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

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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, securing employment and making higher wages. Earlier studies within urban contexts concluded that much of the inequality in children's cognitive performance resulted from what low income children and African Americans lost, or failed to learn, while school was in recess. The findings of these studies have not been supported by more recent ones using the Early Childhood Longitudinal Study, Kindergarten Cohort. To understand how the ecology of neighborhoods and cities might explain the differences among earlier and more recent studies, I assess the growth of racial, social-class, and gender achievement gaps during periods of ecological development (i.e. unguided learning prior to kindergarten and during the summer) and directed development (i.e. formal education) using a full and city sample of children from the ECLS-K. Within each sample, I determine whether cognitive performances vary according to indicators of neighborhood social disorganization. I find that city children experience larger reading and math achievement disparities according to race/ethnicity, social class and gender than those in the full sample, and that drug trafficking/use and violence contribute substantially to neighborhood level differences in early cognition. I conclude with a discussion of the study's implications for research and policy making.

INTRODUCTION

Disparities in children's cognitive performance continue to be a troubling reality. Urban African-American fourth graders have trailed their white counterparts by 31 points in NAEP mathematics since 2004. In contrast, the math gap between urban Hispanics and whites increased slightly to 25 points in 2007 (U.S. Dept. of Education, 2008). Differences in children's cognitive performance according to the socioeconomic status (SES) of families are just as concerning. There is a 23-point gap in math scores between children with parents that did not finish high school, and those that have college degrees (Rampey, Dion, & Donahue, 2009). Yet, perhaps the largest test-score gap ever documented in NAEP mathematics 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 & Norris, 1998). While we have ample evidence about these disparities, uncertainty remains as to *when* and *in which context* they are likely to develop. Do they develop when children are engaged in formal learning activities, as they learn outside of school, and/or within particular kinds of neighborhoods?

The importance of this question is underscored by federal attempts to hold schools accountable for these performance gaps. If achievement inequality arises while children are away from school—before they start formal education or during the summer recess—then NCLB also holds schools accountable for learning that occurs at a time and place beyond their reach. Also, the consequences of cognitive disparities are serious. Early cognitive performances have been linked, in research, to one's subsequent educational attainment (Kao & Thompson 2003; Entwisle, Alexander & Olson, 2005), wages (Neal & Johnson, 1997) and health outcomes (Whalley & Deary, 2001).

Pursuant to these questions, I explore children's learning within different developmental contexts in three ways, 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 periods; two that reflect children's ecological development (i.e. unguided learning before entering kindergarten and the following summer recess) and two that feature directed development (i.e. learning during kindergarten and 1st grade). This study therefore employs a natural experimental design in which achievement growth is assessed under two developmental conditions using a multilevel statistical methodology. Second, in an effort to explain some of the disagreement between the findings of earlier and more recent examinations of learning in these periods, I also consider how disparities in cognitive development may differ for children that reside in central cities. Third, I examine relationships between children's residential features and achievement inequality to ascertain in which developmental period neighborhood social disorganization may be most important to learning. The study results reaffirm the importance of contextual factors to an understanding of variability in children's cognitive trajectories, especially for African American city children, who I show are more sensitive to social inequalities.

REVIEW OF LITERATURE

DIRECTED DEVELOPMENT AND ACHIEVEMENT INEQUALITY

Few public trusts are more important than the one we place in our schools to direct the cognitive development of future generations. Despite this important mission, whether schools decrease (Mann, 1952), increase (Sorokin, 1959; Collins, 1977) or leave unchanged (Bowles & Gintis, 1976; Bourdieu, 1977) the cognitive disparities that exist among status groups as they matriculate through the U.S. educational system remains a primary question of stratification theory. The question extends from the observation of numerous ways in which schools contribute to racial, gender, and social class differences in learning. Achievement disparities might result from inequities in school resources, for example. African Americans attend elementary schools that rank lower on all 14 indicators of school resources measured by the Early Childhood Longitudinal Study, among them, teacher qualifications, class size, average student achievement, and teacher attitudes (Lee & Burkham, 2002). African-American children, followed by Hispanics, are the least likely of the major racial groups to attend majority white, higher resourced schools (Acevedo et al., 2007).

Once in school, racial dynamics often put underrepresented children at a relative disadvantage. Racial bias in the instruction of African Americans has been documented at length in ethnographic research (Wells & Crain, 1997); laboratory experiments (Ferguson, 2003); and mobility studies (Kaufman & Rosenbaum, 1992; Rosenbaum, Kulieke, & Rubinowitz, 1988). Others contend that instruction often lacks the cultural relevancy required to engage children of color (Gay, 2010) and prepare them to be effective citizens (Tate, 1994). Racial/ethnic stereotypes about children's culture and instructional needs often serve to enhance Asian Americans' pressures for high performance, and feelings of personal inadequacy when they might not meet these expectations (Lee, 2009). The stereotype may be most consequential for Pacific Islanders, who are often lumped together with higher income Asian ethnicities—within both their racialized educational experiences and research—leading to a lack of awareness about their higher levels of school poverty (Iton, Witt & Kears, 2008), neighborhood poverty (Hall et al., 2008), and lower test-scores (Takeuchi & Hune, 2008).

Gender inequality within schools is also a concern. Although the gender gap in math has converged since the year 2000, and is significantly smaller than the racial and social class gaps (Rampey, Dion, & Donahue, 2009), its size may vary across racial groups for several reasons. First, although the perception of gender bias in instructional settings has long been thought to advantage males over females (Mickelson, 1989), some argue it poses unique consequences for African American and Hispanic males. For example, observers contend that African American boys clash with the inflexible culture and expectations of schools (Harding, 2010), and are more frequently and severely disciplined (Ferguson, 2001). This may explain why they lose more ground on their white male counterparts between kindergarten and 3rd grade than do African American girls (Fryer & Levitt, 2005). Gender disparities may exist among Hispanic learners because, as Noguera (2008) argues, they are as likely as African Americans to attend the kind of urban schools that are least able to offset the social circumstances particular to males of color.

Other accounts of schooling suggest that social class remains a primary determinant of educational stratification. Not only are children sorted into different schools according to their SES (Brantlinger, 2003), researchers have long held that instruction differs within schools and classrooms according to social class, favoring higher income children (Anyon, 1981). In addition to SES differences in instructional practices, the qualifications and training of teachers (Clotfelter, Ladd, Vigdor & Wheeler, 2007), and teachers' decision to transfer to different schools (Johnson, Kraft & Papay, 2011) are associated with lower test-scores for children in high poverty schools. Finally, since one of the greatest determinants of a child's test performance lays in the qualities of her peers (Coleman et al., 1966), the concentration of low income—and consequently, lower performing children—within public schools reduces the occurrence of beneficial spillover effects that disadvantaged children experience in economically heterogeneous instructional settings (Johnson, 2012).

Recent analyses of the ECLS-K provide general support for many of these concerns. For instance, Lee et al., (2004) report that pre-existing cognitive disparities in math grow during kindergarten and first grade for low-income children, for Hispanics in first grade, and for low income, 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 gaps for African American and low-income children increase during kindergarten.

The thought that schools contribute to cognitive inequities is reinforced by studies that have minimized the possibility that racial and SES 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 inequality in math and reading develops while children are actively engaged in school, implying that there may be fewer disparities in a society that does not direct the development of children's learning.

ECOLOGICAL DEVELOPMENT AND THE "FAUCET THEORY"

An alternative view has stressed that schools are not the only places in which children's cognition is developed. Sociologist H.G. Duncan (1928) argued long ago that the constellation of environments in which a person has membership constitutes his or her personal ecology. Contemporary thought about a personal ecology, as advanced by developmental psychologists, situate cognitive development within a network of environments, with some of them serving as more immediate contexts of development than others (Bronfenbrenner, Moen & Garbarino 1984; Garbarino & Plantz 1980). This ecosystems framework suggests we consider other settings that might provide alternative developmental opportunities for children, and other mechanisms of social stratification.

In line with this thinking, examinations of differing developmental contexts has resulted in the "faucet theory", which proposes that children's social background characteristics are "turned on" like a faucet as children experience other environments within their ecosystem, and are turned off when they experience directed educational development (Entwisle & Alexander, 1992). The theory extends from research that determined black-white test-score differences were largely, if not entirely, due to social class differences in what children did or did not learn during the summer months (Heyns, 1978; Entwisle & Alexander, 1992). Heyns (1978) followed sixth- and seventh-grade students in the Atlanta public schools for two academic years and one intervening summer. She finds that affluent and white students had 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 learning gap among students was due to the inequitable cognitive growth occurring during the summer recess.

The research of Entwisle and Alexander (1992) tells a similar story. The authors find that starting in first grade, the achievement 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 Americans. The disparity was not caused by differences in school achievement; African Americans and low SES students tended to gain as much or more than relatively advantaged students while in school. Most of the difference in test performance was due to the influence of children's SES during the summer. Entwisle and Alexander (1992) conclude that economic status is the main determinant of summer achievement differences, and that summer gains and losses did not vary much according to race when poverty status was controlled.

The findings of these investigations were reaffirmed in recent studies. A meta-analysis of seasonal learning research shows that during the summer, middle class students gained in reading and math while low-income students lost (Cooper et al., 1996). There were no significant moderating effects found for race after controlling for SES. In terms of race, Burkham et al. (2004) analyzed ECLS-K data and report that the gap widened most in math for African-Americans during the summer. Finally, Lee and Burkham (2002), Reardon (2003), and Lee et al. (2004) show that test-performance gaps also accrue as children experience their initial context of learning, before they start formal education. Low income children, and to a lesser degree, African Americans, begin schooling less cognitively prepared in reading and math than their white and middle-class counterparts.

Faucet theory is supported by other studies that demonstrate how 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). On this point, Lareau (2003) argued that the summer learning experiences of lower income and underrepresented children rely on the "accomplishment of natural growth" rather than a more formal development called "concerted cultivation". Consisting of structured enrichment activities, concerted cultivation is thought to better support academic learning and possibly explain why higher income white and Asian children excel academically.

While these studies offer a new perspective on achievement inequality, they also inspire additional questions. First, few studies have examined gender differences within racial/ethnic categories during ecological periods. The findings of neighborhood studies in contrast give the impression that children's exposure to environmental conditions may influence boys and girls of color differently. African American girls, for example, seem to fall further behind boys in math (Entwisle, Alexander & Olson, 1994), and Puerto Rican girls become less likely to matriculate (Flores, 2002) as an area's income level rises. Other studies have found a context's SES is related to race-gender interaction effects, favoring the education of white males most, while unexpectedly disadvantaging African-American males (Johnson, 2008).

Second, articulations of the faucet model have presumed that seasonal effects vary due to the scheduling of schools, and its subsequent mediation of children's exposure to social background influences (Downey, von Hippel & Broh, 2004). The possibility that the social functioning of families and neighborhoods also varies across these periods has seldom been considered. One only has to look to the greater use of neighborhood public spaces and occurrence of crime during the summer to conclude that the nature of a neighborhood's social organization, and consequently its effects too, cannot be constant. Residents and youth in particular become more likely to interact in their neighborhoods during the summer, being brought together by seasonal events such as block socials, festivals, organized youth activities and local markets. Family units may become more active during the summer ecological period too, as they adjust to the loss of learning experiences and child supervision that schools provide (Lareau, 2003). Peer and mentoring relationships that form among children and staff from different neighborhoods are likely to wane in the summer as schools are in recess (Jencks & Mayer, 1990). Seasonal fluctuations in a unit's social organization, such as the aforementioned, result in periods when children have greater exposure to their area's "ecological curriculum" than at other times of the year. These possibilities bring us to a final observation: if the social organization of these units is less active during periods of directed development, examinations of them will produce smaller estimates of ecological effects. Therefore, it is unknown whether schools stop the "flow" of neighborhood and family influences into the system of educational production when in session (as suggested by the faucet theory), or if changes during the school season in the functioning of families and neighborhoods reduce their effects to a trickle, owing to a relative lull in their social activity (Johnson, 2012). Nonetheless, since research views social background effects as invariant when relating them to education outcomes, periodic differences in the social organization of neighborhoods and families are rarely explored.

THE ECOLOGY OF THE CITY

Forming conclusions about the relative importance of ecological and directed development periods from these studies is challenging, especially if one does not consider the origins of the study samples. On this point, the data analyzed by Heyns (1978) and Entwisle et al. (1992) are collected in Atlanta and Baltimore respectively, large urban cities with numerous areas of concentrated disadvantage. It is possible that the summer learning losses reported in these studies are due to the urban samples they employ, and poorer 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 infrequently located in disadvantaged areas (p. 74).

Despite Lee and Burkham's observation, there are at least two ways in which the urban residency of ECLS-K participants may inform the stratification of learning-readiness and educational experiences, as well as the differences between earlier and later examinations of periodic development. First, central cities are qualitatively different than other areas. They are areas of greater population density, diminished personal space (Park, Burgess & McKenzie, 1925), with fewer places than in the suburbs for children to play and engage in out-of-school enrichment activities (Celano & 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). Second, 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 that their schools had higher educational standards, more academic rigor, and teachers that provided greater educational support (Kaufman & Rosenbaum, 1992).

These possibilities have remained unexplored, since no study of seasonal learning has reported the developmental trajectories of urban children from the ECLS-K. Unfortunately, the meta-analysis performed by Cooper et al. (1996) does not consider how the average cognitive effect-size varies according to the origin of the sample, or the qualities of the neighborhoods in which children live and go to school. In an effort to explore why the findings of earlier seasonal learning studies within urban settings differ from those conducted with the ECLS-K, this study details how the cognitive trajectories of urban children of the ECLS-K vary across these different developmental periods, and in relation to the full sample.

NEIGHBORHOOD EFFECTS

If children's learning depends on their interaction with their environment, then inequalities at the neighborhood level may be more strongly related to achievement disparities—and, most detectable—when they are estimated while children are not experiencing directed development. 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, & Klebanov, 1997; Klebanov, Brooks-Gunn, Chase-Lansdale & Gordon, 1997). The other study, and lone application of faucet theory to the estimation of neighborhood effects, reports that the economic segregation of zip code areas was the most salient social background determinant of math and reading performance gaps during the summer, and that racial segregation was unrelated to test-scores (Benson & Borman, 2010).

Even in research that makes no distinction between developmental periods, relationships have been detected between neighborhood characteristics and children's learning. Neighborhood effects research has revealed a neighborhood's level of racial segregation has varied consequences for African American learners (Johnson, 2010), and for Hispanic and Filipino children (Pong & Hoa, 2007). In addition, violence and crime have been linked to 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 & Grogan-Kaylor, 2006; Madyun & Lee, 2007) and, lower vocabulary scores for African American 1st 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. Consequently, joblessness not only indicates an area's SES, but possibly its precarious social organization (Wilson, 1996). Neighborhood joblessness effects are 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 & Aber 1994). These hypotheses have received only modest support in research. Joblessness has been found negatively related to the education of African Americans in only one study, and it did not consider young children's learning (Halpern-Felsher et al., 1997). To date, no seasonal analysis has related neighborhoods' social disorganization to trends in cognitive growth.

Neighborhood problems may also impact child development, indirectly, through the actions of parents. Perceptions about the quality of neighborhoods may compel parents to adopt certain rearing strategies in an effort to manage children's exposure to harm or opportunity (Furstenberg et al., 1999). Inasmuch as risk factors are more common in socially disorganized areas, parents may be more likely to adopt protectionist (Jarrett, 1997) or authoritarian parenting strategies (Gutman, Friedel & Hitt, 2003). Authoritarian parenting is thought to emphasize children's obedience and conformity, and stifle their curiosity, creativity and intellectual growth (Luster & Okagaki 1993; Gutman, Friedel & Hitt, 2003). So parents may unwittingly, and perhaps involuntarily, convey contextual effects through their neighborhood-inspired rearing behaviors. The evidence seems to suggest that authoritarian parenting styles present educational consequences for whites only, after the SES of the neighborhood is considered (Dornbusch, Ritter & Steinberg, 1991).

Researchers have suggested caution because the indirect pathways of these effects may inflate family level variables at the expense of neighborhood variables, especially for young children who experience neighborhoods less directly than adolescents (Shonkoff & Phillips, 2000). Neighborhood selection effects is a related concern, since many of the reasons that parents decide to live in certain neighborhoods are unknown and possibly related to their concern for their child's educational success. However, studies that have explored these issues have found little evidence of parental selection bias (Foster & McLanahan 1996; Duncan, Connell & 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 & 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 period does more racial/ethnic, gender and social class inequality in reading and math develop? How do gender differences within racial/ethnic groups change across developmental periods?
b. Do gaps in learning exist between neighborhoods that vary in quality, and how might they change across developmental periods? 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 makes use of a natural ecological experiment identified by Johnson (2000; 2012) and described by Duncan and Raudenbush (2001) as an often ignored opportunity for experiments to arise from "seemingly non-experimental data" (p. x). This design is depicted in figure 1, in which children experience two developmental periods. In period 1, neighborhood influences on children's learning are mediated by their receipt of formal instruction and adult supervision within schools, and, less idle time in their neighborhood context (i.e. directed development). This model, however, is not consistently experienced by children; learning outcomes are also generated when children are away from school, interacting in their environments, and experiencing an ecological curriculum. This alternative conceptual pathway, identified as period 2 in figure 1, is experienced by children during the time before they begin their schooling careers, and intermittently during the school's summer breaks. These naturally occurring periods represent two distinct treatments and an opportunity for an experimental study in which we distinguish the effects of both ecological and directed developmental periods on children's cognitive trajectory. Assessments that occur at the beginning and end of the school year bound the seasonal changes within the social organization of neighborhoods, parenting strategies, and other unobserved social background and school factors in these periods.

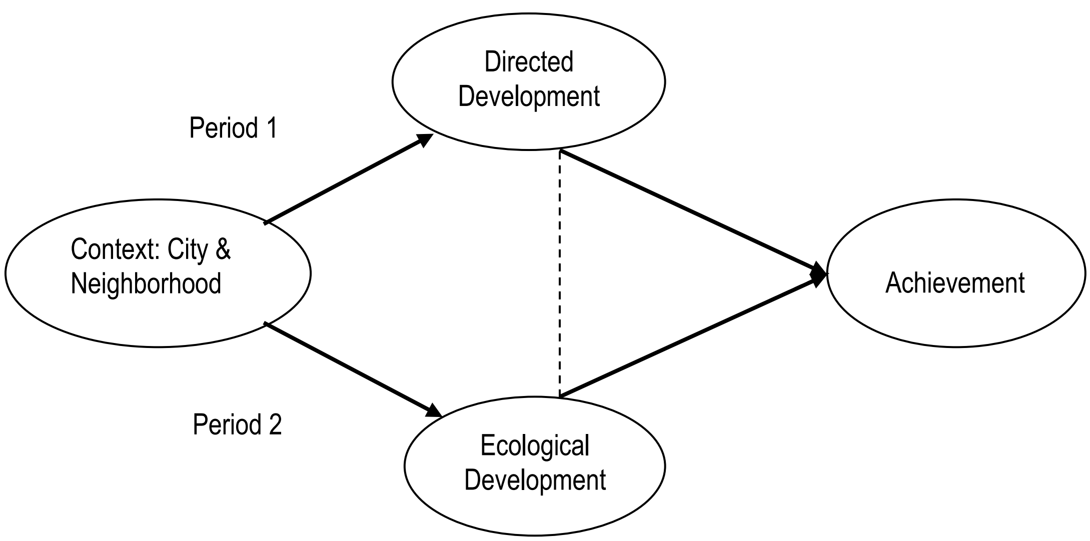

Figure 1. Natural Experimental Design

Figure 1 also reflects a multilevel conceptual model in which test-scores are nested within children, who are also nested within neighborhoods (Raudenbush & 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 developmental periods and 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 during the 1998 -1999 school year. 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 1st 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 ecological 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, 249 Asian American, 125 Native and 89 Pacific Islander children, for a total of 4873 who were kindergartners in 1998. Preliminary analyses reveal the final study-sample mirrors the properties of the larger ECLS-K sample.

In addition to the neighborhood measures included in the ECLS-K, I also rely on an NCES companion data file that links ECLS-K children to the tract and zip code in which they are located (Beveridge et al. 2004). Tract level measures are used in this analysis since the large size of zip-code areas make it uncertain whether its average on any characteristic is similar to that of the study participants' immediate residential area. Subsequently, the proposed research will be the first tract-level analysis of neighborhood impacts on seasonal learning. The results of the geo-coding process of the ECLS-K were almost identical with less than a 1 percent difference in the identification of children's zip-codes and tracts across the first four waves (Beveridge et al., 2004). Rather than deleting children from the sample, I linked those who had no tract

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[2] Variable C1_4PW0 is the parent weight for waves 1 through 4. The weights were not normalized for this analysis.

[3] Downey et al. 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 et al 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. For cases where the information is not reported, data were imputed from identical measures taken from the information collected in the fall of first grade.

[5] The ECLS-K reports the home zip codes for only rounds 3 and 4 and does not report moves that may have occurred at the census tract level.

identified to their zip code characteristics. The merging resulted in the identification of 3712 geographic units. A list of variables and their definitions appear in Table 1.

COGNITIVE 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 & Pollack, 2002).[6] These scores were released in 2009 as the survey's final recalibrated kindergarten and 1st grade scale-scores.[7] 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 1st grade assessment (over the summer); and, from the fall 1st grade assessment until the year-end assessment. Hence, the ECLS-K presents for comparison two distinct periods of directed development (i.e. formal education) and two periods of ecological development (i.e. unguided cognitive development).

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 1st 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 1st grade), and the exclusion of relevant days of instruction from estimates of directed development. Knowing the exact test dates and the beginning and ending dates of the school year allowed me to correct for both problems by extrapolating scores and apportioning cognitive growth between the periods as others have demonstrated (Downey, von Hippel & Broh, 2004; Benson & Borman, 2010).

This process made use of the beginning and end school dates supplied by school administrators, and when those dates were not provided, those given by parents. Although school calendar dates were provided when the children were in first grade, it seemed reasonable to also use them in this analysis to mark the beginning and end of kindergarten. These dates were differenced with the assessment dates to create a series of variables to account for the elapsed time between them measured in months. When included in the models, the *points per month* variables indicate the point change in reading and math scores per month.

CONSIDERING SOCIAL BACKGROUND AND DIRECTED DEVELOPMENT

I also compare growth rates according to child-level social background factors across periods while controlling for school-related factors. Social background dummy variables were coded as 1 = yes, 0 = no for *race/ethnicity*, *race-by-gender*, and *family SES*. Because previous investigations have found evidence of a non-linear relationship between test-performance and family SES as SES reaches high and low levels (Downey, von Hippel & Broh, 2004), I added 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

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[6] Cognitive assessments in reading included concepts related to… Assessments in math included count, number and shape concepts; numerical ordinality and sequences; addition and subtraction and simple multiplication and division.

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

status, educational level and total household income of parents (NCES, 2001). I also consider *gender* and differences in *family structure*.

Though my growth modeling strategy bounds the effects of schooling versus those of the environment, three additional education-related factors were needed to account for variation in the amount of directed development children receive. I consider whether the child attended a *full-day kindergarten* program (versus half-day), *attended summer school* and *repeated kindergarten*, (1 = yes, 0 = no), the latter of these also serving as a control for children who may be older than average. These measures account for differences in school exposure during periods of directed development while removing the influence of formal education during the ecological periods.

IDENTIFYING ECOLOGICAL DETERMINANTS

In addition to the investigation of ecological differences in learning that may emerge *between* different developmental periods, I also explore them *within* developmental periods, and according to children's residential type. Addressing the latter first, I used the *location type* variable to identify children that resided in central cities—approximately 39 percent of the analytical sample—and saved 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-period 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 minority 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' percentage of minority residents 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 & Bryk, 2002). The 3-level model consists of within-child measures of cognition 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 mathematics or reading performance before the start of 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:

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

Since this analysis estimates four parameters from four test-scores, I have constrained the value of the error term to equal the average amount of measurement error. 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 ranged from 7.92 points in the fall of 1998 to 18.24 in fall 2000 for reading, and amounted to an average of 12.45. Within the statistical program settings, I constrained the value of sigma squared to equal the measurement error averages for both reading and math.

Level 2 of the multilevel model includes the social background and school level variables. Each level 2 parameter represents the adjustment in the neighborhood average performance slope, β_{10n}. Since this research investigates racial, SES and race-by-gender differences in cognitive growth over time, there are a variety of Level 2 specifications for each of the four assessment periods. In the first Level 2 model, kindergarten growth rates π_{1cn} are a function of the child's gender, family composition, and the quintiles of family SES (with the middle quintile excluded). I model achievement gaps according to race in the second specification, so the family SES variables are replaced with the variables Black, Hispanic, Asian American, Native and Pacific Islander leaving the largest group, white children, as the reference group. In the third model 2 specification, I consider the race-gender variables for the four largest racial groups along with the SES variables. White males are reserved as the reference group. The fourth and fifth models represent the full model specifications for the total (model 4) and city (model 5) samples. The city model, however, only includes the 4 largest racial/ethnic groups because too few Natives and Pacific Islanders 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 period two, and the addition of the *attended summer school* variable at period three for all models. The full level 2 equation is as follows:

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

At Level 3, I model ecological-based variation in mean achievement with random intercept models (Raudenbush & Bryk, 2002). The Level 3 equation models neighborhood-to-neighborhood variation in their characteristics in each of the four developmental periods for the full (model 4) and city (model 5) samples. Hence, test-scores during each developmental period, β_{10n} are 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' view of whether burglary, drug trafficking/use, and violence are big problems in their neighborhood. I express the level 3 equation as:

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

In this equation, the intercept γ_{100}, represents the average growth rate of a development period 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 cognitive performance associated with a neighborhood's identification as having these problems.

DESCRIPTIVES

Tables 1 and 3 provide descriptive information for the full analytic sample and the city subsample.[8] 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 fewer whites 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.

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 whites are only 59 percent of the total sample, they constitute more than 76 percent of the top SES quintile. Asian Americans however are most likely to be advantaged with 34.5 percent of them being in the top income 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 whites. 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, they are further from the SES of whites than in the full sample. This is an important distinction given that previous examinations of seasonal learning in urban settings report that the SES of whites and blacks were 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 initial cognitive status. Likewise, over a month of schooling had occurred after the wave 2 assessment. As was done in earlier studies, the impact of this month of schooling on learning—and the 1.42 months in 1st grade before the wave 3 assessment—would have been bound in the estimate of summer learning that researchers produce by differencing the wave 2 and 3 assessments. In this study, summer learning will reflect the 2.62 months that spanned the end of kindergarten and the start of 1st grade.

RESULTS

READING

Tables 4 and 5 report the fixed and random effects of the reading analysis. Within these tables, models 1 and 2 estimate the social class and race gaps, respectively. Model 3 contains the race-gender gaps controlling for SES. Models 4 and 5 are the neighborhood models for the full analytical sample and the city

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[8] Correlations were highest among the three neighborhood social disorganization measures. Since these estimates did not exceed .487, I saw no need to replace these variables with a composite variable or undertake dimension reduction procedures.

sub-sample. In general, the analysis reveals prominent test-score gaps grow as children develop within their family and neighborhood environments. Inequality in the performance of children within the lowest and highest SES quintiles equals 9.987 points, approximately .94 standard deviation units. This gap expands to 10.766 points, in excess of a full standard deviation unit in the city sample, even upon considering children's family structure, neighborhood conditions and whether they would have been in kindergarten a second time once school started.

Model 2 shows that racial differences in reading performance are significantly different for all groups except Pacific Islanders. This gap remains between Native and Asian Americans only in the full model, and declines from a standard deviation unit difference of 1.11 (11.80 points) to a difference of .82, or 8.758 points. Only the race-gender estimates of Asian girls and boys, and white girls are significantly higher than that for white males, who were reserved from model 3 as the reference category. However, in the city sample, African Americans and Hispanics score significantly less in reading than whites, trailing the average performance by 2.56 and 2.97 points respectively, or by approximately one-quarter of a standard deviation unit. In addition to the larger social class, black and Hispanic performance gaps among city children, two aspects of social disorganization appeared related to achievement disparities at the neighborhood level. Children within neighborhoods where parents report drugs are a big problem score 4.37 points lower than those in less problematic neighborhoods. Rates of joblessness among inner-city children also appeared associated with lowered reading scores.

The kindergarten estimates show some unequal growth in reading once schools began directing children's learning, but the inequality appears less prominent than in the previous period. No significant social class gaps in learning emerged in models 1 – 4, and only African Americans did less well than the other racial groups. In all models, girls have significantly higher average reading scores than do males, most likely due to the higher performance of white girls (see model 3).

Environmental factors continued to bear on cognitive disparities while children were in school. First, the monthly growth point estimates show that city children benefit substantially more from directed development than the average child. This fact is especially consequential in understanding the relative difference in the negative estimates of black children for the full and city sample. Although the negative point estimate of Black children's growth within the city is larger than that of the full sample, it is offset by the much larger monthly growth rate of city children (2.21), leaving black children's reading to grow .356 points per month. In contrast, black children's loss in the full sample (model 4) exceeds the monthly growth rate, summing to a monthly loss of .396 points, and a 3.714 point loss by the conclusion of kindergarten. Nonetheless, the black gap is larger in central cities because other racial groups are gaining at more than twice the rate of the full sample. Second, only in the city model did I find a social glass gap. Higher income children performed significantly better than those in the other social class categories. Neighborhood drug problems remained related to test scores in both samples, but to a greater degree in the city sample. While the positive relationship between burglary and test outcomes might seem surprising, such a result is reasonable given the higher degree of economic diversity in this city sample (see table 3). Burglaries may be a greater concern for central city families, and especially its higher income populations. In sum, the gender, racial, social class and neighborhood level performance gaps were all larger among city children than geographically diverse children.

In the third period, children once again rely less on formal sources of cognitive guidance and more on their family and neighborhood contexts. During this summer period, the models reveal the reappearance of social class gaps. Not only do lower income children perform significantly less well than middle class children (-1.657), higher income children perform significantly better (2.091). This difference, amounting to 3.748 points per month, results in a 9.8198 point difference by the end of the 2.62 months of summer. The social class gap is largest for city children, however, equaling a social class gap .321 standard deviation units larger than that of the total sample by summer's end. In models 2 and 4, Native Americans have significantly lower reading scores. Even after I consider other social background characteristics, this loss amounts to 6.998 months of what they had learned in kindergarten. Among the ecological dimensions, a negative estimate for African Americans and the gender disadvantage for males reappear in the city. Neighborhood estimates reveal that children have lower test scores where violence is a big problem and rates of racial/ethnic concentration are higher. In sum, it seems inequality grows while children experience the ecological curriculum, and that the monthly point gaps are greater in magnitude than the ones that emerge while in kindergarten.

A return to school in period 4 shows that the influence of the social background faucet remains "turned on." The social class gap in reading widens during first grade due to the significantly lower performance of low income children and the higher performance of economically advantaged children. The well-off city children experience the greatest reading gains during first grade. The only racial group to test significantly less well in all of the models was that of African Americans (model 4). Model 3 intimates that most of this loss among African Americans is likely due to the performance of black boys. However, schooling does appear to offset the influence of neighborhood conditions, for none of their characteristics were significant for children.

MATHEMATICS

The mathematics analysis in tables 6 and 7 show that racial, social class and neighborhood-based cognitive disparities grow as children develop within their initial social contexts. The social class gap in math diminishes only slightly to 10.188 points once the neighborhood and race/ethnicity of the children are also considered. This gap is of comparable size to that found among city children, 10.28. The prominent race/ethnicity gap decreases substantially once family SES and neighborhood factors are considered, leaving a gap of at least 3.939 points between white and Native, Hispanic, and African American children. The gaps of these latter two groups appear to be larger within the central city than in the full sample. Model 3 suggest that their lower performance is likely due to Hispanic and black boys more than girls. Elements of neighborhood social disorganization seem to matter too. Drug trafficking/use for all children and neighborhood problems with violence for city children was related to lower mathematics scores, with the latter amounting to nearly a half (.493) standard deviation loss relative to children in less problematic areas.

Unlike in the reading analysis, social class and racial differences continue to manifest as children experience their first year of school-directed learning. Black children, followed by Pacific Islanders and Hispanics have gains that are lower than the points per month average, after adjusting for their social background characteristics. Black girls, boys and Hispanic girls continue to have less success in math, relative to the other groups. In models 4 and 5, the points per month growth rate shows that city children gain at a faster pace than the total sample. The social class and race gap for African Americans continue to appear larger among city children than among children of all residential types. Consistent with the reading analysis and faucet theory, directed development seems to have muted the influence of neighborhood features.

Fewer disparities in test-score growth occurred during the summer period, and no differences were revealed among city children and neighborhoods. Only children in higher SES families and Native Americans seem to differ significantly from the average test performance in the full model. For this latter group, losing -2.776 points per month over the summer equals a loss of 5.370 months of what Native Americans gained, on average, in math during kindergarten.

More cognitive disparities in math seem to develop during first grade than in the summer, including the first advantage for males in this analysis. This gender gap does not exist among city children, however. Racial/ethnic differences appear most pronounced during this period with Pacific Islanders having the largest performance shortfall in models 2 and 4. While Asian, Hispanic and African Americans also score significantly lower than the average white middle class child, this difference only remains for African Americans in the city sample. It is important to note that by the end of first grade, girls of all racial/ethnic groups perform less well in math, but the largest setback, after adjusting for social background factors, occurs for African American males (-3.937), as was the case in reading. Social class differences were only shown in the city sample, where high SES children performed significantly better than other social class groups. This advantage becomes even more substantial given the much larger growth rate of city children (2.735), relative to the full sample. No significant gaps were found among the neighborhood dimensions.

DISCUSSION

This study sought to increase knowledge about the ecological dimensions of cognitive development and, in doing so, has qualified many of the conclusions reached in previous research. Regarding the question of when does racial/ethnic, gender and social class inequality develop in reading and math, this analysis, like other examinations of these data, found no reading gap before the start of schooling or over the summer for Hispanic and African Americans. However, this analysis finds that gaps formed for their city counterparts in these ecological periods. Nonetheless, the racial difference for city African Americans that accrued during both ecological periods totaled 6.7 points, far less than the amount of inequality that resulted from just one period of directed development. So while the relevance of ecological differences implied in non-school development is supported in the city sample to a greater degree than that of Benson and Borman (2010), it does not confirm the applicability of faucet theory to race effects. The same can be said of children in the subject of math. Gaps grew for black and Hispanic Americans in the full and city samples in period one, not over the summer, and paled in comparison to those that formed during both periods of directed development. Only for Native Americans is the total study period gap in math due to losses during ecological periods.

Faucet theory was most applicable in the social class analysis. Prominent SES gaps existed by the end of children's first developmental period, and schooling moreover left this reading gap unchanged by the end of kindergarten. The summer social class gap in reading eclipsed both of the previous periods, but was surpassed by large disparities in first grade. In math however, children were affected by social class differences primarily during ecological periods, resulting in these periods explaining most of the total gap in mathematics. The idea that schools compensate for differences in family income (Downey, von Hippel & Broh, 2004; Condron, 2009) does not apply to city schools. Contrary to the faucet theory, less advantaged city children experienced greater losses in reading and math during periods of directed development. Moreover, the majority of social class inequality was due to what higher income children learned rather than what lower income children lost in relation to average growth estimates.

This analysis also adds to our understanding of differences between girls and boys, across and within racial groups. Although as frequently evident, gender gaps were much smaller than the racial and social class gaps. These gaps in reading favored girls, as did the math gap prior to the start of school. Girls however lost their advantage in math during kindergarten, and eventually trailed boys by the end of first grade.

Gender gaps interacted with race to create large disparities in cognitive growth. While these gaps were unchanged during the summer, more disparities grew during the directed development periods. The largest of these gaps by the end of the study period was for black males, in both subjects. Despite concerns about the non-school contexts of black males, their cognitive risks are greatest when they are in school.

The second question I posed regarded the existence of neighborhood level achievement differences, their change across developmental periods, and the power of neighborhoods to account for disparities among children of different social backgrounds. All of the neighborhood features were, in one period or another, significantly related to test scores. The largest neighborhood level cognitive gaps were recorded for children that resided where drug selling/usage and violence were problems. The social class gaps reduced, but not much, with the specification of neighborhood covariates. However, the level 3 variance estimates, τ, in tables 5 and 7 indicate modest changes in the percentage of between-neighborhood test-score variation from model 3, where the neighborhood characteristics are unspecified, to model 4 where they are specified. Once included, these neighborhood features explained the greatest amount of variation during the first ecological period, at .069 and .056 percent for reading and math, respectively.

More telling however is the consistency at which these neighborhood effects appeared: they were notably less consequential during periods of directed development. None of the neighborhood factors were significant in both subjects during the first grade, or in mathematics during kindergarten. A few tentative conclusions can be drawn from this pattern. First, this pattern supports the faucet theory in that directed development obstructs the flow of neighborhood influences. Second, that this pattern mirrored the periodic growth and wane of social class effects suggests neighborhood and social class stratification share an underlying structure that differs from that of racial/ethnic stratification, which seemed to be a contributor to learning differences irrespective of the period. Third, this pattern also lends credence to the idea that neighborhood influences are more easily detected if estimated in the absence of schooling. This observation is especially important from a methodological standpoint, since research that distinguishes the effects of multiple contexts on children's learning is rare. Natural experimental approaches of this kind and cross-classified random effects modeling (Raudenbush & Bryk, 2002; Pong & Hao, 2007) permit researchers to make these distinctions, but are limited by the availability of suitable data and the nascence of the field (Johnson, 2010). Depending on the relative magnitude of these periodic associations, school or neighborhood effects may be understated in research that fails to make distinctions between the two.

I called these conclusions tentative for a couple of reasons. First, this analysis' examination of periodic learning in central cities shows that city life has consequences apart from the specific neighborhood attributes included in this analysis. The generally larger cognitive disparities according to social class, gender, and for African Americans in particular, found within cities suggest that they are social units in which the greater economic inequality among families, lower level of school resources, and environmental norms suppress children's early cognitive development. Although growth rates were stronger in central city schools, part of this is due to the fact that children in those schools had the most to learn. Black city children for example began school with a reading score average lower than black children in the full sample, and 4.16 points lower than that of non-African Americans in the city. Still another reason is that more prosperous families within central cities use their greater resources to secure educational environments of privilege. Higher private, magnet and possibly charter school enrollments within cities may explain, in part and both, the larger growth rate in reading and mathematics, and the greater magnitude of the achievement gaps within central cities. This analysis has shown that the capacity of directed development to offset environmental inequalities depends on the demographic reality schools face.

Second, the literature review acknowledges that neighborhood and family dynamics may also change across these periods due to seasonal changes that lessen children's exposure to the ecological curriculum. To the extent that the provision of directed development inspires these changes in families and neighborhoods, then the periodic differences in the relevance of social class and neighborhood characteristics revealed in this analysis may still be attributed, however indirectly, to schooling. We would be even more confident about this possibility if periodic differences in neighborhood effects were muted in an approach where schooling was constant. Only then could we be more certain that the lesser importance of neighborhoods during periods 2 and 4 were due to children's participation in directed development, rather than a relative lull in the neighborhood's social activity. However, too few children attend year-round schools within the ECLS-K to test this hypothesis.

In conclusion, this research informs the consideration of many policy proposals and aides in the understanding of outcomes of federal efforts to close the achievement gap. We can infer from the SES and neighborhood differences that were found during ecological periods that the NCLB legislation, alone, is 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 ecological stratification. Year-round schooling is a frequently mentioned possibility. Since schooling appears to contribute to learning disparities in this analysis, especially according to race, giving children more schooling will not necessarily solve the problem.

After-school and early childhood programs are more targeted approaches that have had varied outcomes over the years. Still, they tend to not address 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 Promise Neighborhoods funded by the federal government in 2011. 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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TABLE 1. Descriptive Statistics, N = 4873 Full Analytical Sample, 1905 Urban Sample

	Mean Full	STDV	Mean Urban	STDV
Gender (1 = male, 2 = female)	1.49	.50	1.49	.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	.398
High SES (1 = yes, 0 = no)	.22	.42	.23	.42
Single parent (1 = yes, 0 = no)	.22	.42	.26	.44
Black (1 = yes, 0 = no)	.15	.36	.21	.41
White (1 = yes, 0 = no)	.59	.49	.45	.497
Hispanic (1 = yes, 0 = no)	.16	.37	.27	.44
Asian (1 = yes, 0 = no)	.05	.22	.06	.23
Pacific Islander (1 = yes, 0 = no)	.02	.13	.00	.05
Native (1 = yes, 0 = no)	.03	.16	.01	.09
Black male (1 = yes, 0 = no)	.08	.27	.11	.31
Black female (1 = yes, 0 = no)	.07	.26	.10	.30
White female (1 = yes, 0 = no)	.29	.46	.22	.41
White male (1 = yes, 0 = no)	.30	.46	.23	.42
Hispanic male (1 = yes, 0 = no)	.08	.27	.13	.34
Hispanic female (1 = yes, 0 = no)	.08	.27	.14	.34
Asian female (1 = yes, 0 = no)	.03	.16	.03	.17
Asian male (1 = yes, 0 = no)	.03	.16	.03	.17
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 (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 minority	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
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

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) using item response theory. If the reliability is r and the total variance of a test is $Var(Ysct)$, then the measurement error variance is $(1-r)\ Var(Ysct)$.

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

Race/Ethnicity	Distribution Category	Full Sample SES, N = 4873					City Sample SES, N = 1905				
		Low	Middle Low	Middle	Middle High	High	Low	Middle Low	Middle	Middle High	High
Black											
	Number	203	169	159	122	75	117	95	87	67	37
	% Within Black	27.9	23.2	21.8	16.8	10.3	29.0	23.6	21.6	16.6	9.2
	% Within Quintile	23.7	18.6	16.5	11.7	6.8	26.2	30.0	26.3	17.8	8.5
White											
	Number	238	490	593	722	836	47	100	151	225	329
	% Within White	8.3	17.0	20.6	25.1	29.0	5.5	11.7	17.7	26.4	38.6
	% Within Quintile	27.8	53.8	61.5	69.0	76.3	10.5	31.5	45.6	59.8	75.8
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
Asian											
	Number	34	41	34	54	86	27	22	13	20	27
	% Within Asian	13.7	16.5	13.7	21.7	34.5	24.8	20.2	11.9	18.3	24.8
	% Within Quintile	4.0	4.5	3.5	5.2	7.8	6.0	6.9	3.9	5.3	6.2
Pacific Islander											
	Number	20	26	25	11	7	1	1	2	0	1
	% Within Pacific Islander	22.5	29.2	28.1	12.4	7.9	20.0	20.0	40.0	.0	20.0
	% Within Quintile	2.3	2.9	2.6	1.1	.6	.2	.3	.6	.0	.2
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

TABLE 4. READING GROWTH, PERIODS 1 – 4

	MODEL 1 SES		MODEL 2 Race		MODEL 3		MODEL 4 Full		MODEL 5 City	
Fixed Effects	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Period 1: Time before Kindergarten										
Intercept	33.139***	0.238	33.347***	0.256	33.233***	0.242	33.231***	0.239	34.12***	0.352
Months before school	0.387***	0.069	0.412***	0.072	0.387***	0.525	0.39***	0.069	0.46***	0.798
Gender	1.211***	0.455	1.148*	0.463	--	--	1.216**	0.445	2.28**	0.733
Single parent	-1.822**	0.453	-2.854***	0.517	-1.249*	0.492	-1.230*	0.487	-0.77	0.694
Repeated Kindergarten	0.359	1.118	-0.974	1.250	0.322	1.134	0.256	1.146	0.56	2.025
Low SES	-5.432***	0.864	--	--	-5.172***	0.860	-4.93***	0.852	-3.77***	0.856
Mid low SES	-2.494**	0.843	--	--	-2.363**	0.837	-2.212**	0.818	-1.16	0.935
Mid high SES	1.334	0.849	--	--	1.314	0.841	1.344	0.815	0.99	0.918
High SES	4.555***	0.890	--	--	4.372***	0.890	4.327***	0.869	6.996***	1.179
Black	--	--	-2.341**	0.736	--	--	-0.71	0.746	-2.56**	0.914
Hispanic	--	--	-5.227***	0.757	--	--	-1.193	0.718	-2.97**	0.948
Asian	--	--	-2.613**	1.749	--	--	4.671**	1.668	2.42	1.803
Pacific Islander	--	--	-0.896	1.779	--	--	0.374	1.699	--	--
Native	--	--	-6.574***	1.118	--	--	-4.087***	1.088	--	--
White girls	--	--	--	--	1.428*	0.569	--	--	--	--
Black boys	--	--	--	--	-0.920	0.996	--	--	--	--
Black girls	--	--	--	--	0.886	0.880	--	--	--	--
Hispanic boys	--	--	--	--	-0.813	0.944	--	--	--	--
Hispanic girls	--	--	--	--	-0.031	0.986	--	--	--	--
Asian boys	--	--	--	--	4.664*	2.264	--	--	--	--
Asian girls	--	--	--	--	5.844*	2.390	--	--	--	--
Drugs	--	--	--	--	--	--	-4.373***	1.141	-1.77	1.815
Burglary	--	--	--	--	--	--	1.393	1.584	1.87	3.029
Violence	--	--	--	--	--	--	3.6999	1.932	1.74	5.018
Median income	--	--	--	--	--	--	0.043	0.275	-0.28	0.000
% Jobless	--	--	--	--	--	--	0.088	0.058	-0.14*	0.085
% Minority	--	--	--	--	--	--	0.009	0.009	0.02	0.020

Period 2: Kindergarten

Points/Month	0.937*	0.365	0.996**	0.379	1.012**	0.372	0.989**	0.378	2.210***	0.561
Gender	1.029**	0.390	1.043**	0.389	--	--	1.041**	0.389	1.271*	0.612
Single parent	-1.082*	0.441	-1.023*	0.460	-0.825+	0.466	-0.808+	0.465	-0.954	0.687
Repeated Kindergarten	-1.757*	1.891	-1.843*	0.877	-1.700+	0.875	-1.743*	0.861	-2.066+	1.130
All day K	1.508***	0.409	1.730***	0.423	1.717***	0.417	1.790***	0.433	0.169	0.718
Low SES	-1.190+	0.636	--	--	-0.952	0.658	-0.864	0.658	-0.102	0.842
Mid low SES	-0.115	0.726	--	--	-0.080	0.730	-0.065	0.725	-0.407	0.852
Mid high SES	0.229	0.666	--	--	0.222	0.666	0.218	0.663	-0.192	0.829
High SES	0.619	0.621	--	--	0.506	0.613	0.459	0.614	2.047*	1.004
Black	--	--	-1.737**	0.591	--	--	-1.385*	0.610	-1.854*	0.753
Hispanic	--	--	-0.865	0.580	--	--	-0.717	0.574	-0.156	0.770
Asian	--	--	0.122	1.142	--	--	-0.168	1.137	-0.140	1.628
Pacific Islander	--	--	-2.022	1.273	--	--	-1.965	1.315	--	--
Native	--	--	-1.529+	0.877	--	--	-1.287	0.903	--	--
White girls	--	--	--	--	1.237**	0.457	--	--	--	--
Black boys	--	--	--	--	-1.425+	0.863	--	--	--	--
Black girls	--	--	--	--	-0.141	0.688	--	--	--	--
Hispanic boys	--	--	--	--	-0.265	0.746	--	--	--	--
Hispanic girls	--	--	--	--	0.233	0.853	--	--	--	--
Asian boys	--	--	--	--	0.142	1.444	--	--	--	--
Asian girls	--	--	--	--	1.710	1.794	--	--	--	--
Drugs	--	--	--	--	--	--	-2.621**	1.017	-4.071**	1.333
Burglary	--	--	--	--	--	--	-0.217	1.306	4.061**	1.415
Violence	--	--	--	--	--	--	3.667	3.057	4.478	3.941
Median income	--	--	--	--	--	--	-0.346	0.271	0.611	0.418
% Jobless	--	--	--	--	--	--	-0.025	0.021	0.014	0.080
% Minority	--	--	--	--	--	--	0.001	0.008	0.013	0.013

Period 3: Summer

Points/Month	-0.745	0.883	-0.505	0.904	-0.807	0.892	-0.562	0.896	-0.411	1.247
Gender	0.611	0.344	0.558	0.344	--	--	0.643	0.342	1.347*	0.618
Single parent	0.060	0.519	-0.386	0.511	0.064	0.528	0.129	0.528	0.455	0.958
Repeated Kindergarten	-0.898	0.770	-1.267	0.784	-0.895	0.770	0.882	0.765	-0.588	1.114
Summer school	0.578	0.519	0.615	0.515	0.561	0.509	0.535	0.519	-0.668	0.966
Low SES	-1.740**	0.610	--	--	-1.681**	0.604	-1.657**	0.613	-0.112	0.763

Mid low SES	0.345	0.555	--	--	0.366	0.549	0.385	0.548	1.016	0.812
Mid high SES	1.241*	0.512	--	--	1.244*	0.511	1.176*	0.512	1.008	0.740
High SES	2.183***	0.526	--	--	2.153***	0.528	2.091***	0.527	4.719***	1.010
Black	--	--	-0.839	0.511	--	--	0.046	0.523	-1.563*	0.766
Hispanic	--	--	-1.013*	0.493	--	--	-0.197	0.480	-0.792	0.719
Asian	--	--	0.413	1.017	--	--	0.375	0.979	1.874	1.378
Pacific Islander	--	--	-0.354	0.779	--	--	0.243	0.770	--	--
Native	--	--	-3.440***	0.697	--	--	-2.566***	0.703	--	--
White girls	--	--	--	--	0.615	0.425	--	--	--	--
Black boys	--	--	--	--	-0.715	0.672	--	--	--	--
Black girls	--	--	--	--	1.215	0.658	--	--	--	--
Hispanic boys	--	--	--	--	0.131	0.714	--	--	--	--
Hispanic girls	--	--	--	--	0.066	0.761	--	--	--	--
Asian boys	--	--	--	--	1.164	1.116	--	--	--	--
Asian girls	--	--	--	--	-0.076	1.604	--	--	--	--
Drugs	--	--	--	--	--	--	-0.195	0.806	1.378	0.981
Burglary	--	--	--	--	--	--	-2.140	1.427	-1.746	1.957
Violence	--	--	--	--	--	--	-2.758*	1.427	-1.823	1.822
Median income	--	--	--	--	--	--	-0.720***	0.224	-1.016**	0.369
% Jobless	--	--	--	--	--	--	-0.012	0.019	-0.046	0.048
% Minority	--	--	--	--	--	--	-0.014*	0.006	-0.022	0.012
Period 4: 1st Grade										
Points/Month	0.644	0.585	0.663	0.599	0.676	0.586	0.684	0.590	2.096+	1.21
Gender	1.28*	0.64	1.332*	0.643	--	--	1.354*	0.636	1.12	1.03
Single parent	-2.267**	0.810	-2.241**	0.795	-1.51+	0.84	-1.534+	0.841	-2.21+	1.34
Repeated Kindergarten	-3.519**	0.28	-3.893**	1.335	-3.502**	1.26	-3.414**	1.273	-1.075	0.71
Low SES	-3.167**	1.04	--	--	-2.74**	1.05	-2.622*	1.032	-1.30	1.86
Mid low SES	-2.19	1.06	--	--	-1.49	1.06	-1.503	1.062	-0.56	1.84
Mid high SES	0.993	0.903	--	--	0.84	0.89	0.742	0.895	-0.25	1.47
High SES	2.951**	0.962	--	--	2.571**	0.95	2.469**	0.948	3.55*	1.60
Black	--	--	-4.571***	0.862	--	--	-3.549***	0.856	-2.83*	1.43
Hispanic	--	--	-1.344	0.987	--	--	-0.277	0.980	-0.22	1.66
Asian	--	--	1.758	1.671	--	--	1.491	1.597	-1.13	2.27
Pacific Islander	--	--	-1.370	1.781	--	--	-0.978	1.751	--	--
Native	--	--	-3.632+	2.077	--	--	-2.455	2.079	--	--
White girls	--	--	--	--	1.14	0.78	--	--	--	--

Black boys	--	--	--	--	-4.768***	1.240	--	--	--	--
Black girls	--	--	--	--	-1.40	1.206	--	--	--	--
Hispanic boys	--	--	--	--	-0.356	1.417	--	--	--	--
Hispanic girls	--	--	--	--	1.174	1.301	--	--	--	--
Asian boys	--	--	--	--	3.825	2.389	--	--	--	--
Asian girls	--	--	--	--	-0.992	1.594	--	--	--	--
Drugs	--	--	--	--	--	--	-0.799	1.690	0.348	2.41
Burglary	--	--	--	--	--	--	-2.477	1.524	-1.24	3.27
Violence	--	--	--	--	--	--	-1.216	2.163	-4.61	3.34
Median income	--	--	--	--	--	--	-0.676	0.431	-0.86	0.67
% Jobless	--	--	--	--	--	--	-0.063	0.064	-0.096	0.11
% Minority	--	--	--	--	--	--	-0.020	0.013	-0.02	0.02

*** = p < .000, ** = p < .01, * = p < .05

TABLE 5. READING GROWTH, PERIODS 1 – 4

RANDOM EFFECTS

Period 1	Model 1		Model 2		Model 3		Model 4		Model 5	
Level 1 & 2 Variances										
Tau, τ /SD	34.87001	5.905	37.38425	6.114	35.12890	5.927	36.21085	6.018	39.84394	6.312
X^2 / DF	2627.808***	297	2812.677***	296	2674.789***	291	2685.416***	292	700.408***	92
Level 3 Variances										
Tau, τ /SD	39.86571	6.314	44.66250	6.683	38.63158	6.215	35.98982	5.999	20.07966	4.481
X^2 / DF	4159.883***	2554	4280.583***	2554	4091.663***	2554	3925.313***	2548	1110.985***	881
Period 2										
Level 1 & 2 Variances										
Tau, τ /SD	10.60538	3.257	11.21804	3.349	11.03627	3.322	11.45475	3.385	17.58128	4.193
X^2 / DF	1497.604***	301	1517.095***	300	1513.459***	295	1531.654***	296	488.778***	94
Level 3 Variances										
Tau, τ /SD	35.38847	5.949	34.52825	5.876	34.5312	5.876	33.74403	5.809	23.05273	4.801
X^2 / DF	5788.918***	2531	5608.027***	2531	5633.358***	2531	5491.811***	2525	1427.337***	872
Period 3										
Level 1 & 2 Variances										
Tau, τ /SD	9.31693	3.052	9.93663	3.152	9.42406	3.070	9.54869	3.090	29.06888	5.392
X^2 / DF	1586.003***	162	1610.745***	161	1584.270***	156	1591.530***	157	721.344***	56
Level 3 Variances										
Tau, τ /SD	23.40154	4.838	23.57552	4.855	23.0832	4.805	22.52585	4.746	11.55163	3.399
X^2 / DF	6246.343***	3129	6160.718***	3129	6188.732***	3129	6101.672***	3123	1295.104	1073
Period 4										
Level 1 & 2 Variances										
Tau, τ /SD	97.2632	9.862	96.1162	9.804	95.75569	9.785	96.45423	9.821	98.75217	9.937
X^2 / DF	6863.971***	197	6880.303***	195	6818.725***	191	6864.330***	192	2726.806***	67
Level 3 Variances										
Tau, τ /SD	44.8029	6.694	47.2793	6.876	44.57324	6.676	43.47767	6.594	44.66005	6.683
X^2 / DF	3934.532***	3085	4015.126***	3085	3946.387***	3085	3907.108***	3079	1383.507***	1080

*** = p < .000, ** = p < .01, * = p < .05

TABLE 6. MATH GROWTH, PERIODS 1 – 4

Fixed Effects	MODEL 1 SES Estimate	SE	MODEL 2 Race Estimate	SE	MODEL 3 Estimate	SE	MODEL 4 Full Estimate	SE	MODEL 5 City Estimate	SE
Period 1: Time before Kindergarten										
Intercept	25.671***	0.180	25.765***	0.195	25.758***	0.178	25.748***	0.177	23.14***	0.275
Months before school	0.585***	0.047	0.603***	0.051	0.575***	0.047	0.576***	0.047	0.47***	0.000
Gender	-0.165	0.341	-0.391	0.362	--	--	-0.193	0.337	-0.07	0.527
Single parent	-1.575***	0.402	-2.823***	0.407	-1.328**	0.406	-1.258**	0.403	-1.06	0.629
Repeated Kindergarten	-1.474	0.870	-2.281*	1.013	-1.240	0.874	-1.227	0.880	-0.48	1.167
Low SES	-4.987***	0.511	--	--	-4.203***	0.531	-4.064***	0.536	-3.58***	0.76
Mid low SES	-1.424*	0.584	--	--	-1.274*	0.586	-1.159	0.588	-0.77	0.794
Mid high SES	2.337***	0.522	--	--	2.226***	0.516	2.205***	0.514	1.27	0.88
High SES	6.534***	0.573	--	--	6.192***	0.567	6.124***	0.567	6.70***	0.95
Black	--	--	-3.792***	0.489	--	--	-2.216***	0.476	-2.37**	0.785
Hispanic	--	--	-5.237***	0.497	--	--	-2.751***	0.486	-3.398***	0.685
Asian	--	--	2.698*	1.276	--	--	1.760	1.153	-0.10	1.74
Pacific Islander	--	--	-2.981**	1.066	--	--	-1.1399	1.010	--	--
Native	--	--	-6.011***	1.090	--	--	-3.939**	1.124	--	--
White girls	--	--	--	--	-0.108	0.429	--	--	--	--
Black boys	--	--	--	--	-2.506***	0.675	--	--	--	--
Black girls	--	--	--	--	-1.694**	0.617	--	--	--	--
Hispanic boys	--	--	--	--	-2.724***	0.663	--	--	--	--
Hispanic girls	--	--	--	--	-2.447***	0.655	--	--	--	--
Asian boys	--	--	--	--	3.123	1.636	--	--	--	--
Asian girls	--	--	--	--	0.017	1.456	--	--	--	--
Drugs	--	--	--	--	--	--	-1.884*	0.797	-0.51	1.297
Burglary	--	--	--	--	--	--	1.132	1.080	4.68	2.435
Violence	--	--	--	--	--	--	1.150	1.977	-4.62**	1.78
Median income	--	--	--	--	--	--	-0.135	0.203	-0.23	0.29
% Jobless	--	--	--	--	--	--	-0.001	0.022	-0.07	0.04
% Minority	--	--	--	--	--	--	0.000	0.007	0.00	0.01

Period 2: Kindergarten										
Points/Month	1.227**	0.278	1.331***	0.286	1.351***	0.277	1.352***	0.279	1.530***	0.414
Gender	-0.250	0.298	-0.290	0.299	--	--	-0.311	0.296	-0.319	0.447
Single parent	-0.502	0.362	-0.371	0.370	-0.058	0.369	-0.047	0.368	-0.766	0.560
Repeated Kindergarten	-1.220	0.780	-1.395+	0.793	-1.124	0.773	-1.128	0.769	-2.202*	0.919
All day Kindergarten	1.344***	0.317	1.559***	0.325	1.583***	0.323	1.593***	0.323	0.999*	0.504
Low SES	-2.064***	0.461	--	--	-1.635**	0.470	-1.566**	0.472	-2.068**	0.764
Mid low SES	-1.248**	0.484	--	--	-1.170*	0.477	-1.141*	0.477	-1.052	0.812
Mid high SES	0.107	0.454	--	--	0.080	0.452	-0.033	0.452	-0.855	0.753
High SES	0.962*	0.491	--	--	0.749	0.492	0.666	0.491	1.523*	0.782
Black	--	--	-3.105***	0.435	--	--	-2.702***	0.431	-2.375***	0.637
Hispanic	--	--	-2.013***	0.397	--	--	-1.370**	0.406	-1.100+	0.618
Asian	--	--	-1.020	1.744	--	--	-1.113	0.896	-2.325	1.591
Pacific Islander	--	--	-2.616**	0.859	--	--	-2.346**	0.869	--	--
Native	--	--	-1.589*	0.788	--	--	-1.852	0.811	--	--
White girls	--	--	--	--	-0.180	0.373	--	--	--	--
Black boys	--	--	--	--	-2.569***	0.625	--	--	--	--
Black girls	--	--	--	--	-2.848***	0.544	--	--	--	--
Hispanic boys	--	--	--	--	-1.113+	0.618	--	--	--	--
Hispanic girls	--	--	--	--	-1.606**	0.560	--	--	--	--
Asian boys	--	--	--	--	-1.466	1.193	--	--	--	--
Asian girls	--	--	--	--	-0.651	1.213	--	--	--	--
Drugs	--	--	--	--	--	--	-1.609+	0.864	-1.872+	1.095
Burglary	--	--	--	--	--	--	0.311	1.548	-0.523	1.587
Violence	--	--	--	--	--	--	0.778	1.447	1.726	1.435
Median income	--	--	--	--	--	--	0.339+	0.181	0.394	0.291
% Jobless	--	--	--	--	--	--	0.016	0.026	0.035	0.048
% Minority	--	--	--	--	--	--	0.006	0.006	0.009	0.010
Period 3: Summer										
Points/Month	0.462	0.722	0.607	0.747	0.350	0.719	0.566	0.743	-0.476	1.283
Gender	-0.059	0.340	-0.089	0.342	--	--	-0.041	0.339	-0.448	0.535
Single parent	-0.170	0.415	-0.257	0.422	-0.087	0.430	-0.089	0.431	-0.727	0.611
Repeat Kindergarten	-0.646	0.825	-0.704	0.814	-0.624	0.822	-0.598	0.819	-1.479	1.147

Summer school	-0.751	0.470	-0.665	0.468	-0.689	0.466	-0.652	0.469	-0.025	0.884
Low SES	-0.436	0.523	--	--	-0.218	0.543	-0.132	0.552	-0.056	0.835
Mid low SES	-0.190	0.474	--	--	-0.160	0.474	-0.083	0.476	0.867	0.884
Mid high SES	-0.091	0.500	--	--	-0.093	0.501	-0.122	0.499	-0.469	0.820
High SES	1.786**	0.524	--	--	1.724**	0.530	1.682**	0.533	1.154	0.941
Black	--	--	-0.870	0.552	--	--	-0.632	0.558	-0.794	0.835
Hispanic	--	--	-1.087*	0.460	--	--	-0.774	0.488	-1.1996	0.786
Asian	--	--	0.520	0.971	--	--	0.397	1.002	2.764	1.445
Pacific Islander	--	--	-0.555	1.021	--	--	-0.213	1.019	--	--
Native	--	--	-3.133***	0.649	--	--	-2.766***	0.670	--	--
White girls	--	--	--	--	-0.222	0.436	--	--	--	--
Black boys	--	--	--	--	-1.062	0.659	--	--	--	--
Black girls	--	--	--	--	-0.074	0.834	--	--	--	--
Hispanic boys	--	--	--	--	-0.930	0.669	--	--	--	--
Hispanic girls	--	--	--	--	-0.535	0.641	--	--	--	--
Asian boys	--	--	--	--	0.081	1.182	--	--	--	--
Asian girls	--	--	--	--	0.896	1.732	--	--	--	--
Drugs	--	--	--	--	--	--	-0.247	1.092	1.096	1.375
Burglary	--	--	--	--	--	--	2.342	2.461	0.882	2.676
Violence	--	--	--	--	--	--	-1.066	1.827	-0.364	2.284
Median income	--	--	--	--	--	--	0.082	0.197	-0.274	0.312
% Jobless	--	--	--	--	--	--	-0.002	0.020	0.019	0.034
% Minority	--	--	--	--	--	--	-0.000	0.006	0.004	0.011

Period 4: 1st Grade

Points/Month	0.556	0.440	0.629	0.433	0.671	0.437	0.707	0.438	2.735**	0.869
Gender	-1.081*	0.440	-1.123*	0.439	--	--	-1.095*	0.438	-0.401	0.699
Single parent	-1.359*	0.595	-0.961	0.614	-0.722	0.624	-0.708	0.627	-0.411	0.908
Repeat Kindergarten	-2.770**	1.013	-2.688**	1.021	-2.461*	1.027	-2.563*	1.027	-2.471+	1.412
Low SES	-0.692	0.699	--	--	-0.237	0.704	-0.157	0.713	0.938	1.113
Mid low SES	-0.779	0.704	--	--	-0.703	0.698	-0.684	0.696	0.267	1.120
Mid high SES	1.062	0.691	--	--	1.063	0.688	0.963	0.686	1.433	1.102
High SES	1.266+	0.702	--	--	1.101	0.712	1.020	0.707	3.282**	1.118
Black	--	--	-3.533***	0.660	--	--	-3.179***	0.676	-2.597**	0.999
Hispanic	--	--	-1.615*	0.639	--	--	-1.219+	0.669	-1.096	1.078
Asian	--	--	-2.754*	1.119	--	--	-2.905**	1.107	-2.293	1.761
Pacific Islander	--	--	-4.242**	1.331	--	--	-3.903**	1.330	--	--

Native	--	--	-0.977	1.119	--	--	-0.537	1.151	--	--
White girls	--	--	--	--	-1.164*	0.572	--	--	--	--
Black boys	--	--	--	--	-3.937***	0.918	--	--	--	--
Black girls	--	--	--	--	-3.512***	0.859	--	--	--	--
Hispanic boys	--	--	--	--	-1.135	0.931	--	--	--	--
Hispanic girls	--	--	--	--	-2.233**	0.813	--	--	--	--
Asian boys	--	--	--	--	-2.945+	1.683	--	--	--	--
Asian girls	--	--	--	--	-3.699*	1.659	--	--	--	--
Drugs	--	--	--	--	--	--	-1.248	1.258	-0.855	1.494
Burglary	--	--	--	--	--	--	1.915	2.026	3.242	2.103
Violence	--	--	--	--	--	--	-1.970	2.628	-3.776	2.838
Median income	--	--	--	--	--	--	-0.073	0.306	-0.401	0.525
% Jobless	--	--	--	--	--	--	0.042	0.044	-0.054	0.077
% Minority	--	--	--	--	--	--	-0.010	0.009	0.002	0.015

*** = p < .000, ** = p < .01, * = p < .05

TABLE 7. MATH GROWTH, PERIODS 1 – 4

RANDOM EFFECTS										
Period 1	MODEL 1		MODEL 2		MODEL 3		MODEL 4		MODEL 5	
Level 1 & 2 Variances										
Tau, τ /SD	29.39005	5.421	32.22207	5.676	29.83936	5.463	30.1943	5.495	30.53526	5.526
X^2 / DF	2234.095***	309	2353.589***	308	2242.460***	303	2251.830***	304	768.497***	72
Level 3 Variances										
Tau, τ /SD	15.4098	3.926	20.95112	4.577	13.52672	3.678	12.76238	3.573	4.68073	2.164
X^2 / DF	3515.360***	2884	3785.277***	2884	3393.557***	2884	3338.051***	2878	1169.596***	1165
Period 2										
Level 1 & 2 Variances										
Tau, τ /SD	10.87909	3.298	10.03737	3.168	10.37539	3.221	10.40985	3.226	13.69850	3.701
X^2 / DF	1381.364***	315	1359.904***	314	1363.538***	309	1363.637***	310	549.307***	83
Level 3 Variances										
Tau, τ /SD	16.96719	4.119	17.77530	4.216	16.81346	4.100	16.53846	4.067	10.80122	3.287
X^2 / DF	4615.497***	2854	4805.310***	2854	4655.767***	2854	4618.356***	2848	1509.161***	1153
Period 3										
Level 1 & 2 Variances										
Tau, τ /SD	14.53274	3.812	15.03860	3.878	14.55199	3.815	14.74838	3.840	29.0426	5.389
X^2 / DF	2017.452***	133	2030.698***	132	2010.865***	127	2018.902***	128	1218.480***	34
Level 3 Variances										
Tau, τ /SD	18.50752	4.302	18.17281	4.263	18.34932	4.284	17.95410	4.237	9.50426	3.083
X^2 / DF	5432.199***	3388	5352.842***	3388	5414.361***	3388	5353.565***	3388	1452.786***	1295
Period 4										
Level 1 & 2 Variances										
Tau, τ /SD	47.92772	6.923	47.15862	6.867	46.60511	6.827	47.0235	6.857	46.94583	6.852
X^2 / DF	4101.283***	170	4056.201***	169	4071.544***	164	4058.888***	165	1355.854***	42
Level 3 Variances										
Tau, τ /SD	30.29953	5.505	30.30266	5.505	30.74416	5.545	29.7994	5.459	26.53325	5.151
X^2 / DF	4530.498***	3289	4551.368***	3289	4587.515***	3289	4530.342***	3283	1642.980***	1251

*** = p < .000, ** = p < .01, * = p < .05