhoods that vary in quality, and how might they change across contexts? To what extent do neighborhoods account for social background differences in learning?

c. How might test-score disparities among central city children differ from those found among children of all locations?

To pursue these questions, I use a research design that includes two key components. First, it exploits an infrequent opportunity to apply observational data to a natural ecological experiment. This design is depicted in figure 1, in which children experience two "treatments". In treatment 1, the forces of residential stratification on children's learning are mediated by their exposure to schools, and less time in their family and neighborhood contexts. I define the school context as kindergarten and first grade programs within public or private schools. This treatment, however, is not the only one experienced by children. Learning outcomes are also generated when children are away from school, interacting in other aspects of their ecosystem. This ecosystem reflects neighborhoods, families, day-care and any optional learning experiences arranged by parents (e.g. Head Start, Pre-school). Identified as treatment 2 in figure 1, this alternative treatment is experienced by children before they enroll in kindergarten, and intermittently during the school's summer breaks. Assessments that occur at the beginning and end of the school year bound, in these treatments, the seasonal changes of the neighborhood's social organization, parenting strategies, and other unobserved social background and school factors. These naturally occurring treatments present an opportunity for an experimental study in which I distinguish the effects of non-school and school contexts on social inequalities in achievement.

[FIGURE 1 NEAR HERE]

Figure 1 also reflects a multilevel conceptual model in which test-scores are nested within children, who are also nested within neighborhoods (Raudenbush and Bryk 2002). Subsequently, I employ a 3-Level Hierarchical Linear Growth Model to consider the contributions of child, social background and neighborhood characteristics to learning across different contexts.

DATA

The Early Childhood Longitudinal Study, Kindergarten Cohort 1998 -1999 (ECLS-K) is ideal for this analysis since no other national survey of young children includes biannual assessments. The National Center for Education Statistics (NCES) collected data about the families, schools, neighborhoods and activities of 22,782 children, who were chosen at random from 1277 randomly selected public and private kindergarten programs. This analysis uses a panel weight to compensate for the unequal probabilities of selection inherent in the ECLS-K's stratified sampling design.[2] Thus, the findings of this study are generalizable to the U.S. population of children that entered kindergarten in 1998 and continued on to first grade.

I limit the analysis to the random 30 percent subsample of children that were assessed at the beginning and end of kindergarten and first grade.[3] This subsample reduced from 5470 to 5354 once I eliminated children that did not have parent data or were missing all four cognitive scores.[4] Since the analysis accounts for possible differences in the type of kindergarten program, I also eliminated 98 children that changed schools during kindergarten. Next, my interest in ecological factors required that I eliminate children that changed neighborhoods between assessments, which reduced the sample from 5256 to 4993.[5] Last, an estimation of summer context effects free of unwanted school effects required that I omit children who were attending year-round schools. The final sample includes 2879 White, 728 African-American, 776 Hispanic, 338 Asian, and 125 Native American children, for a total of 4873. Preliminary analyses reveal the final study-sample mirrors the properties of the larger ECLS-K sample.[6]

I also rely on an NCES companion data file that links ECLS-K children to the tract and zip code in which they reside (Beveridge et al. 2004). Tract level measures are used in this analysis to denote neighborhoods. While the use of census tracts as proxies for neighborhoods has been called "arbitrary"

[2] Variable C1_4PW0 is the child-parent weight for waves 1 through 4.

[3] Downey, von Hippel and Broh (2004) use methods that extrapolate scores for children that were not included in the 30 percent subsample, which allows them to estimate seasonal growth for the full ECLS-K sample. However, Downey, von Hippel and Broh (2004) are unable to use HLM software to do so, and do not examine children nested in neighborhoods.

[4] Parents were surveyed to gather social background measures in the spring of the 1999 kindergarten year. In cases where the information is missing, I added values from identical measures collected in the fall of first grade.

[5] The ECLS-K reports moves for rounds 3 and 4 only at the zip code level.

[6] This sample size includes more children than Condron (2009) and Benson and Borman (2010) because their nested-within-schools design required them to eliminate more than 800 children that switched schools. Benson and Borman (2010) show that the removal of these children yields a sample that is more advantaged and higher performing. Since this analysis nests children within neighborhoods and does not require the removal of children that switched schools between waves 2 - 4, it will yield results that more closely reflect the properties of the ECLS-K sample.

(Jencks and Mayer 1990), I use them because the larger size of zip-code areas makes it uncertain that its average on any characteristic is similar to that of the children's immediate residential area. Subsequently, this study will be the first tract-level analysis of neighborhood impacts across school and non-school contexts. The geo-coding process of the ECLS-K resulted in a less than 1 percent difference in the identification of children's zip-codes and tracts across the four assessments (Beveridge et al. 2004). Rather than deleting children from the sample, I linked those who had no tract identified to their zip code characteristics. The merging resulted in the inclusion of 3454 geographic units. A list of variables and their definitions appear in Table 1.

[TABLE 1 NEAR HERE]

TEST-SCORE GROWTH

I use the *reading* and *math* Item Response Theory (IRT) scale-scores since they are designed to reduce ceiling and floor effects in estimates of cognitive growth (Rock and Pollack 2002).[7] These scores were released in 2009 as the survey's final recalibrated kindergarten and first grade scale-scores.[8] Children of the wave 3 subsample were assessed near the beginning and end of kindergarten and first grade. These biannual assessments permit the measurement of what children learned by the fall kindergarten assessment; from the fall kindergarten assessment to the year-end assessment; between the year-end kindergarten assessment and the beginning of the first grade assessment (over the summer); and, from the fall first grade assessment until the year-end assessment. Hence, the ECLS-K presents for comparison two schooling contexts (kindergarten and first grade) and two non-school contexts (before-school and summer recess).

[7] Cognitive assessments in reading included concepts related to letter-case recognition; reading words in context; recognizing common words; and knowing letter sounds at the beginning and end of words. Assessments in math included count, number and shape concepts; numerical ordinality and sequences; addition and subtraction and simple multiplication and division.

[8] Refer to Rock and Pollack (2002) for more information on the calibration of scale scores.

There are two complications with these data regarding the estimation of periodic growth that are addressed in my analytical approach. First, some students had only one test-score in kindergarten or first grade instead of two. The second problem was that the testing dates did not coincide with the beginning and ending dates of the school year, leading to both the contamination of the summer period by the inclusion of days of schooling (that occurred after the last assessment of kindergarten and before the first assessment of first grade), and the exclusion of relevant days of instruction from school estimates. Knowing the test dates and the beginning and ending dates of the school year allowed me to create a series of variables to account for the elapsed time between them measured in months.[9] When included in the models, these time-elapsed variables indicate the *points per month* change in reading and math scores, and permit the extrapolation of missing scores and reapportionment of cognitive growth.

CONSIDERING SOCIAL BACKGROUND AND SCHOOL CONTEXTS

I also compare growth rates according to child-level social background characteristics across contexts while controlling for school-related factors. Social background variables were coded as 1 = yes, 0 = no for race/ethnicity (*Asian, Black, Hispanic*, *Native American* and *white*) and *family SES*. In order to examine achievement differences between social classes, I use a composite measure of family SES that is segmented into equal-sized quintiles. This composite measure of family SES, provided by NCES, reflects the occupational status, educational level and total household income of parents (NCES 2001). I also consider children's *gender* and *single parent* family structure.

Although my growth modeling strategy isolates the effects of schools versus non-school contexts, three additional education-related factors were needed to account for variation in the amount of schooling children receive. I consider whether the child attended a *full-day kindergarten* program (versus half-day),

[9] I used the beginning and end school dates supplied by school administrators, and when those dates were not provided, those given by parents. The school calendar dates were provided when the children were in first grade, and are also used in this analysis to mark the beginning and end of kindergarten.

attended summer school and *repeated kindergarten*, (1 = yes, 0 = no), the last of these also serving as a control for children who may be older than average. These measures account for differences in the amount of children's exposure to school while also removing its influence during the summer context.

IDENTIFYING NEIGHBORHOOD AND CITY DETERMINANTS

In addition to the investigation of ecological differences in learning through the juxtaposition of school and non-school contexts, I also explore them within each context, and according to children's residential type. Addressing the latter first, I used the *location type* variable to identify children that reside in central cities—approximately 39 percent of the analytical sample—and save them to a second file. This city sample, consisting of 1905 children from 1490 geographic units, will contrast the analysis results of the full sample.

I use subjective and objective measures of neighborhood conditions to estimate within-context effects for both samples. The subjective measures consist of social disorganization variables. Parents were asked: "*how much of a problem is burglary*", "*violent crime*" and "*selling/using drugs in the area*" (1 = big problem, 2 = somewhat a problem, 3 = no problem). I dichotomized these variables so that 1 indicates a big problem, and 0, not a big problem.

The objective variables include three census measures of the tract's *median family income*; the *percentage of black and Hispanic residents*; and the *percentage of jobless males* age 16 or over within the civilian labor force. Including the median income measure to account for a neighborhood's economic composition allows the joblessness variable to better reflect its hypothesized impact on a neighborhood's social organization. The median income variable was created by first using a natural log transformation to achieve a more suitable distribution of incomes, then converting those values into z-scores. For the sake of interpretation, Table 1 reports the original values of this variable. I combined measures of the proportion of African American and Hispanic individuals to create the tracts' minority composition measure because those racial groups tend to be highly segregated and more likely to reside in areas with social problems (Wilson 1996).

ESTIMATION

I use HLM version 6.08 to estimate cognitive growth (Raudenbush and Bryk 2002). The 3-level model consists of within-child test-score measures at Level 1, between child-measures reflecting social background and school-related factors at Level 2, and neighborhood measures at Level 3. Given cognitive growth is viewed as happening in distinct periods, I elected a piecewise approach for the separate estimation of growth parameters. To model growth rates, I view cognitive growth Y_{tcn} as a function of an intercept representing math or reading performance before kindergarten for child *c* in neighborhood *n*, and her or his exposure to kindergarten, summer, and 1st grade at the time of test *t*, yielding the Level 1 equation:

$$Y_{tcn} = \pi_{0cn} + \pi_{1cn}(\mathit{Kindergarten}_{tcn}) + \pi_{2cn}(\mathit{Summer}_{tcn}) + \pi_{3cn}(\mathit{First\ Grade}_{tcn}) + e \qquad (1)$$

Since this analysis estimates four parameters from four test-scores, I constrain the value of the error term within the statistical program settings to equal the average amount of measurement error across contexts. Using the test reliability estimates provided by Rock and Pollack (2002), I computed the measurement error variance for each assessment as one minus the reliability of the test, multiplied by its total variance. I then averaged the measurement error variance across the four assessments. As seen in Table 2, the measurement error ranges from 7.92 points in the fall of 1998 to 18.24 in fall 2000 for reading, and amounts to an average of 12.45.

[TABLE 2 NEAR HERE]

Level 2 of the multilevel model includes the social background and school variables. Each Level 2 parameter represents the adjustment in the neighborhood average performance slope, β_{10n}. Since this research investigates racial, SES and race-gender differences in cognitive growth over time, there are a variety of Level 2 specifications for each of the four contexts. In the first Level 2 model, test-score growth π_{1cn} is a function of the child's gender, single parent family structure, and the racial groups, Black, Hispanic, Asian American, and Native American leaving the largest group, white children, as the reference group. I model achievement gaps according to race and social class in the second specification, so I add quintiles of family SES (with the middle quintile excluded). The third and fourth set of models represents the full model specifications for the national and city samples. The city model, however, only includes the 4 largest racial/ethnic groups because too few Native Americans were located in central cities (see Table 3). The only way in which these models differ across developmental periods is in the addition of the *all-day kindergarten* variable in the kindergarten context, and the addition of the *attended summer school* variable in summer context for all models. The full Level 2 equation is as follows:

$$\pi_{1cn} = \beta_{10n} + \beta_{1n}(\textit{Repeated kindergarten}_{cn}) + \beta_{12n}(\textit{Gender}_{cn}) + \beta_{13n}(\textit{Single parent}_{cn}) + \beta_{1,4\text{-}7n}(\textit{SES quintiles}_{cn}) + \beta_{1,8\text{-}12n}(\textit{Race}_{cn}) + \beta_{1,13\text{-}19n}(\textit{Race/Gender}) + \beta_{120n}(\textit{Full-day kindergarten}_{cn}) + \beta_{121n}(\textit{Summer school}_{cn}) + a_{cn} \quad (2)$$

At Level 3, I model neighborhood-based variation in mean achievement with random intercept models (Raudenbush and Bryk 2002). The Level 3 equation models neighborhood-to-neighborhood variation in their characteristics in each of the four contexts for the nation and city samples. Hence, test-score growth in each context, β_{10n} is a function of the census tracts' median income; percentage of blacks and Hispanics; percentage of jobless males age 16 or over, and three variables representing parents' report that burglary, drug trafficking/use, and violence are problems in their neighborhood. I express the Level 3 equation as:

$$\beta_{10n} = \gamma_{100} + \gamma_{101n}(\textit{Median family income}_{n}) + \gamma_{102n}(\%\ \textit{Black and Hispanic}_{n}) + \gamma_{103n}(\%\ \textit{Jobless}_{n}) + \gamma_{104n}(\textit{Burglary}_{n}) + \gamma_{105n}(\textit{Drugs}_{n}) + \gamma_{106n}(\textit{Violence}_{n}) + r_{10n} \quad (3)$$

In this equation, the intercept γ_{100}, represents the average growth rate of a specific context for all neighborhoods in the sample. In the first three continuous neighborhood parameters, γ_{101n} - γ_{103n} indicates the estimated deviation from the neighborhood mean growth rate associated with a point increase among those characteristics. The second set of neighborhood parameters are categorical, and represents the average point change in children's test performance associated with a neighborhood's identification as having these problems.

ANALYSIS

DESCRIPTIVE STATISTICS

Tables 1 and 3 provide descriptive information for the national sample and the city subsample.[10] The means reported in Table 1 show that, among most indicators, the children of both samples are similar. The most notable differences between the two are in the higher proportion of African Americans and Hispanics, and lower proportion of white children in the city sample. Also more city children are in the lowest SES quintile and residing in neighborhoods with drug problems than are children in the full sample. Otherwise, only minor differences exist in the samples' neighborhood quality, amount of schooling, and achievement scores.

[TABLE 3 NEAR HERE]

More notable demographic differences are revealed in Table 3. These figures show that African-Americans and Hispanics constitute 23.7 and 37.1 percent of the children in the low SES quintile though they are only 15 and 16 percent of the total sample, respectively. Approximately 41 percent of all Hispanic children and 32.8 percent of all Native children are in low-income families, compared to 8.3 percent of white children. Although white children are only 59 percent of the total sample, they constitute more than 76

[10] Correlations and collinearity diagnostics reveal modest correlations among the analysis variables of .487 or lower, and acceptable variance inflation factors near 1.00.

percent of the top SES quintile. The representation of African Americans among the disadvantaged increases slightly in the city sample, more dramatically for Hispanics, while the opposite is true for white children. White city families have the highest proportion, 38.6 percent, within the high-income range of any sub-population across both samples. So not only are populations of color in central cities more likely to be disadvantaged, their relative disadvantage appears greater than it is among children of all residential types. This is an important distinction given that previous examinations of seasonal learning in urban settings report that the SES of white and black children is more similar (Entwisle et al. 1992).

The time elapsed between the assessments and the beginning and end dates of schooling reported in Table 1 show that without the steps taken in this study to compensate for the unaligned dates, approximately 2.17 months of schooling would have been misattributed to children's before-school context. Likewise, over a month of schooling had occurred after the wave 2 assessment. The impact of this month of schooling on academic growth—and the 1.42 months in first grade before the wave 3 assessment—would have been bound in the summer growth estimate if I had left them unadjusted. In this study, summer growth reflects the 2.62 months that spanned the end of kindergarten and the start of first grade.

TEST-SCORE INEQUALITIES IN READING AND MATH

Tables 4 thru 7 report the fixed and random effects of the reading and math analyses. The Tables' first two models under each context (before-school, kindergarten, summer and first grade) address the first research question by estimating race, social class and gender differences in achievement growth. The second two models of each context address the second and third questions regarding neighborhood and city variability in test performances. Similar to Downey, von Hipple and Broh (2004), I report achievement inequality as an estimate of monthly growth by differencing the estimated point deviation within the models from the intercept then dividing it by the average number of months for each observational context (e.g. kindergarten, summer, etc.). To calculate the growth gap, the monthly growth rate estimate is subtracted from the mean monthly growth rate of white children (which are withheld from the models). I also at times provide the standard deviation unit difference to facilitate comparison of test-scores across contexts and academic subjects.

[TABLE 4 NEAR HERE]

Reading Inequality. The results of the reading analysis are shown in Table 4. Column 1 shows that prominent test-score gaps among racial groups manifest in non-school contexts before they enter kindergarten. By the time children enter school, African American, Hispanic and Native American children trail their white and Asian-Pacific Islander counterparts, with Native Americans scoring 6.52 points, or .61 standard deviation units, lower than whites. There is also a gender gap favoring girls and a performance level 2.905 points lower for children with a single parent.

Once children's social class is considered in column 2, the performances of African American (33.81 points) and Hispanic (33.46 points) children become insignificantly different than that of whites, leaving only Native Americans (30.80 points) to have a significant shortfall of approximately 3.84 points in reading. While some of the gap between children with single and two parents in the home is accounted for by their social class, the gender advantage for girls changes little. Social class differences emerge at both ends of its distribution, with low SES children falling 4.883 points short of the average performance and high SES children exceeding the average by 4.247 points. Taken together, the point-spread between children in the lowest and highest social classes is 9.13 points, or .858 standard deviation units, and surpasses the inequality among racial groups.

The third column summarizes the model that includes children's residential characteristics. Accounting for children's neighborhood quality changes little how the other covariates relate to reading, however, the point estimate for residing in areas where drug use and trafficking are big problems (28.88 points) is associated with a substantial setback totaling 5.265 points, almost one-half of a standard deviation unit. The fourth column in contrast, shows that African American (31.63 points) and Hispanic (31.23 points) city children begin school less prepared in reading than their co-ethnic counterparts nationally and other racial ethnic groups within the city. There we find the largest gender advantage for girls at 2.275 points, a larger performance gap between the least and most economically advantaged children (10.80 points, 1.015 standard deviation units), and a significantly lower performance level for children in areas where joblessness is a big concern (34.01 points).

The next set of estimates shows that reading trajectories during kindergarten differ from those shown in the before kindergarten analysis in notable ways. First and consistent with other reports of less social class stratification within schools than within largely non-school contexts, no significant social class gaps emerged in models 2 and 3. Second, only African Americans do less well than the other racial groups after accounting for social class and residential characteristics, reaffirming the thought that African Americans gain less only in instructional settings. Similar to the before kindergarten context, girls have a higher reading growth estimate than do boys and, once again, drug use and trafficking within neighborhoods appear associated with lower reading growth nationally (1.28 points per month), but even more restrained in the city (1.07 points per month) where children fall behind by nearly half a point each month (-.47 points).

[TABLE 5 NEAR HERE]

The next set of models estimates achievement differences over the summer, accounting for the possibility that children attended summer school. In this second non-school context, social class gaps reappear while racial inequality continues to grow. The social class gap expands due to the higher than average performance of advantaged children, who gain approximately .62 points each month even after residential characteristics are considered. But this difference does not surpass the racial gaps that appear, especially between Asian-Pacific Islanders and Native Americans, with the latter experiencing a .70 point decline each month for a shortfall of 1.83 points, as Asians gained 1.76 points relative to the scores of whites, by the end of summer. While African Americans have a significantly slower growth rate in the city, there, social class differences are most impressive due to the performances of advantaged children. City children in the highest social class gain 1.805 points beyond the average monthly gain (.695 points). To put this difference in perspective, children in the highest social class gain, during the summer, over 45 percent (or 4.22 months) of what was gained on average in kindergarten, while their counterparts only gain an additional 12.5 percent (1.17 months), for a total difference of 3.05 months of school time reading growth by summers' end. Moreover, social class differences eclipse racial differences in this period only in the city, as was the case in kindergarten.

A return to the school context in first grade shows that racial stratification remains prominent with a lower rate of monthly growth in reading for Native (3.11 points) and African Americans (3.28 points) after controlling for social class and neighborhood conditions. But once again, growth in reading among social class groups appears more unequal than among racial groups. The social class gap in reading widens during first grade due to the significantly lower growth rate of children within the lowest social class (3.33 points per month) and the stronger than average gains of advantaged children (4.04 points per month). This gap grows by approximately .71 points per month until the two social classes are separated at the end of first grade by an additional 1.78 months of average reading growth (6.681 points, .34 standard deviation units). While the performance of advantaged children in the city is even stronger than that of their social class counterparts nationally, the social class gap is smaller because the test-scores of less advantaged children is insignificantly different than the average test performance. The reading scores of African Americans also keep pace with those of their peers. There are some tentative conclusions that can be drawn from models in Tables 4 and 5 related to the research questions:

1. No race gaps in reading emerge before kindergarten for children nationally. Moreover, changes in the relative size of race and social class gaps in reading show no pattern related to the context in which they arise.
2. In the city, racial gaps in reading were evident before kindergarten's start for Hispanics and African Americans in the city. However, social class inequality is greater than racial inequality in the city in every context.
3. Although the amount or racial, social class and gender inequality in test-scores accounted for by considering residential stratification was trivial, residential test-score gaps in reading, especially those associated with residency in neighborhoods where drugs use and trafficking are big problems, were among the most prominent shortfalls before kindergarten and exceeded race and social class setbacks in kindergarten.

[TABLE 6 NEAR HERE]

Math Inequality. The results of the math analysis in Table 6 differ from the reading analysis in noteworthy ways. First, there are no significant gender differences before the start of kindergarten. Second, lower math test-scores emerge for African American (21.99 points), Hispanic (20.54 points), and Native American (19.76 points) children begin schooling. While social class and residential characteristics account for some of this shortfall, significantly lower scores remain for these racial groups after considering their social backgrounds. Third, math differences exist for all social class groups with a range between the least (21.83 points) and most advantaged (31.92 points) children eclipsing one standard deviation unit.

Considering residential characteristics in columns 3 and 4 shows that neighborhood problems with drug use and trafficking are associated with lower than average math scores (23.86 points). Unlike in the reading analysis, the average test performance in math is lower in cities (23.143 points) than it is among children nationally (25.75 points). While lower than average math performance levels for African American, Hispanic and less advantaged children manifests in the city, living in a neighborhood where violent crime is a big problem is related to the lowest before-school test average (18.94 points) among all of the social background characteristics.

In kindergarten (Table 6, columns 5-8), the math growth rate continues to be slower than the white average for Hispanics (1.18 points per month) and African Americans (1.04 points per month), and for the first time, Asian-Pacific Islanders (1.15 points per month). African Americans in particular accumulate a loss of -.32 points per month for a total year-end setback of 3.00 points, or approximately 2.20 months of average growth in math. Social class stratification in math appears less in kindergarten than in the before-kindergarten context, primarily because the stronger than average performance of advantaged children becomes insignificant once their residential characteristics are considered. However, children in the low and mid-low social class strata trail the average math monthly growth rate by -.19 and -.13, respectively, with the former shortfall equaling 1.782 points, or 1.31 months of average kindergarten-year growth by its end.

The residential models (columns 7 and 8) show that drug use and trafficking continues to be associated with lower than average growth in math (1.13 points per month)—the second largest monthly test-score loss (-.24 months per month) for children nationally. In the city, the average white test performance continues to be lower than it is nationally, and the largest monthly shortfall remains among African Americans (-.33 points per month). In addition, social class inequality is more prominent among city kids, not only because less advantaged kids (1.06 points per month) have a lower monthly growth rate than do disadvantaged kids do nationally (1.17 points per month), but also because advantaged city children are posting stronger than average gains (1.52 points per month). The test-score gap between these two groups amounts to 4.314 points by kindergarten's end, or 3.28 months of kindergarten-year average math growth.

[TABLE 7 NEAR HERE]

While summer was a time when race and social class gaps widened in reading, the math growth rate and gap estimates of Table 7 show little change in the summer test-score performances of children. In terms of race, only Asian-Pacific Islanders gain in math during the summer, having by summer's end increased beyond the white average test-score performance by 2.227 points, or .26 standard deviation units. No other estimate achieves significance once I include children's social background characteristics, nationally or in the city.

When children return to school, the growth of racial gaps in math performances resume with columns 4 – 8 showing that all racial groups perform less well than their white counterparts. This time the slowest rate of growth is among Asian-Pacific Islanders (2.17 points per month) followed by African Americans (2.33 points per month), Native Americans (2.36 points per month) and Hispanics (2.46 points per month). Asian-Pacific Islanders trail the growth rate of whites by -.56 points per month, for a total shortfall of 5.269 points or 1.93 months of school time growth by the end of grade one. Noticeably absent are any significant departures from the mean growth rate for children in different social classes or neighborhood conditions. Inequality in math performances in the city differs from the national picture in noteworthy ways. First, the math test-scores of whites appear higher in the city (26.123 points) than nationally (25.729 points) for the first time. Second, African American children are the only racial group to have lower than average monthly growth (2.42 points per month), while children in the highest social class appear to be the only social group with higher than average monthly growth (3.21 points per month). Gains among advantaged children exceed the average year-end points by a total of 4.05; an amount equal to 1.46 additional months of school-time growth in math. In sum, the math analysis shows:

1. Racial gaps in children's math test-scores exist before kindergarten. While these racial gaps in math are initially smaller than the social class gap, their growth exceeds increases in social class inequality in all the periods that follow.

2. Little racial, social class and gender inequality in math test-scores was accounted for by considering residential stratification, yet large residential test-score gaps were identified before kindergarten and during kindergarten. In fact, before kindergarten shortfalls linked to residency in neighborhoods where drugs and violence are big problems were larger than those shown for economically disadvantaged or underrepresented children.
3. While all racial groups in the city perform less well than they do nationally until they reach 1st grade, social class inequality in the city is greater than racial inequality in all contexts.

DISCUSSION

To better understand the social underpinnings of persistent status-group differences in achievement, researchers have sought to separate school and non-school determinants of achievement inequality. A preponderance of the evidence they have produced suggests that racial stratification is most evident in schools while social class stratification dominates within non-school contexts. In this study, I sought to add to this literature knowledge about residential stratification's role in the creation of test-score inequality. In doing so, I have produced results that qualify many of the conclusions reached in previous research.

Moreover, this analysis deviates from the findings of previous research, likely due to its use of census tracts instead of zip codes or schools as units of analysis (Benson and Borman 2010), its reliance on the final recalibrated IRT scale scores that were not available to Downey, von Hipple and Broh (2004), and because the analysis of urban test-score inequality included greater economic diversity than found in earlier city-studies. Previous research using city samples proposed that the influence of children's social background characteristics, especially their racial classification, was turned off like a faucet during the school year. Contemporary examinations of ECLS-K data revealed a different pattern wherein prominent social class differences in non-school contexts retreated in school contexts where they were surpassed in size by racial differences. In contrast to both areas of research, this analysis shows that the relative size of race and social class gaps in reading show no pattern related to the context in which they arise, and that in math, growth in racial inequality exceeds increases in social class inequality after children begin schooling. Important implications extend from these observations.

First, race as a key dimension of academic differentiation seems somewhat robust to children's exposure to different environments. This result may extend from the inability of schools to completely offset the effects related to race or that they function passively or actively to reinforce racial status hierarchies. Second, we must also consider that families may adjust to the provision or absence of schooling in ways that vary according to race, but also in a manner too dynamic to describe as simply "turned on" or "turned off." Since there was no summer setback in math or reading for African American or Hispanic children nationally, claims that families of color rely on the "accomplishment of natural growth" during the summer and as a consequence, put their children at an academic disadvantage find little support in this analysis. In sum, schools nationally did not appear to function as the great equalizers Horace Mann and researchers had envisioned, nor did the summers function as "great dividers."

By considering neighborhood effects, this analysis also sheds light on the applicability of faucet theory to neighborhood effects. Significant neighborhood factors failed to appear for either subject during the first grade, but they emerged in both subjects before kindergarten and during kindergarten where they surpassed, in magnitude, all other social background factors in reading. While this mixed pattern does not confirm or contradict neighborhood faucet theory, the absence of neighborhood effects in the summer fails to support the contention that an uptick in neighborhoods' summer social activity leads to enhanced neighborhood effects in education, or that residential effects in cognitive outcomes are greater in the absence of schooling.

These observations hold important methodological implications for the estimation of neighborhood effects. For instance, neighborhood crime and drug problems were, at times, prominent enough to trump the inequalities associated with race and class in this analysis because estimates of their effect are bound by two observations (i.e beginning and year-end test-scores). Since these residential characteristics were generally insignificant during the summer, combining the neighborhood's school-year and summer effects within a single test-score observation—as is the practice in neighborhood studies of education—would have generated neighborhood effect-sizes of a lesser magnitude and significance than those produced in this study. As a consequence, the ability of schools to offset neighborhood influences and the school's importance relative to neighborhoods is likely overstated in research that has not made analytical distinctions between school and non-school contexts.

Perhaps the most compelling contribution of this research extends from the analysis of social class, racial and residential stratification within central cities. By examining the contextual test-score trajectories of city children, I hoped to learn if differences that exist between earlier and contemporary study results extend from the reliance of the former on city samples, and the latter on nationally representative data. The city analysis shows that while the patterns of race and social class differences in test performance in central cities deviate from the patterns just described for children nationally, they also fail to conform to earlier investigations of city children. Considering the performance trajectories of racial groups first, African American and Hispanic children begin school with lower average test-scores, in contrast to the school-readiness of those groups nationally. African American test-score growth was significantly slower in both school contexts in math, and in kindergarten reading, unlike the results of the Beginning School Study of Baltimore children, where they tended to gain as much or more than their white counterparts while in school once social class differences were considered.

Addressing social class next, I found that the amount of social class stratification among central city children was generally larger than the social class and race gaps among children nationally. Only in first grade reading and summer math did social class inequality in cities fail to exceed its measure within the national sample. In most contexts, this inequality arises because of what higher income children gain in relation to average growth estimates, rather than what lower income children lose. The contrasting results clearly extend from the greater level of inequality in the distribution of family incomes within the city (see the cross-tabulations of table 3). Understanding these results with an interest in place stratification and its intersection with race and social class inequality implicates the thoughts of Wilson (1996), who suggested that social class characteristics within inner-cities were more powerful determinants of the social outcomes of inner-city residents than race. While this may be true, this analysis can claim only that the performance trajectories of children differ according to city residency, not *because* of city residency. Studies that summarized the outcomes of HUD mobility programs are better suited to address causal questions related to city/non-city differences, although evidence about the relative importance of race and social class has not been tested in a single mobility program. Across mobility studies we know that the only program (i.e. Gautreaux Assisted Housing Program) to show consistently that non-city residency is related to higher academic outcomes than city residency used the neighborhoods' racial make-up (rather than social class) to identify areas suitable for tenant relocation. Mobility studies that used social class as the basis of neighborhood assignment for movers found few positive educational effects (Johnson 2012b). Future research is needed to test the relative importance of a neighborhood's race and social class within a methodological design supportable of causal claims.

Neighborhood social disorganization may be yet another indicator of qualitatively different learning environments for city children. For instance, the monthly point loss associated with neighborhood drug problems in the city is the largest social background gap estimated in kindergarten, for both samples and both academic outcomes. In general, considering the intersection of city and neighborhood effects, as this analysis does, shows that residential gaps in test-scores were greatest within the city, especially before kindergarten in math and in kindergarten reading. While few children of the ECLS-K reside in problematic neighborhoods, apparently the educational consequences for those that do are among the direst.

In conclusion, this research informs the consideration of many policy proposals and aides in the understanding of outcomes of federal efforts to close test-score gaps. We can infer from the social class, race and neighborhood differences that were found in the city that school-based reforms, in isolation, are unlikely to bring about equal educational outcomes. While surely schools can be retooled with better teachers and an appropriate level of resources to address school determinants of performance gaps, other approaches are needed to address the educational consequences of residential stratification. Year-round schooling is a frequently mentioned possibility because it keeps children academically engaged while reducing their time in other less-supportive learning environments. However, since this analysis shows that schooling appears to contribute to test-score inequality, giving children more time in unequal schools is unlikely to solve the problem. More importantly, these approaches rarely address, directly, the contextual circumstances that put children at a developmental disadvantage in the first place. More comprehensive and geographically specific approaches are now underway in the Harlem Children's Zone and the federal government's Promise Neighborhoods. These programs seek to coordinate resources that affect children at the neighborhood, school and family level, directly and indirectly, and during the summer and academic term. Future evaluations will reveal whether these approaches can address, more fundamentally, the ecological circumstances that alter the future possibilities of young children.

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FIGURE 1. NATURAL EXPERIMENTAL DESIGN

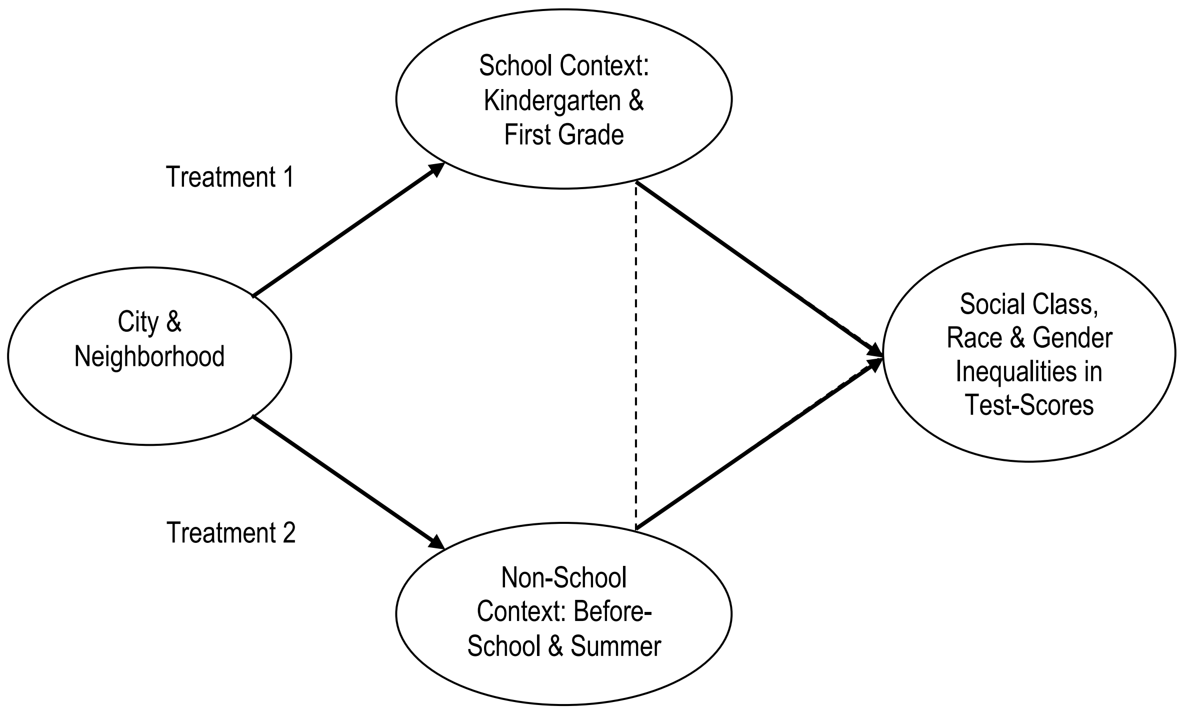

TABLE 1. Descriptive Statistics, N = 4873 Full Analytic Sample, 1905 City Sample

	Mean Full	STDV	Mean City	STDV
Gender (1 = female, 0 = male)	.49	.50	.49	.50
Low SES (1 = yes, 0 = no)	.18	.38	.24	.42
Middle low SES (1 = yes, 0 = no)	.19	.39	.17	.37
Middle SES (1 = yes, 0 = no)	.20	.40	.17	.38
Middle high SES (1 = yes, 0 = no)	.21	.41	.20	.40
High SES (1 = yes, 0 = no)	.22	.42	.23	.42
Single parent (1 = yes, 0 = no)	.22	.42	.26	.44
Asian/Pacific Islander (1 = yes, 0 = no)	.07	.25	.06	.24
Black (1 = yes, 0 = no)	.15	.36	.21	.41
Hispanic (1 = yes, 0 = no)	.16	.37	.27	.44
Native (1 = yes, 0 = no)	.03	.16	.01	.09
White (1 = yes, 0 = no)	.59	.49	.45	.50
Repeated kindergarten (1 = yes, 0 = no)	.04	.20	.06	.23
Attended summer school (1 = yes, 0 = no)	.11	.31	.12	.33
All day kindergarten (1 = yes, 0 = no)	.58	.49	.66	.47
Months before school start (Age)	65.54	4.28	65.65	4.34
Months between kindergarten start and test 1	2.17	.52	2.16	.46
Months between test 2 and kindergarten end	1.08	.49	1.06	.50
Months between kindergarten end and grade 1 start	2.62	.28	2.60	.27
Months between grade 1 start and test 3	1.42	.52	1.39	.52
Months between kindergarten start and test 2	8.30	.51	8.33	.53
Months between grade 1 start and test 4	8.29	.58	8.36	.50
Neighborhood median family income	52453.14	23084.67	53245.71	23573.13
Neighborhood percentage Black and Hispanic	25.09	29.93	24.46	29.34
Neighborhood percentage males jobless	6.77	8.34	6.63	8.55
Big drug problem in area (1 = yes, 0 = no)	.03	.18	.06	.23
Big burglary problem in area (1= yes, 0 = no)	.02	.13	.03	.18
Big violence problem in area (1= yes, 0 = no)	.01	.11	.03	.16
Reading test 1 score	35.89	10.64	35.73	10.63
Reading test 2 score	47.28	14.47	47.01	14.70
Reading test 3 score	53.76	18.20	53.25	18.45
Reading test 4 score	78.45	24.66	77.72	25.52
Reading kindergarten	14.53	9.41	14.25	9.30
Reading summer	-.32	8.18	-.01	8.58
Reading grade 1	35.33	19.65	34.97	19.78
Math test 1 score	26.47	9.38	25.86	9.74
Math test 2 score	36.88	12.30	36.25	13.15
Math test 3 score	43.89	14.48	42.83	15.21
Math test 4 score	62.20	18.43	61.56	19.11
Math kindergarten	12.91	7.87	12.69	8.08
Math summer	1.63	8.55	1.20	8.57
Math grade 1	26.01	14.97	26.31	15.04

TABLE 2. Measurement Error Variance on Four Reading and Math Tests

Assessment Period	Fall 1998	Spring 1999	Fall 1999	Spring 2000	Average
Reading					
Total variance	113.12	209.41	329.04	607.97	
Reliability	0.93	0.95	0.96	0.97	
Measurement error variance	7.92	10.47	13.16	18.24	12.45
Math					
Total variance	88.01	151.31	209.93	339.64	
Reliability	0.92	0.94	0.94	0.94	
Measurement error variance	7.04	9.07	12.60	20.38	12.27

Note: Reliabilities were calculated by Rock and Pollack (2002). With a reliability of *r,* and total test variance *Var* (*Ysct*), the measurement error variance is (1–*r*) *Var* (*Ysct*).

Table 3. Cross-tabulations According to Race/Ethnicity and SES for Full and City Sample

Race/Ethnicity	Full Sample SES, N = 4873					City Sample SES, N = 1905				
Distribution Category	Low	Middle Low	Middle	Middle High	High	Low	Middle Low	Middle	Middle High	High
Asian/Pacific Islander										
Number	54	67	59	65	93	28	23	15	20	28
% Within Asian	16.0	19.8	17.5	19.2	27.5	24.6	20.2	13.2	17.5	24.6
% Within Quintile	6.3	7.4	6.1	6.2	8.5	6.3	7.3	4.5	5.3	6.5
Black										
Number	203	169	159	122	75	117	95	87	67	37
% Within Black	27.8	23.2	21.9	16.7	10.3	29.0	23.6	21.6	16.6	9.2
% Within Quintile	23.7	18.6	16.6	11.7	6.8	26.2	30.0	26.3	17.8	8.5
Hispanic										
Number	318	143	124	111	80	250	96	72	55	38
% Within Hispanic	41.0	18.4	16.0	14.3	10.3	48.9	18.8	14.1	10.8	7.4
% Within Quintile	37.1	15.7	12.9	10.6	7.3	55.9	30.3	21.8	14.6	8.8
Native										
Number	41	37	21	17	9	3	2	3	6	2
% Within Native	32.8	29.6	16.8	13.6	7.2	18.8	12.5	18.8	37.5	12.5
% Within Quintile	4.8	4.1	2.2	1.6	.8	.7	.6	.9	1.6	.5
White										
Number	238	490	593	722	836	47	100	151	225	329
% Within White	8.3	17.0	20.6	25.0	29.1	5.5	11.7	17.7	26.4	38.6
% Within Quintile	27.8	53.8	61.4	68.8	76.3	10.5	31.5	45.6	59.8	75.8

TABLE 4. READING AVERAGE MONTHLY GROWTH GAP, BEFORE KINDERGARTEN AND KINDERGARTEN

	BEFORE KINDERGARTEN				KINDERGARTEN			
	Race	SES	Residential	City	Race	SES	Residential	City
Intercept	33.345***	34.643***	33.230***	34.145***	14.362***	14.326***	14.339***	14.373***
Monthly growth rate	--	--	--	--	1.531	1.527	1.529	1.532
Growth	Total	Total	Total	Total	GR / Gap	GR / Gap	GR / Gap	GR / Gap
Gender	34.51***	35.86**	34.46**	36.42**	1.67/ .14**	1.66/ .14**	1.66/ .14**	1.70/ .16*
Black	31.02*	33.81	32.53	31.63**	1.29/ -.24***	1.33/ -.20**	1.33/ -.20**	1.34/ -.19*
Hispanic	30.74***	33.46	32.05	31.23**	1.42/ -.11	1.45/ -.08	1.44/ -.09	1.55/ .01
Asian-PI	36.93**	37.77*	36.67**	34.29	1.51/ -.03	1.50/ -.03	1.50/ -.03	1.55/ .02
Native	26.82***	30.80***	29.19***		1.28/ -.25*	1.33/ -.20	1.32/ -.21	
Low SES		29.76***	28.30***	30.37***		1.38/ -.15	1.39/ -.14	1.49/ -.04
Mid-Low SES		32.43**	31.01**	33.00		1.49/ -.04	1.50/ -.03	1.48/ -.05
Mid-High SES		35.92	34.60	35.16		1.56/ .03	1.56/ .03	1.55/ .02
High SES		38.89***	37.62***	41.17***		1.61/ .08	1.61/ .08	1.82/ .29*
Single Parent	30.44***	33.39**	31.97*	33.40	1.40/ -.13*	1.43/ -.10	1.43/ -.10	1.44/ -.09
Repeated K	32.39	34.98	33.51	34.69	1.34/ -.19	1.37/ -.16	1.36/ -.17	1.25/ -.29
Full Day K					1.74/ .21***	1.75/ .22***	1.75/ .22***	1.58/ .05
Area Family Income			33.28	33.87			1.49/ -.04	1.60/ .07
Area Percent Minority			33.24	34.16			1.53/ .00	1.53/ .00
Area Percent Jobless			33.32	34.01*			1.53/ -.00	1.53/ .00
Area Drugs			28.88***	32.37			1.28/ -.25*	1.07/ -.47**
Area Burglary			34.66	36.05			1.47/ -.06	1.95/ .42*
Area Violent Crime			36.96	35.87			1.97/ .44	2.10/ .57
Level 1 & 2 tau	37.13***	31.74***	36.15***	39.68***	24.291***	25.04***	25.013***	27.11***
Standard Deviation	6.09	5.63	6.01	6.30	4.93	5.00	5.00	5.21
Level 3 tau	35.32***	35.51***	36.21***	20.19***	38.512***	37.11***	36.893***	26.67 ***
Standard Deviation	6.73	5.96	6.02	4.49	6.21	6.09	6.07	5.16

*** = p < .000, ** = p < .01, * = p < .05 Note: GR = monthly growth average over 9.38 (k), 2.62 (sum), and 9.41 (1st) months. Gap = GR – Mean Growth Rate (White children).

TABLE 5. READING AVERAGE MONTHLY GROWTH GAP, SUMMER AND FIRST GRADE

	SUMMER				FIRST GRADE			
	Race	SES	Residential	City	Race	SES	Residential	City
Intercept	-0.102	-.161	-0.144	1.820***	34.818***	34.827***	34.811***	33.805***
Monthly growth rate	-0.039	-.061	-0.055	.695	3.700	3.701	3.699	3.592
Growth	GR / Gap	GR / Gap	GR / Gap	GR / Gap	GR / Gap	GR / Gap	GR / Gap	GR / Gap
Gender	-.03/ .01	-.05/ .01	-.03/ .03	1.21/ .51*	3.93/ .23*	3.93/ .23*	3.93/ .23*	3.83/ .24
Black	-.33/ -.29	-.20/ .13	-.13/ -.08	.12/ -.58*	3.10/ -.60***	3.25/ -.45**	3.28/ -.42**	3.23/ -.36
Hispanic	.25/ .29	.37/ .43	.40/ .46	.41/ -.28	3.32/ -.38*	3.48/ -.22	3.48/ -.22	3.42/ -.17
Asian-PI	.64/ .68	.63/ .69*	.67/ .73*	1.65/ .96	3.68/ -.02	3.68/ -.02	3.68/ -.02	3.17/ -.43
Native	-.92/ -.88***	-.65/ -.59*	-.70/ -.64*		2.89/ -.81**	3.10/ -.60*	3.11/ -.58*	
Low SES		-.40/ -.34	-.41/ -.35	.64/ -.05		3.32/ -.38*	3.33/ -.37*	3.52/ -.07
Mid-Low SES		.06/ .12	.04/ .09	1.08/ .38		3.51/ -.19	3.37/ -.29	3.59/ -.00
Mid-High SES		.18/ .24	.17/ .23	1.09/ .39		3.88/ .18	3.87/ .17	3.50/ -.10
High SES		.61/ .67*	.62/ .68*	2.50/ 1.81***		4.05/ .35*	4.04/ .34*	4.13/ .54*
Single Parent	-.09/ -.05	.04/ .10	.07/ .12	.88/ .18	3.36/ -.34**	3.48/ -.22	3.48/ -.22	3.27/ -.32
Repeated K	.18/ .22	.27/ .33	.27/ .33	.47/ -.22	3.19/ -.51*	3.28/ -.42	3.28/ -.42	3.53/ -.06
Summer School	.25/ .29	.24/ .30	.23/ .28	-.43/ -.26				
Area Family Income			-.29/ -.23*	.31/ -.39**			3.62/ -.08	3.41/ -.18
Area Percent Minority			-.06/ -.01	.69/ -.01			3.70/ -.00	3.59/ -.00
Area Percent Jobless			-.05/ .00	.68/ -.02			3.69/ -.01	3.58/ -.02
Area Drugs			.19/ .14	1.22/ .53			3.38/ -.32	3.36/ -.24
Area Burglary			-.59/ -.53	.03/ -.66			3.53/ -.17	3.30/ -.29
Area Violent Crime			-.79/ -.73	-.00/ -.70			3.43/ -.27	3.12/ -.47
Level 1 & 2 tau	27.725***	27.51***	27.494***	29.01***	219.25***	218.94***	220.20***	216.01***
Standard Deviation	5.26	5.25	5.24	5.39	14.81	14.80	14.84	14.70
Level 3 tau	29.576***	28.99***	28.707***	11.55***	98.63***	93.77***	90.90***	88.119***
Standard Deviation	5.44	5.38	5.36	3.40	9.93	9.68	9.53	9.39

*** = p < .000, ** = p < .01, * = p < .05 Note: GR = monthly growth average over 9.38 (k), 2.62 (sum), and 9.41 (1st) months. Gap = GR – Mean Growth Rate (White children).

TABLE 6. MATH AVERAGE MONTHLY GROWTH GAP, BEFORE KINDERGARTEN AND KINDERGARTEN

	BEFORE KINDERGARTEN				KINDERGARTEN			
	Race	SES	Residential	Cities	Race	SES	Residential	Cities
Intercept	25.761***	25.842***	25.75***	23.143***	12.808***	12.818***	12.799***	12.334***
Monthly growth rate	--	--	--	--	1.365	1.366	1.364	1.315
Growth	Total	Total	Total	Total	GR / Gap	GR / Gap	GR / Gap	GR / Gap
Gender	25.39	25.67	25.57	23.07	1.33/ -.04	1.32/ -.04	1.32/ -.04	1.27/ -.04
Black	21.99***	23.64***	23.55***	20.77**	.99/ -.38***	1.04/ -.32***	1.04/ -.32***	.98/ -.33***
Hispanic	20.54***	23.23***	23.02***	19.74***	1.09/ -.27***	1.18/ -.18***	1.18/ -.19***	1.15/ -.16*
Asian-PI	26.86	26.70	26.68	23.03	1.15/ -.21*	1.15/ -.22*	1.15/ -.21*	1.05/ -.26
Native	19.76***	22.08***	21.83***		1.15/ -.22*	1.23/ -.14	1.24/ -.12	
Low SES		21.87***	21.68***	19.56***		1.17/ -.20**	1.17/ -.19***	1.06/ -.25**
Mid-Low SES		24.70*	24.59*	22.38		1.24/ -.13*	1.24/ -.13*	1.18/ -.14
Mid-High SES		28.00***	27.98***	24.41		1.38/ .01	1.37/ .01	1.21/ -.10
High SES		31.81***	31.92***	29.84***		1.49/ .12*	1.48/ .12	1.52/ .21*
Single Parent	22.92***	24.59**	24.48**	22.08	1.30/ -.07	1.34/ -.02	1.34/ -.02	1.25/ -.06
Repeated K	23.45*	24.70	24.51	22.66	1.19/ -.18	1.23/ -.14	1.23/ -.14	1.02/ -.29*
Full Day K						1.58/ .21***	1.57/ .20***	1.47/ .15*
Area Family Income			25.62	22.91			1.40/ .04	1.37/ .05
Area Percent Minority			25.75	23.15			1.36/ -.00	1.32/ .00
Area Percent Jobless			25.75	23.07			1.37/ .00	1.32/ .00
Area Drugs			23.86*	22.63			1.13/ -.24*	1.05/ -.27
Area Burglary			26.89	27.82			1.55/ .19	1.31/ -.00
Area Violent Crime			26.84	18.94**			1.34/ .02	1.54/ .22
Level 1 & 2 tau	32.15***	27.157***	30.25***	30.53***	18.822***	19.143***	19.154***	22.75***
Standard Deviation	5.67	5.21	5.50	5.53	4.34	4.38	4.38	4.77
Level 3 tau	21.37***	12.160***	12.79***	4.68***	21.04***	19.622***	19.437***	11.85***
Standard Deviation	4.62	3.49	3.58	2.16	4.59	4.43	4.41	3.44

*** = p < .000, ** = p < .01, * = p < .05 Note: GR = monthly growth average over 9.38 (k), 2.62 (sum), and 9.41 (1st) months. Gap = GR – Mean Growth Rate (White children).

TABLE 7. MATH AVERAGE MONTHLY GROWTH GAP, SUMMER AND FIRST GRADE

	SUMMER				FIRST GRADE			
	Race	SES	Residential	Cities	Race	SES	Residential	Cities
Intercept	1.928***	1.934***	1.942***	.474	25.742***	25.766***	25.729***	26.123***
Monthly growth rate	.736	.738	.741	.181	2.736	2.738	2.734	2.776
Growth	GR / Gap	GR / Gap	GR / Gap	GR / Gap	GR / Gap	GR / Gap	GR / Gap	GR / Gap
Gender	.86/ .12	.86/ .12	.86/ .12	.01/ -.17	2.60/ -.14*	2.60/ -.14*	2.60/ -.13	2.71/ -.06
Black	.77/ .04	.75/ .01	.88/ .13	-.12/ -.30	2.29/ -.45***	2.32/ -.42***	2.33/ -.40**	2.42/ -.35*
Hispanic	.78/ .04	.93/ .20	.93/ .19	-.28/ -.46	2.41/ -.33***	2.46/ -.27**	2.46/ -.27**	2.60/ -.18
Asian-PI	1.61/ .87*	1.59/ .86*	1.59/ .85*	1.17/ .99	2.18/ -.56***	2.18/ -.56***	2.17/ -.56***	2.20/ -.58
Native	.12/ -.61*	.26/ -.48	.26/ -.48		2.29/ -.44**	2.36/ -.38*	2.36/ -.38*	
Low SES		.49/ -.24	.49/ -.25	.17/ -.01		2.69/ -.04	2.69/ .05	3.04/ .26
Mid-Low SES		.94/ .20	.94/ .20	.52/ .34		2.64/ -.10	2.64/ -.09	2.87/ .10
Mid-High SES		.80/ .07	.81/ .07	.01/ -.17		2.82/ .08	2.81/ .08	2.96/ .18
High SES		1.21/ .48	1.22/ .48	.63/ .45		2.86/ .12	2.86/ .13	3.21/ .43*
Single Parent	.67/ -.06	.77/ .03	.77/ .03	-.10/ -.28	2.57/ -.17	2.60/ -.14	2.60/ -.14	2.72/ -.05
Repeated K	-.01/ -.75*	.08/ -.66	.09/ -.65	-.38/ -.56	2.35/ -.39*	2.37/ -.37*	2.36/ -.37*	2.36/ -.42
Summer School	.81/ .07	.82/ -.08	.83/ .09	.17/ -.01				
Area Family Income			.76/ .02	.08/ -.10			2.71/ -.02	2.65/ -.12
Area Percent Minority			.74/ .00	.18/ .00			2.73/ -.00	2.77/ -.00
Area Percent Jobless			.74/ -.00	.19/ .01			2.74/ .01	2.77/ -.01
Area Drugs			1.16/ .42	.60/ .42			2.54/ -.19	2.66/ -.12
Area Burglary			.90/ .16	.52/ .34			3.15/ .42	3.19/ .41
Area Violent Crime			.28/ -.46	.04/ -.14			2.44/ -.30	2.33/ .45
Level 1 & 2 tau	28.25***	28.260***	28.239***	29.04***	125.687***	125.837***	125.90***	115.17***
Standard Deviation	5.31	5.32	5.31	5.39	11.21	11.22	11.22	10.73
Level 3 tau	29.10***	28.714***	28.712***	9.52***	61.56***	60.763***	60.248***	54.978***
Standard Deviation	5.39	5.36	5.36	3.09	7.85	7.80	7.76	7.41

*** = p < .000, ** = p < .01, * = p < .05 Note: GR = monthly growth average over 9.38 (k), 2.62 (sum), and 9.41 (1st) months. Gap = GR – Mean Growth Rate (White children).