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Behavioral Self-regulation, Early Academic Achievement, and the Effectiveness of Urban Schools for Low-Income Ethnic Minority Children

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Abstract

The independent and joint associations between child behavioral self-regulation ability and school effectiveness in relation to academic achievement were examined in a sample of low-income African American ($n = 132$) and Latino ($n = 198$) children attending kindergarten and first grade across a large metropolitan area. Child behavioral self-regulation and school effectiveness were positively associated with both reading and mathematics performance. School effectiveness moderated the effect of behavioral self-regulation on reading but not math achievement. Lower child behavioral self-regulation during early elementary school was associated with lower reading achievement the following year but only among children attending less effective schools. Behavioral self-regulation was not related to reading achievement among children attending more effective schools. Implications of these findings for policies addressing disparities in early academic achievement are discussed.

Keywords

self-regulation; academic achievement; urban schools

Children's ability to manage their behavior has been identified as one of the most important prerequisites to school success (Rimm-Kaufman, Pianta, & Cox, 2000). Children must be able to sit quietly and listen to the teacher, change activities when requested to do so, and resist temptations to touch their fellow students or take their personal belongings. The range of individual differences in the ability to self-regulate in early childhood is wide, and the job of managing a classroom of 5-year olds has been described by kindergarten teachers as akin to "trying to keep crickets in a basket" (Bodrova & Leong, 2008). These individual differences in behavioral self-regulation during early childhood are predictive of academic success, with better self-regulation during the transition to formal schooling associated with

better academic achievement as well as behavioral outcomes (see Ursache, Blair, & Raver, 2012 for a review).

Self-regulation has been defined as “a broad construct representing the cognitive, motivational-affective, social and physiological processes that modulate attention, emotion, and behavior to a given situation/stimulus, for the purpose of pursuing a goal” (Bassett, Denham, Wyatt, & Warren-Khot, 2012) (p. 597) and is supported by the interrelated cognitive skills of working memory (the ability to hold information in mind), inhibitory control (the ability to suppress a dominant response in favor of a subordinate response), and cognitive flexibility (the ability to shift attention or cognitive set) (Denham, Warren-Khot, Bassett, Wyatt, & Perna, 2012; Garon, Bryson, & Smith, 2008). In the present study, we focus on *behavioral* self-regulation, as opposed to emotional self-regulation. McClelland et al. (2014) define behavioral self-regulation as “deliberately applying multiple component processes of attentional or cognitive flexibility, working memory, and inhibitory control to overt, socially contextualized behaviors” (p. 2) and identified it as especially important for early academic achievement due to requirements for children to manage their behavior in the classroom.

Children who are exposed to conditions of poverty during early childhood are more likely to display deficits in self-regulation when entering school which, in turn, places children at risk for academic failure (Raver, Blair, & Willoughby, 2013; Vernon-Feagans, Willoughby, & Garrett-Peters, 2016). African American and Latino children are significantly more likely to live in economically distressed households which puts them at increased risk for academic failure. In 2014, almost a third of African American and Latino children in the United States were living in households with incomes below the federal poverty level compared to 13% of non-Latino white children (Jiang, Econo, & Skinner, 2016).

Child development is best conceived as unfolding within the context of nested and interrelated settings of families, schools, and communities (Bronfenbrenner, 1986). Outcomes are influenced not only by individual differences in children but also by characteristics of the families in which they live, the schools they attend, and the communities in which those schools are situated. Community conditions impact children’s cognitive and behavioral development in early childhood directly (Beyers, Bates, Pettit, & Dodge, 2003; Caughy & O’Campo, 2006; Caughy, O’Campo, & Nettles, 2008; Szapocznik et al., 2006) and also shape family-level processes. Furthermore, the specific family conditions supportive of healthy child development depend, in part, on the characteristics of the community in which the child and family live (Lima, Caughy, Nettles, & O’Campo, 2010; Roche & Leventhal, 2009).

The prominent conceptual framework of Garcia Coll et al. (1996) highlights the unique ecological niches of ethnic minority children. Not only are children of color more likely to live in families living below the federal poverty level, they are more likely to live in distressed neighborhoods independent of family socioeconomic status (Duncan & Magnuson, 2005). In this study, we examine schools as an important context shaping the development of self-regulation skills and early academic achievement among low-income African American and Latino children. Low-income children, particularly those of color, are

significantly more likely to attend schools with high proportions of poor children. High poverty schools are characterized by less qualified teachers, high staff turnover, and fewer resources (Lankford, Loeb, & Wyckoff, 2002; O'Day & Smith, 2016), and such characteristics of school environments have important implications for children's achievement (Dupere, Leventhal, Crosnoe, & Dion, 2010; Raver, McCoy, Lowenstein, & Pess, 2013; Sasser, Beekman, & Bierman, 2015). In addition, there is evidence that schools are shaped by the community in which the school is located (Emory, Caughy, Harris, & Franzini, 2008; McCoy, Roy, & Sirkman, 2013). For example, McCoy, Roy and Sirkman (2013) found school characteristics were a function of neighborhood crime rates, and that school climate partially mediated the relation between neighborhood crime and students' academic achievement.

Both proximal and distal contexts also shape self-regulation development specifically. Families characterized by high levels of disorganization and chaos are associated with poorer self-regulation development (Vernon-Feagans et al., 2016). Neighborhood conditions that increase stress may affect self-regulation development through their impact on glucocorticoid production and the effect of these hormones on the development of brain regions associated with executive functions fundamental to self-regulation (Blair, 2010; McCoy, 2013). A small body of research indicates neighborhoods characterized by high rates of poverty and crime are associated with higher rates of impulsivity and overall dysregulation among children (Jones & Lynam, 2009; King, Lengua, & Monahan, 2013; McCoy, Raver, & Sharkey, 2015; Roy, McCoy, & Raver, 2014; Zimmerman, 2010). McCoy (2013) proposed a bioecological systems perspective to elucidate how contextual factors at the family and community level translate into individual differences in self-regulation development. Although McCoy (2013) focuses specifically on extreme stressors such as neighborhood violent crime and family domestic violence, the foundational principles of a bioecological systems perspective translate to less extreme circumstances such as generalized household chaos and/or community disorganization/instability. Contexts characterized by disorganization have the potential of increasing stress for children and, in turn, having a negative impact on self-regulation development.

Self-regulation skills may partially mediate the relation between school context and academic achievement. Consistent with a bioecological systems perspective, schools characterized by disorganization and few resources may create stress for children and potentially undermine self-regulation development. There is evidence that supportive school environments enhance children's development of self-regulation (Merritt, Wanless, Rimm-Kaufman, Cameron, & Peugh, 2012; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). Furthermore, evidence suggests synergistic interactions between school environments and self-regulation skills critical to academic progression (Curby, Rudasill, Edwards, & Pérez-Edgar, 2011; Liew, Chen, & Hughes, 2010). Specifically, the impact of school environments may depend, at least partly, on early individual differences in children's self-regulation skills. For example, attending elementary schools identified as unsafe is associated with poorer self-regulation in middle childhood, but only for those children identified as having poor self-regulation skills in preschool (Raver, McCoy, et al., 2013). These findings highlight another aspect of McCoy's (2013) bioecological systems model, which is the transactional, bidirectional relations between contextual risk factors and

children's self-regulation and are consistent with other developmental literature demonstrating the impact of a particular environment is often moderated by child characteristics (Belsky, Bakermans-Kranenburg, & van Ijzendoorn, 2007; Obradovi , Bush, Stamperdahl, Adler, & Boyce, 2010).

In this paper, we explore the relation of child self-regulation and school characteristics with both early academic achievement as well as gains in achievement over the first couple of years of formal schooling. Although schools have been identified as an important context shaping children's development and academic achievement (Sylva, 1994), research on the relation of school context to self-regulation development is sparse. A few studies have examined classroom-level effects on self-regulation (Raver et al., 2011; Raver, McCoy, et al., 2013; Rimm-Kaufman et al., 2009), but other than Raver et al. (2013), we could not identify any other studies of broader school characteristic effects on self-regulation and academic achievement.

We focus specifically on low-income African American and Latino children attending predominantly urban schools. We characterize schools using an index of school effectiveness reflecting how children attending that school perform on standardized tests relative to predicted performance based on school demographic characteristics. Using data on child self-regulation skills and school effectiveness, we examine how these factors independently as well as jointly relate to children's academic performance during the first few of years of formal schooling. We predict that having better self-regulation as well as attending more effective schools will be associated with better academic achievement. We examine achievement in both reading and mathematics based on evidence that self-regulation effects on mathematics are stronger than for reading (Blair, Ursache, Greenberg, & Vernon-Feagans, 2015; McClelland et al., 2014). Furthermore, based on previous research as cited above, we predict the relation between school effectiveness and academic achievement will be stronger for children with less well-developed self-regulation skills.

Finally, based on literature suggesting ethnic differences in the processes and factors related to early self-regulation and academic development (Brewis, Schmidt, & Casas, 2003; McLeod & Nonnemaker, 2000), we test for ethnic differences in the relations between behavioral self-regulation, school environments, and early academic achievement. According to the framework put forth by Garcia-Coll and colleagues (1996), the development of children of color is shaped by both current and historical contextual demands. African American and Latino families differ dramatically both in terms of their history as well as their current ecological niches. Our previously published research with the present sample has identified ethnic differences in self-regulation development (favoring African American children in some domains and Latino children in other domains) (author references) as well as differences in the relation of family-level processes with both self-regulation development (author reference) as well as early academic achievement (author reference).

Method

Participants

Participants were drawn from a longitudinal study of self-regulation development and school readiness among low-income, ethnic minority preschoolers (author reference). Families were recruited for the parent study using numerous strategies including outreach and distribution of study-related information to agencies and organizations serving low-income populations (e.g., WIC clinics, Head Start programs, day care centers, churches, community recreational centers) as well as directly recruiting study participants while out at community venues. Half of the recruitment team was bilingual, and all recruitment information was available in English and Spanish. Study procedures were reviewed and approved by the institutional review boards of [author institution] and [author institution].

Eligibility criteria for the parent study included: child would be between the age of 29 and 31 months sometime during the enrollment period, one of the child's parents self-identified as African American or Latino, child not hospitalized at birth for more than 7 days, and the family planned to remain in the metropolitan area for at least one year. Children and families were enrolled during a home visit when the target child was 2½ years old, and children were reassessed at age 3½, during the 2013–14 academic year (kindergarten/first grade), and during the 2014–15 academic year (first/second grade). The current investigation utilizes data from the third wave of data collection, when the children were in kindergarten/first grade, and the fourth wave of data collection, when the children were in first and second grade, because of the focus on school environments and academic achievement.

Of the original 407 children enrolled at age 2½, five were subsequently withdrawn due to developmental disability or serious illness, and six requested to be withdrawn from the study prior to the Wave 3 visit. Of the remaining 396, 330 (83.3%) completed the Wave 3 and/or Wave 4 data collection. Girls were more likely to be lost to follow-up (21%) compared to boys (13%), $\chi^2(1) = 5.08, p < .05$. Likewise, African American children were significantly more likely to be lost to follow-up, with a 25% lost to follow up rate among African American families compared to 10% among Latinos, $\chi^2(1) = 17.67, p < .001$. Family income and family size were used to calculate a family income-to-needs ratio at each wave of data collection, and families lost to follow-up had a lower average household income-to-needs ratio over the course of the study, .66 versus .88 for those not lost to follow-up, $t(389) = 2.83, p < .01$. However, children lost to follow up did not differ in terms of their self-regulation skills assessed at age 2½.

Characteristics of the sample of children and families in this analysis are displayed in Table 1. Latino children were more likely to live in a two-parent family than were African American children (83.4% vs. 23.8%). Based on literature documenting chronic poverty as more detrimental for children's development than intermittent poverty (see (Bradley & Corwyn, 2002) for a review), we categorized family income by the number of times across the four waves of data the family's income fell below 100% of the federal poverty level (see Table 1). African American children were significantly more likely to experience chronic poverty (40%) compared to Latino children (25%). However, Latino parents had completed fewer years of schooling, with 42% having not completed high school compared with 14%

of African American parents. Three-quarters of Latino caregivers were foreign-born, with the vast majority originating from Mexico. Most of the Latino caregivers spoke primarily Spanish (58%) or were bilingual (31%).

Procedures

Two research assistants conducted the interviews and assessments during a home visit with one interviewing the caregiver and the other conducting the child assessments. For our Latino families, both research assistants who conducted the home visits were fully bilingual. When the home visit was scheduled, it was requested that other children in the household be provided with other care during the time of the home visit. However, home visit teams carried additional toys that could be used to engage other siblings during the home visit if needed. Finally, the research assistant in charge of interviewing the parent also worked to minimize distractions by keeping other siblings (and pets) out of the area where the child assessments were occurring.

Approximately 86% of the study children were in kindergarten in Wave 3 with the remaining 14% in first grade. The average age of children at Wave 3 was 75.56 months, $sd = 3.95$, range 64 to 86 months. Latino children were slightly older than African American children, mean = 76.22, $sd = 3.72$ versus mean = 74.58, $sd = 4.09$, $t(323) = -3.75$, $p < .001$. This is likely an artifact of the fact the recruitment of Latino families for the first wave of the study was fielded a few months ahead of the recruitment of African American families. During Wave 3, just over half (54%) of assessments occurred in the spring, 18.3% occurred during the fall, and an estimated 27% occurred during the summer after the academic year ended. The average length of time between Wave 3 and 4 assessments was 11.86 months; range: 8.52 months to 17.52 months. For Wave 4, 65% of the children were assessed between 11 and 13 months after their Wave 3 assessments, and 86% were assessed between 10 and 14 months after their Wave 3 assessments.

Measures

Child academic achievement—Academic achievement in reading and mathematics was assessed by administering three subtests of the Woodcock-Johnson Revised (Woodcock, 1990) and the Bateria Woodcock-Muñoz (Woodcock & Munoz-Sandoval, 1996) for Spanish-speaking children. The Applied Problems subtest was used as a measure of mathematics achievement, and the Letter-Word Identification and Word Attack subtests were combined and used as a composite measure of reading achievement. W-scores were used in the analysis.

Child behavioral self-regulation ability—At both time points, child behavioral self-regulation ability was assessed using the *Heads-Toes-Knees-Shoulder* (HTKS) task (Ponitz et al., 2008). The HTKS task is a short, game-like task appropriate for children between the ages of 4 and 8 years that requires children to integrate the full range of executive functions to respond accurately. The “game” starts with a set of paired rules: “touch your head” versus “touch your toes”. At the beginning of the game, the experimenter tells the child to do what s/he does and either touches his/her head or toes while the child copies the experimenter’s actions. Next, the experimenter changes the rules and tells the child to do the opposite of

what the experimenter does (e.g., touch toes when experimenter touches head and vice versa). After 10 trials of heads and toes, the next 10 trials consist of a different set of paired rules: “touch your knees” versus “touch your shoulders”. Finally, if the child performed adequately during the first two phases, the last 10 trials of the task re-combine the pairs such that the rules are “touch your head” versus “touch your knees” and “touch your shoulders” versus “touch your toes”.

Each test trial is coded as incorrect (0), self-correct (1), and correct (2). For a total of 30 test trials across all three phases, the possible score ranges from 0 to 60. In the present study, the HTKS task was video recorded and scored from the video recordings. Interrater reliability based on an intraclass correlation coefficient (ICC) was .89 and .90 for Wave 3 and Wave 4, respectively. The construct and predictive validity of the HTKS have been demonstrated in numerous studies (Duncan, McClelland, & Acock, 2017; McClelland & Cameron, 2012; McClelland et al., 2014; Montroy, Bowles, Skibbe, McClelland, & Morrison, 2016; Schmitt, Geldof, Purpura, Duncan, & McClelland, 2017).

School effectiveness—An index reflecting effectiveness of the school the child attended during Wave 3 (kindergarten/first grade) and Wave 4 (first/second grade) was obtained from a public policy advocacy group called CHILDREN AT RISK that compiles ranking data each year for all public and charter schools in Texas. A detailed description of the methodology used for creating the school effectiveness index can be found at www.childrenatrisk.org (Sanborn, Carter, Davila, & Tipton, 2015). Briefly, school demographic characteristics and test data are used to create an adjusted deviation score for the school which is the difference between the predicted pass rate on the state standardized tests as a function of school demographic characteristics and the actual pass rate. For example, a school with a pass rate higher than predicted based on school demographics will have a positive adjusted deviation score, and a school with a lower than predicted pass rate will have a negative adjusted deviation score.

In addition to this measure of school effectiveness, we used CHILDREN AT RISK data files to obtain descriptive data for schools including school ethnic composition and proportion of students in the school who were economically disadvantaged. These characteristics of the schools attended by study children at Wave 3 are displayed in Table 1. Study children attended 184 different schools in Wave 3, and 182 different schools in Wave 4. During Wave 3, the average number of children per school was 1.66, range 1 to 8, median 1.00. Approximately 64% of the study children were the only child from their school, and 86% were in a school with only 1 or no other study children. During Wave 4, the average children per school was 1.58, range 1 to 7, median 1.00. In Wave 4, 67% of the study children were the only child from their school, and 88% were in a school with only 1 or no other study children.

Approximately 78% of study children attended public schools, and about 19% attended charter schools. Type of school attended differed by child ethnicity, with Latino children more likely to attend public schools compared to African American children (81% vs. 73%), and African American children more likely to attend charter schools compared with Latino children (26% vs. 15%). Ethnic composition of schools also differed by ethnicity. More than

60% of African American children in the study attended ethnically-mixed schools with about a third attending predominantly African American schools. Latino children participating in the study showed the opposite pattern, with two-thirds attending predominantly Latino schools and a third attending ethnically mixed schools. The proportion of children in the school who were economically disadvantaged ranged from .02 to 1.00, $M = .86$, $sd = .18$, median = .93. African American children attended schools with a higher proportion of economically disadvantaged children on average, $m = .90$, $sd = .15$, compared with Latino children, $m = .81$, $sd = .19$, $t(204) = -3.29$, $p < .001$. For descriptive purposes, school effectiveness scores, expressed as Z-scores, were categorized based on number of standard deviations below or above the predicted pass rate. As can be seen in Table 1, African American children in the study attended lower performing schools compared to the Latino children in the school, with 37.5% attending low performing or marginal schools and only 14.5% attending high average or higher performing schools, compared with 18.5% and 37.1%, respectively, among Latino children.

Of the 306 children who participated during both Wave 3 and Wave 4, 223 (76%) attended the same school both years. The proportion of children changing schools was higher among African Americans (35%), more than twice the proportion of Latino children who changed schools (16%), $\chi^2(1) = 13.96$, $p < .001$. For children who switched schools, schools did not differ in terms of proportion of economically disadvantaged students in the two schools, either for the sample over all or stratified by ethnicity. For African American children who switched schools, the average school effectiveness score did not differ between the two schools. However, Latino children who moved were likely to move to a higher performing school, mean for W3 school = .11 ($sd = .61$) versus mean for W4 school = .33 ($sd = .94$), $t(21) = 2.14$, $p < .05$.

Analysis Plan

After examining bivariate relations between the study variables using Pearson correlation coefficients, both prospective and concurrent effects of school effectiveness and child self-regulation on reading and math achievement were assessed in a path analytic framework modeled using MPlus (Muthén & Muthén, 1998–2006). In addition, we estimated the prospective and concurrent effects of the interaction between school effectiveness and child self-regulation. The advantage of path analysis is that all effects are modeled (and adjusted for) simultaneously. Additionally, direct maximum likelihood estimation was used to ensure valid inference in the presence of data missing completely at random (MCAR) or missing at random (MAR). Based on evidence of differential relations between self-regulation development and reading achievement versus mathematics achievement from the work of others (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; Lan, Legare, Ponitz, Li, & Morrison, 2011; Matthews, Ponitz, & Morrison, 2009; McClelland et al., 2014; Ponitz, McClelland, Matthews, & Morrison, 2009) as well as our own published research (author references), reading and mathematics achievement scores were modeled separately. All path models were adjusted for child ethnicity, child age at the time of assessment for Wave 3, and number of times the child's household income was below the federal poverty level across all four waves of data collection.

Results

Descriptive statistics as well as intercorrelations among the study variables are displayed in Table 2. Latino children had higher achievement scores in both reading and math and also scored higher on the HTKS at both waves. In addition, Latino children attended more effective schools compared with African American children. Child self-regulation was positively associated with both reading and mathematics performance at both waves. School effectiveness was positively associated with both achievement as well as child self-regulation at Wave 4.

The results of path analyses are displayed in Table 3. In Model 1, all possible prospective and concurrent effects were included in the model. In Model 2, the interaction between school effectiveness and child self-regulation was dropped in cases of non-significance, but concurrent and prospective main effects of school effectiveness and child self-regulation were retained. The final path models are shown in Figure 1. The concurrent effect of child self-regulation at W3 was significant for both reading and math such that higher scores on W3 HTKS were associated with better reading and mathematics achievement at W3. Although there was no concurrent effect of child self-regulation for reading at W4, the concurrent effect of the HTKS at W4 was significant for mathematics. Specifically, higher HTKS scores at W4 significantly predicted higher mathematics scores during the same period. Because Wave 3 achievement is controlled in the path analysis, this effect is independent of the child's previous mathematics achievement and reflects the extent to which W4 HTKS predicts a "reshuffling" in the rank order of achievement scores across time.

With regard to school effects, although there were no concurrent effects of school effectiveness, there was a prospective effect for reading such that higher school effectiveness at W3 predicted higher reading achievement at W4. Finally, there was a significant prospective interaction between child self-regulation and school effectiveness for reading. The nature of the interaction is displayed in Figure 2, which shows the marginal impact of school effectiveness in W3 on reading achievement in W4 at different levels of child self-regulation ability in W3. Self-regulation is scaled as a z-score, with axis indicators for the mean and one standard deviation above and below the mean. At low levels of child self-regulation, approximately one standard deviation below the mean, the per unit change in the reading achievement score for one standard deviation change in school effectiveness was just over 20 points, approximately half a standard deviation. Because school effectiveness is standardized, a unit change is equivalent to a one standard deviation increase in school effectiveness relative to all schools in the state. However, as child self-regulation skill increases, the marginal impact of school effectiveness declines. At one standard deviation above the child self-regulation mean, the impact of school effectiveness is no longer significant, and the 95% confidence interval includes zero.

Differences by ethnicity were examined in a series of multiple group path models. For both reading and math, we first ran an unconstrained multiple group model, allowing all parameters to vary by ethnicity. Next, all path coefficients were constrained to equality across ethnicity (intercepts and residual variances remained free to vary by ethnicity).

Modification indices from these constrained models were then inspected for values exceeding 10 (a conservative threshold given the number of parameters and no hypothesized differences). For mathematics achievement, no modification indices exceeded this threshold. For reading achievement, other than several nonsensical modification indices (such as ones suggesting reverse causation across time), only the autoregressive path representing the influence of reading achievement in kindergarten on reading achievement in first grade differed by ethnicity. Results for the fully constrained, fully unconstrained and partially constrained multiple group path model for reading achievement are available from the authors upon request. The autoregressive path from kindergarten reading achievement to first grade reading achievement was stronger among African Americans compared to Latinos. The significant interaction between school effectiveness and child self-regulation did not differ by ethnicity.

Discussion

There is extensive research documenting the importance of children's ability to control their behavior for academic success during the transition to formal schooling (Liew, 2012; Ursache et al., 2012). Using two waves of data in which most of the children were in kindergarten during the first wave and in first grade during the second wave, we extend this research by examining how an indicator of low-income ethnic minority children's readiness for school in terms of their behavioral self-regulation ability as well as the effectiveness of the school the child attends independently as well as jointly contribute to early academic achievement. Contrary to predictions, we did not find any significant concurrent effects of school effectiveness for either math or reading achievement in multivariate path models, which included measures of school effectiveness, child behavioral self-regulation and school achievement at both waves. However, there was a significant prospective effect of school effectiveness for subsequent reading achievement. Children who attended more effective schools during kindergarten demonstrated better reading achievement during the following year. However, the relation between school effectiveness and later reading achievement was conditioned on child behavioral self-regulation ability. School effectiveness was important for the reading achievement of children with low self-regulation skills but not for those with well-developed self-regulation skills. The association did not appear to differ by child ethnicity.

This finding echoes research suggesting environmental risk factors have a greater impact when coupled with child vulnerability factors such as poor behavioral self-regulation (Lengua, 2002; Obradović et al., 2010; Raver, McCoy, et al., 2013) and provides evidence of the bidirectional, transactional relation between children and their environmental ecosystem (Sameroff & Fiese, 2000). This interaction makes sense insofar as less effective schools may be characterized by less organized classrooms and less experienced teachers that may translate into a more stressful school environment for children. Children who enter school with poorer behavioral self-regulation are more dependent on environmental supports to maximize their ability to focus attention (Curby et al., 2011; Downer, Rimm-Kaufman, & Pianta, 2007; Hamre & Pianta, 2005), which in turn impacts academic performance.

Concurrent effects of behavioral self-regulation were significant in the first wave of data collection, when most children were in kindergarten, for both reading and mathematics. Specifically, children with poorer self-regulation skills displayed lower achievement in both academic domains. The finding that children who entered kindergarten with better behavioral self-regulation skills concurrently displayed better academic achievement is consistent with other research in the area (Ursache et al., 2012). The importance of the first three years of formal schooling lies in the fact that the skills being acquired provide the foundation for virtually all learning that comes after (Entwisle & Alexander, 1999). As such, entering school with less well developed behavioral self-regulation skills can have a negative impact on the development of these foundational skills and, in turn, have a lasting impact on academic achievement. In addition, the effect of school effectiveness on the children's growth in reading achievement, controlling for concurrent effects of school effectiveness also reinforces the importance of higher quality school experiences in children's earliest years in school.

Concurrent effects of HTKS performance in wave 4, the second year of school-age assessments of the children and when most of the children were in first grade, were significant for mathematics but not reading, and the prospective effect of W3 HTKS performance for W4 achievement was not significant for reading or mathematics. The empirical literature is mixed in terms of whether behavioral self-regulation predicts academic performance equally well across achievement domain. While some report that self-regulation predicts academic achievement in both reading and mathematics (Lan et al., 2011; McClelland et al., 2007; McClelland et al., 2014), others report relations for mathematics but not reading (Blair et al., 2015; Brock et al., 2009; Ponitz et al., 2009; Schmitt et al., 2017). Others report prospective effects differ by the specific component of executive function being assessed (Brock et al., 2009), author reference). Conclusions are difficult to draw because of methodological differences across studies including whether self-regulation was measured across time or at a single point, whether achievement outcomes were modeled as a single point in time or growth over time, and what specific measures of self-regulation were the focus of study. The studies that report prospective effects tightly controlled for social age at the time of assessment with all child assessments occurring during the fall or spring semesters of the school year or both. The current study was not designed to control for social age in the same way, and consequently, the time varied relative to the academic year in terms of when children completed the assessments. A little over half of the children in the present study were assessed in the spring semester with the remainder roughly split between the summer months and the fall semester after school ended. The variability in timing relative to the academic year is one of the limitations of the current investigation and may have muddled potential prospective effects for behavioral self-regulation for academic achievement.

Although not a primary focus of the current investigation, it is notable that more than half of the children in the sample (58%) attended schools that were rated below average in terms of effectiveness. The proportion of children attending below average schools was significantly higher among African American children (76%) compared to Latino children (46%). It is also notable that in the current sample, African American children were almost twice as likely as Latino children to attend charter schools. The average reading achievement for

children in our study attending public schools in kindergarten was marginally higher than those attending public schools relative to charter schools, 441.82 ($sd = 46.15$) versus 430.63 ($sd = 29.57$), respectively, $t(286) = 1.73$, $p = .085$. This difference was statistically significant one year later, 475.32 ($sd = 41.81$) for public schools versus 459.33 ($sd = 28.29$) for charter schools, $t(291) = 3.45$, $p < .01$. Mathematics achievement did not differ by school type. There is currently a lively debate regarding the effectiveness of charter schools relative to public schools for supporting academic achievement (see e.g., (Center for Research on Education Outcomes, 2015; Maul, 2015). Although the range of effectiveness for the charter schools attended by children in our sample was wide, the average effectiveness was lower relative to public schools. Our data suggest that charter schools are less effective in supporting reading achievement for low-income ethnic minority children living in an urban area.

This study adds to a growing body of research underscoring the importance of community contexts in shaping developmental outcomes. Although there is a plethora of research documenting how the interrelated contexts of neighborhoods and schools have important implications for children's behavioral and academic outcomes (see e.g., Caughy, Nettles, & O'Campo, 2007; Emory et al., 2008), only a very small portion of this body of research has focused on how these contexts affect self-regulation specifically. Self-regulation development may be the mediating process linking structural inequalities in communities and schools and children's well-being, e.g., how these inequalities "get under the skin" (Lupien, King, Meaney, & McEwen, 2001; McCoy, 2013).

One of the limitations of the current investigation is undoubtedly the limited information regarding the schools attended by study children. Our measure of school effectiveness, operationalized as the difference between predicted and actual performance of students at the school level, is a crude measure at best of school quality. A more comprehensive measure of school quality would include direct assessments of teacher qualifications, school climate, and school resources. However, the fact that significant school effects on achievement were identified despite the relatively crude measure of the school context underscores the importance of the school environment for supporting academic achievement. Another limitation of the current investigation is the fact we were limited to only two years of academic achievement and school measurement. Although prior waves of data collection exist for this sample, these waves do not include measures of academic achievement and school environments because children in the sample were not yet attending school. We are continuing to follow this sample from late elementary school through middle school. With more waves of school and academic achievement data, we can determine if the patterns evident in the first two waves are maintained.

Implications for research, policy and practice

The results of the current investigation underscore that efforts to reduce disparities in educational outcomes must look beyond interventions focused solely on changing characteristics of children and/or families. Academic adjustment is a function of the interrelated contexts of family, school, and community; factors at each level interact dynamically with characteristics of the child, which can function as either sources of risk or

resilience (Nettles, Caughy, & O'Campo, 2008). In the present study, a child's capacity for self-regulation represented a source of resilience in the face of attendance at ineffective schools, and echoes intervention research findings that improving self-regulation during early childhood may be particularly important for children who subsequently attend lower quality schools (Bierman et al., 2014).

These findings add to the growing body of research supporting the importance of not only a child's self-regulatory capacity at school entry but also how the school environment either supports early achievement or contributes additional risk that compound the effects of vulnerabilities the child brings to the school setting. As we outlined elsewhere (author reference), policy makers must address issues at multiple levels and strive to address both community barriers as well as capitalize on community strengths to ensure the well-being of all children. School environments reflect community strengths and weaknesses, and efforts to improve academic performance should strive to increase the strengths present in the school environment. Our findings underscore the importance of policy initiatives targeted toward ensuring that schools are equipped to support the academic achievement of all the children they serve.

References

- Bassett HH, Denham S, Wyatt TM, Warren-Khot HK. Refining the Preschool Self-Regulation Assessment for use in preschool classrooms. *Infant and Child Development*. 2012; 21:596–616. DOI: 10.1002/icd.1763
- Belsky J, Bakermans-Kranenburg MJ, van Ijzendoorn MH. For better and for worse: Differential susceptibility to environmental influences. *Current Directions in Psychological Science*. 2007; 16(6):300–304. DOI: 10.1111/j.1467-8721.2007.00525.x
- Beyers JM, Bates JE, Pettit GS, Dodge KA. Neighborhood structure, parenting processes, and the development of youths' externalizing behaviors: A multilevel analysis. *American Journal of Community Psychology*. 2003; 31(1–2):35–53. [PubMed: 12741688]
- Bierman KL, Nix RL, Heinrichs BS, Domitrovich CE, Gest SD, Welsh JA, Gill S. Effects of Head Start REDI on children's outcomes 1 year later in different kindergarten contexts. *Child Development*. 2014; 85(1):140–159. DOI: 10.1111/cdev.12117 [PubMed: 23647355]
- Blair CB. Stress and the development of self-regulation in context. *Child Development Perspectives*. 2010; 4(3):181–188. DOI: 10.1111/j.1750-8606.2010.00145.x [PubMed: 21779305]
- Blair CB, Ursache A, Greenberg M, Vernon-Feagans L. Multiple aspects of self-regulation uniquely predict mathematics but not letter–word knowledge in the early elementary grades. *Developmental Psychology*. 2015; 51(4):459–472. DOI: 10.1037/a0038813 [PubMed: 25688999]
- Bodrova E, Leong DJ. Developing self regulation in kindergarten: Can we keep all the crickets in the basket? *Young Children on the Web*, March. 2008:1–3.
- Bradley RH, Corwyn RF. Socioeconomic status and child development. *Annual Review of Psychology*. 2002; 53:371–399. DOI: 10.1146/annurev.psych.53.100901
- Brewis A, Schmidt KL, Casas CAS. Cross-cultural study of childhood developmental trajectory of attention and impulse control. *International Journal of Behavioral Development*. 2003; 27(2):174–181.
- Brock LL, Rimm-Kaufman SE, Nathanson L, Grimm KJ. The contributions of 'hot' and 'cool' executive function to children's academic achievement, learning-related behaviors, and engagement in kindergarten. *Early Childhood Research Quarterly*. 2009; 24(3):337–349.
- Bronfenbrenner, U. Recent advances in research on the ecology of human development. In: Silbereisen, RK, Exferth, K., Rudineger, G., editors. *Development as Action in Context*. Berlin Heidelberg: Springer-Weerlag; 1986. p. 287–309.

- Caughy MO, Nettles SM, O'Campo PJ. Community influences on behavioral and academic adjustment in first grade: An examination of an integrated process model. *Journal of Child and Family Studies*. 2007; 16:819–836. DOI: 10.1007/s10826-006-9128-8
- Caughy MO, O'Campo PJ. Neighborhood impoverishment, social capital, and the cognitive development of African American preschoolers. *American Journal of Community Psychology*. 2006; 37(1–2):141–154. [PubMed: 16680542]
- Caughy MO, O'Campo PJ, Nettles SM. The effect of residential neighborhood on child behavior problems in first grade. *American Journal of Community Psychology*. 2008; 42(1–2):39–50. [PubMed: 18607720]
- Center for Research on Education Outcomes. Urban Charter School Study: Report on 41 Regions 2015. 2015. Retrieved from Stanford, CA: <http://urbancharters.stanford.edu/download/Urban%20Charter%20School%20Study%20Report%20on%2041%20Regions.pdf>
- Curby TW, Rudasill KM, Edwards T, Pérez-Edgar K. The role of classroom quality in ameliorating the academic and social risks associated with difficult temperament. *School Psychology Quarterly*. 2011; 26(2):175–188. DOI: 10.1037/a0023042
- Denham SA, Warren-Khot HK, Bassett HH, Wyatt T, Perna A. Factor structure of self-regulation in preschoolers: Testing models of a field-based assessment for predicting early school readiness. *Journal of Experimental Child Psychology*. 2012; 111(3):386–404. DOI: 10.1016/j.jecp.2011.10.002 [PubMed: 22104321]
- Downer JT, Rimm-Kaufman SE, Pianta RC. How do classroom conditions and children's risk for school problems contribute to children's behavioral engagement in learning? *School Psychology Review*. 2007; 36(3):413–432.
- Duncan GJ, Magnuson KA. Can family socioeconomic resources account for racial and ethnic test score gaps? *The Future of Children*. 2005; 15(1):35–54. [PubMed: 16130540]
- Duncan RJ, McClelland MM, Acock AC. Relations between executive function, behavioral regulation, and achievement: Moderation by family income. *Journal of Applied Developmental Psychology*. 2017; 49:21–30. DOI: 10.1016/j.appdev.2017.01.004
- Dupere V, Leventhal T, Crosnoe R, Dion E. Understanding the positive role of neighborhood socioeconomic advantage in achievement: The contribution of the home, child care, and school environments. *Developmental Psychology*. 2010; 46(5):1227–1244. DOI: 10.1037/a0020211 [PubMed: 20822235]
- Emory R, Caughy MO, Harris TR, Franzini L. Neighborhood social processes and the academic achievement of ethnic minority children in elementary school. *Journal of Community Psychology*. 2008; 36(7):885–898. DOI: 10.1002/jcop.20266
- Entwisle, DR., Alexander, KL. Early schooling and social stratification. In: Pianta, RC., Cox, MJ., editors. *The transition to kindergarten*. Baltimore, MD: Paul H. Brookes; 1999.
- Garcia Coll C, Lamberty G, Jenkins R, McAdoo HP, Crnic K, Wasik BH, Garcia HV. An integrative model for the study of developmental competencies in minority children. *Child Development*. 1996; 67(5):1891–1914. DOI: 10.1111/j.1467-8624.1996.tb01834.x [PubMed: 9022222]
- Garon N, Bryson SE, Smith IM. Executive function in preschoolers: A review using an integrative framework. *Psychological Bulletin*. 2008; 134(1):32–60. DOI: 10.1037/0033-2909.134.1.31
- Hamre BK, Pianta RC. Can instructional and emotional support in the first-grade classroom make a difference for children at risk of school failure? *Child Development*. 2005; 76(5):949–967. DOI: 10.1111/j.1467-8624.2005.00889.x [PubMed: 16149994]
- Hill, PT., Celio, MB. *Fixing urban schools*. Brookings Institution Press; 2010.
- Jiang, Y., Econo, M., Skinner, C. Basic facts about low-income children: Children under 18 years, 2014. 2016. Retrieved from New York: http://nccp.org/publications/pub_1145.html
- Jones S, Lynam DR. In the eye of the impulsive beholder: The interaction between impulsivity and perceived informal social control on offending. *Criminal Justice and Behavior*. 2009; 36(3):307–321. DOI: 10.1177/0093854808328653
- King KM, Lengua LJ, Monahan KC. Individual differences in the development of self-regulation during pre-adolescence: Connections to context and adjustment. *Journal of Abnormal Child Psychology*. 2013; 41(1):57–69. DOI: 10.1007/s10802-012-9665-0 [PubMed: 22865096]

- Lan X, Legare CH, Ponitz CC, Li S, Morrison FJ. Investigating the links between the subcomponents of executive function and academic achievement: A cross-cultural analysis of Chinese and American preschoolers. *Journal of Experimental Child Psychology*. 2011; 108(3):677–692. DOI: 10.1016/j.jecp.2010.11.001 [PubMed: 21238977]
- Lankford H, Loeb S, Wyckoff J. Teacher sorting and the plight of urban schools: A descriptive analysis. *Educational Evaluation and Policy Analysis*. 2002; 24(1):37–62. DOI: 10.3102/01623737024001037
- Lengua LJ. The contribution of emotionality and self-regulation to understanding of children's response to multiple risks. *Child Development*. 2002; 73(1):144–161. DOI: 10.1111/1467-8624.00397 [PubMed: 14717249]
- Liew J. Effortful control, executive functions, and education: Bringing self-regulatory and social-emotional competencies to the table. *Child Development Perspectives*. 2012; 6(2):105–111. DOI: 10.1111/j.1750-8606.2011.00196.x
- Liew J, Chen Q, Hughes JN. Child effortful control, teacher–student relationships, and achievement in academically at-risk children: Additive and interactive effects. *Early Childhood Research Quarterly*. 2010; 25(1):51–64. DOI: 10.1016/j.ecresq.2009.07.005 [PubMed: 20161421]
- Lima J, Caughy MO, Nettles SM, O'Campo PJ. Effects of cumulative risk and effects on behavioral adjustment in first grade: Moderation by neighborhood context. *Social Science & Medicine*. 2010; 71:1447–1454. [PubMed: 20732735]
- Lupien SJ, King S, Meaney MJ, McEwen BS. Can poverty get under your skin: Basal cortisol levels and cognitive function in children from low and high socioeconomic status. *Development and Psychopathology*. 2001; 13:653–676. [PubMed: 11523853]
- Matthews JS, Ponitz CC, Morrison FJ. Early gender differences in self-regulation and academic achievement. *Journal of Educational Psychology*. 2009; 101(3):689–704.
- Maul, A. Review of National Charter School Study 2015. 2015. Retrieved from Boulder, CO: <http://nepc.colorado.edu/%20thinktank/review-urban-charter-school>
- McClelland MM, Cameron CE. Self-regulation in early childhood: Improving conceptual clarity and developing ecologically valid measures. *Child Development Perspectives*. 2012; 6(2):136–142. DOI: 10.1111/j.1750-8606.2011.00191.x
- McClelland MM, Cameron CE, Connor CM, Farris CL, Jewkes AM, Morrison FJ. Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology*. 2007; 43(4):947–959. DOI: 10.1037/0012-1649.43.4.947 [PubMed: 17605527]
- McClelland MM, Cameron CE, Duncan R, Bowles RP, Acock AC, Miao A, Pratt ME. Predictors of early growth in academic achievement: the Head-Toes-Knees-Shoulders task. *Frontiers in Psychology*. 2014; 5:599.doi: 10.3389/fpsyg.2014.00599 [PubMed: 25071619]
- McCoy DC. Early violence exposure and self-regulatory development: A bioecological systems perspective. *Human Development*. 2013; 56(4):254–273. DOI: 10.1159/000353217
- McCoy DC, Raver CC, Sharkey P. Children's cognitive performance and selective attention following recent community violence. *Journal of Health and Social Behavior*. 2015; 56(1):19–36. DOI: 10.1177/0022146514567576 [PubMed: 25663176]
- McCoy DC, Roy AL, Sirkman GM. Neighborhood crime and school climate as predictors of elementary school academic quality: A cross-lagged panel analysis. *American Journal of Community Psychology*. 2013; 52(1–2):128–140. DOI: 10.1007/s10464-013-9583-5 [PubMed: 23764745]
- McLeod JD, Nonnemaker JM. Poverty and child emotional and behavioral problems: Racial/ethnic differences in processes and effects. *Journal of Health & Social Behavior*. 2000; 41(2):137–161.
- Merritt EG, Wanless SB, Rimm-Kaufman SE, Cameron C, Peugh JL. The contribution of teachers' emotional support to children's social behaviors and self-regulatory skills in first grade. *School Psychology Review*. 2012; 41(2):141–159.
- Montroy JJ, Bowles RP, Skibbe LE, McClelland MM, Morrison FJ. The development of self-regulation across early childhood. *Developmental Psychology*. 2016; 52(11):1744–1762. Supplemental. DOI: 10.1037/dev0000159.supp [PubMed: 27709999]
- Muthén, B., Muthén, L. Mplus User's Guide. Fourth. Los Angeles, CA: Muthén and Muthén; 1998–2006.

- Nettles SM, Caughy MO, O'Campo PJ. School adjustment in the early elementary years: Toward an integrated model of neighborhood, parental, and child processes. *Review of Educational Research*. 2008; 78:3–32.
- O'Day, JA., Smith, MS. Quality and equality in American education: Systemic problems, systemic solutions. In: Kirsch, I., Braun, H., editors. *The Dynamics of Opportunity in America: Evidence and Perspectives*. New York: Springer; 2016. p. 297–358.
- Obrovski J, Bush NR, Stamperdahl J, Adler NE, Boyce WT. Biological sensitivity to context: The interactive effects of stress reactivity and family adversity on socioemotional behavior and school readiness. *Child Development*. 2010; 81(1):270–289. DOI: 10.1111/j.1467-8624.2009.01394.x [PubMed: 20331667]
- Ponitz CC, McClelland MM, Jewkes AM, Connor CM, Farris CL, Morrison FJ. Touch your toes! Developing a direct measure of behavioral regulation in early childhood. *Early Childhood Research Quarterly*. 2008; 23:141–158. DOI: 10.1016/j.ecresq.2007.01.004
- Ponitz CC, McClelland MM, Matthews JS, Morrison FJ. A structured observation of behavioral self-regulation and its contribution to kindergarten outcomes. *Developmental Psychology*. 2009; 45(3): 605–619. DOI: 10.1037/a0015365 [PubMed: 19413419]
- Raver CC, Blair CB, Willoughby M. Poverty as a predictor of 4-year-olds' executive function: New perspectives on models of differential susceptibility. *Developmental Psychology*. 2013; 49(2):292–304. DOI: 10.1037/a0028343 [PubMed: 22563675]
- Raver CC, Jones SM, Li-Grining C, Zhai F, Bub K, Pressler E. CSRP's impact on low-income preschoolers' preacademic skills: Self-regulation as a mediating mechanism. *Child Development*. 2011; 82(1):362–378. DOI: 10.1111/j.1467-8624.2010.01561.x [PubMed: 21291447]
- Raver CC, McCoy DC, Lowenstein AE, Pess R. Predicting individual differences in low-income children's executive control from early to middle childhood. *Developmental Science*. 2013; 16(3): 394–408. DOI: 10.1111/desc.12027 [PubMed: 23587038]
- Rimm-Kaufman SE, Curby TW, Grimm KJ, Nathanson L, Brock LL. The contribution of children's self-regulation and classroom quality to children's adaptive behaviors in the kindergarten classroom. *Developmental Psychology*. 2009; 45(4):958–972. DOI: 10.1037/a0015861 [PubMed: 19586173]
- Rimm-Kaufman SE, Pianta RC, Cox MJ. Teachers' judgments of problems in the transition to kindergarten. *Early Childhood Research Quarterly*. 2000; 15(2):147–166. DOI: 10.1016/S0885-2006(00)00049-1
- Roche KM, Leventhal T. Beyond neighborhood poverty: family management, neighborhood disorder, and adolescents' early sexual onset. *Journal of Family Psychology*. 2009; 23(6):819–827. DOI: 10.1037/a0016554 [PubMed: 20001140]
- Roy AL, McCoy DC, Raver CC. Instability versus quality: Residential mobility, neighborhood poverty, and children's self-regulation. *Developmental Psychology*. 2014; 50(7):1891–1896. DOI: 10.1037/a0036984 [PubMed: 24842459]
- Sameroff AJ, Fiese BH. Transactional regulation: The developmental ecology of early intervention. *Handbook of early childhood intervention*. 2000; 2:135–159.
- Sanborn, R., Carter, L., Davila, J., Tipton, T. 2015 Texas public school rankings methodology. 2015. Retrieved from Houston, Texas: <http://childrenatrisk.org/>
- Sasser TR, Beekman CR, Bierman KL. Preschool executive functions, single-parent status, and school quality predict diverging trajectories of classroom inattention in elementary school. *Development and Psychopathology*. 2015; 27(3):681–693. DOI: 10.1017/S0954579414000947 [PubMed: 25200465]
- Schmitt SA, Geldof GJ, Purpura DJ, Duncan R, McClelland MM. Examining the relations between executive function, math, and literacy during the transition to kindergarten: A multi-analytic approach. *Journal of Educational Psychology*, in press. 2017
- Sylvia K. School influences on children's development. *Journal of Child Psychology and Psychiatry*. 1994; 35(1):135–170. DOI: 10.1111/j.1469-7610.1994.tb01135.x [PubMed: 8163626]
- Szapocznik J, Lombard J, Martinez F, Mason CA, Gorman-Smith D, Plater-Zyberk E, Spokane A. The impact of the built environment on children's conduct grades: The role of diversity of use in a

Hispanic neighborhood. *American Journal of Community Psychology*. 2006; 38:299–310. [PubMed: 16967342]

Ursache A, Blair CB, Raver CC. The promotion of self-regulation as a means of enhancing school readiness and early achievement in children at risk for school failure. *Child Development Perspectives*. 2012; 6(2):122–128. DOI: 10.1111/j.1750-8606.2011.00209.x

Vernon-Feagans L, Willoughby M, Garrett-Peters P. Predictors of behavioral regulation in kindergarten: Household chaos, parenting, and early executive functions. *Developmental Psychology*. 2016; 52(3):430–441. DOI: 10.1037/dev0000087 [PubMed: 26751500]

Woodcock RW. Theoretical foundations of the WJ-R measures of cognitive ability. *Journal of Psychoeducational Assessment*. 1990; 8(3):231–258. DOI: 10.1177/073428299000800303

Woodcock, RW., Munoz-Sandoval, AF. *Bateria Woodcock-Munoz: Pruebas de aprovechamiento-Revisada*. Itasca, IL: Riverside Publishing; 1996.

Zimmerman G. Impulsivity, offending, and the neighborhood: Investigating the person– context nexus. *Journal of Quantitative Criminology*. 2010; 26(3):301–332. DOI: 10.1007/s10940-010-9096-4

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a. Reading achievement

b. Mathematics achievement

Figure 1.

Path model examining concurrent and prospective relations of school effectiveness and self-regulation with academic achievement in reading (a) and mathematics (b). W3 = Wave 3 (kindergarten/first grade); W4 = Wave 4 (first/second grade). Model is adjusted for family poverty level, child ethnicity, and child age at Wave3. Non-significant prospective effects are excluded for the sake of clarity. All coefficients can be found in Table 3.

Figure 2. Marginal prospective effects of school effectiveness on reading achievement at different levels of self-regulation ability. Error bars represent the upper and lower bounds for the 95% confidence interval of point estimates one standard deviation below the self-regulation mean, at the mean, and one standard deviation above the mean.

Table 1

Characteristic of study sample (N = 330)

	African American (N = 132)	Latino (N = 198)	
	N (%)	N (%)	χ^2
<u>Child gender</u>			
Boy	80 (60.6)	105 (53.0)	1.84
Girl	52 (39.4)	93 (47.0)	
<u>Child grade in school, Wave 3</u>			
Kindergarten	117 (88.6)	168 (85.4)	.90
1st grade	15 (11.4)	30 (14.6)	
<u>Family structure^a</u>			
Nuclear	27 (20.8)	119 (60.1)	130.02 ***
Nuclear extended	3 (2.3)	46 (23.2)	
Single parent	35 (26.9)	8 (4.0)	
Single extended	32 (24.6)	21 (10.6)	
Single parent plus partner	21 (16.2)	1 (0.5)	
Other	12 (9.2)	3 (1.5)	
<u>Family poverty (# times below 100% FPL)</u>			
None	17 (12.9)	34 (17.2)	9.56*
Once or twice	33 (25.0)	69 (34.9)	
Three times	29 (22.0)	46 (23.2)	
Four times	53 (40.2)	49 (24.7)	
<u>Primary caregiver's level of education</u>			
Less than 8 years	1 (0.8)	37 (18.7)	39.03 ***
9–12 years, no diploma	17 (12.9)	46 (23.2)	
High school/GED	58 (43.9)	72 (36.4)	
More than high school	56 (42.4)	43 (21.7)	
<u>School type (W3)</u>			
Public	95 (73.1)	160 (81.2)	9.06*
Charter	34 (26.2)	29 (14.7)	
Private	1 (.8)	8 (4.1)	
<u>School race/ethnicity^b</u>			
Predominantly African American	39 (32.8)	3 (1.7)	127.91 ***
Predominantly Latino	6 (5.0)	117 (66.9)	
Predominantly non-Latino white	2 (1.7)	1 (.6)	
Ethnically mixed	72 (60.5)	54 (30.9)	
<u>School effectiveness score^b</u>			
Low performing (score –1.00 or lower)	21 (17.6)	4 (2.3)	48.87 ***
Marginal (score –.50 to –1.00)	25 (21.0)	31 (17.7)	
Low average (score 0 to –.50)	42 (35.3)	34 (19.4)	

	African American (N = 132)	Latino (N = 198)	
	N (%)	N (%)	χ^2
Average (score 0 to .50)	15 (12.6)	41 (23.4)	
High average (score .5 to 1.00)	12 (10.1)	29 (16.6)	
Higher performing (score >1.00)	4 (3.4)	36 (20.6)	
<i>Latino families only</i>			
<u>Caregiver language</u>			
Spanish-dominant		115 (58.1)	
English-dominant		8 (4.0)	
Bilingual		62 (31.3)	
Missing		13 (6.6)	
<u>Nativity (caregiver)</u>			
U.S. born		50 (25.5)	
Foreign born		148 (74.7)	
<u>Country of origin (foreign-born caregivers)</u>			
Mexico		141 (95.3)	
Central America		6 (4.0)	
South America		1 (0.7)	

^a Balance of cases are missing. Data are only available for public and charter schools. Also, not all schools could be linked to CHILDREN AT RISK data.

^b Family structure could not be determined for two families due to an incomplete family roster

**
 $p < .01$;

 $p < .001$

Table 2

Descriptive statistics and intercorrelations of study variables

	Full Sample		African American		Latino		Intercorrelations								
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	t	1	2	3	4	5	6	7	8	9
1. WJ Reading, W3	439.63 (43.16)	422.99 (30.07)	452.73 (47.28)	-6.57***	1.00										
2. WJ Mathematics, W3	440.34 (19.38)	436.33 (17.95)	443.26 (19.90)	-3.13**	.59***	1.00									
3. WJ Reading, W4	472.32 (39.49)	453.84 (28.59)	484.54 (40.99)	-7.79***	.72***	.49***	1.00								
4. WJ Mathematics, W4	461.97 (17.60)	458.05 (17.68)	464.73 (17.08)	-3.29**	.59***	.76***	.52**	1.00							
5. HTKS, W3	35.98 (17.24)	31.54 (17.66)	38.88 (16.37)	-3.61***	.38***	.46***	.28***	.43***	1.00						
6. HTKS, W4	47.37 (12.54)	43.98 (13.69)	49.66 (11.17)	-3.82***	.32***	.48***	.34***	.52***	.44***	1.00					
7. Sch effectiveness, W3	.02 (.85)	-.34 (.80)	.27 (.79)	-6.31***	.16**	.16**	.26***	.21**	.11	.08	1.00				
8. Sch effectiveness, W4	.05 (.88)	-.33 (.82)	.32 (.81)	-6.66***	.21**	.32***	.31***	.30***	.14*	.17***	.88***	1.00			
9. Family poverty ^a	2.42 (1.42)	2.70 (1.39)	2.23 (1.42)	2.94**	-.23***	-.16**	-.18**	-.21**	-.20**	-.16**	-.08	-.15*	1.00		

Note. HTKS = Head Toes Knees Shoulders; WJ = Woodcock-Johnson

^aDefined as the number of times across four waves of data collection that the family income was below 100% of the federal poverty level

* $p < .05$;

** $p < .01$;

*** $p < .001$

Table 3

Path analysis results.

	Reading						Mathematics					
	Model 1			Model 2			Model 1			Model 2		
	b	se (b)	t	b	se (b)	t	b	se (b)	t	b	se (b)	t
<u>WJ Wave 4 on</u>												
WJ Wave 3 (centered)	.55	.05	10.99***	.57	.05	11.78***	.59	.05	11.47***	.60	.04	13.59***
School effectiveness (W3)	13.56	7.29	1.86 ⁺	15.87	6.73	2.38*	.52	2.81	.18	-.18	1.66	-.11
HTKS (W3)	-1.15	2.10	-.55	-.47	2.01	-.24	1.45	.85	1.71 ⁺	1.54	.84	1.84 ⁺
HTKS (W3) × SE (W3)	-5.97	2.48	-2.41*	-6.57	2.30	-2.85***	-.70	.96	-.73	—	—	—
School effectiveness (W4)	13.38	13.77	.97	2.22	4.24	.52	7.26	5.48	1.33	1.65	1.61	1.02
HTKS (W4)	1.91	2.05	.93	1.87	2.02	.92	1.83	.82	2.23*	2.42	.79	3.07**
HTKS (W4) × SE (W4)	-1.95	2.43	-.80	—	—	—	-1.05	.97	-1.08	—	—	—
Child ethnicity	-14.61	4.35	-3.36***	-14.30	4.28	-3.34***	-.61	1.63	-.37	.63	1.52	.42
Family income-to-needs	-.33	1.41	-.24	-.32	1.37	-.24	-1.25	.55	-2.29*	-1.12	.51	-2.20*
<u>WJ Wave 3 (centered) on</u>												
School effectiveness (W3)	-4.98	7.24	-.69	.26	3.08	.09	.89	2.77	.32	1.18	1.27	.93
HTKS (W3)	12.10	2.48	4.87***	12.10	2.37	5.10***	6.20	.93	6.63***	7.80	.98	8.00***
HTKS (W3) × SE (W3)	2.43	3.06	.79	—	—	—	.41	1.15	.35	—	—	—
Child ethnicity	-20.83	5.29	-3.94***	-21.53	5.24	-4.10***	-1.63	2.04	-.80	-.73	2.10	-.35
Family income-to-needs	-2.68	1.77	-1.52	-2.98	1.74	-1.71 ⁺	-.25	.68	-.36	.01	.70	.02
<u>HTKS Wave 4 on</u>												
HTKS (W3)	.25	.07	3.77***	.24	.06	3.69***	.21	.07	3.06**	.20	.06	3.14**
School effectiveness (W3)	-.10	.14	-.67	-.10	.14	-.71	-.08	.14	-.55	-.11	.13	-.82
WJ Wave 3 (centered)	.00	.00	1.67	.00	.00	1.74 ⁺	.01	.00	2.81**	.01	.00	3.46**
School effectiveness (W4)	.15	.14	1.13	.15	.14	1.12	.11	.14	.79	.11	.13	.82
Child ethnicity	-.23	.14	-1.68 ⁺	-.25	.14	-1.83 ⁺	-.27	.13	-2.01*	-.25	.12	-2.07*
Family income-to-needs	-.07	.05	-1.51	-.07	.04	-1.52	-.07	.04	-1.65	-.07	.04	-1.78 ⁺
<u>HTKS (W3) on</u>												

	Reading						Mathematics					
	Model 1			Model 2			Model 1			Model 2		
	b	se (b)	t	b	se (b)	t	b	se (b)	t	b	se (b)	t
School effectiveness (W3)	.08	.08	.96	.09	.08	1.10	.08	.08	.96	.08	.08	.98
Child ethnicity	-.21	.14	-1.48	-.26	.14	-1.84 ⁺	-.21	.14	-1.48	-.18	.14	-1.29
Family income-to-needs	-.15	.05	-3.30 ^{**}	-.15	.05	-3.17 ^{**}	-.15	.05	-3.30 ^{**}	-.14	.05	-2.98 ^{**}
<u>School effectiveness Wave 4 on</u>												
School effectiveness (W3)	.88	.04	23.53 ^{***}	.88	.04	23.53 ^{***}	.88	.04	24.39 ^{***}	.88	.03	26.04 ^{***}
HTKS (W3)	-.01	.03	-.40	-.00	.03	-.40	-.01	.03	-.39	.01	.03	.21
Child ethnicity	-.11	.06	-1.68 ⁺	-.11	.06	-1.68 ⁺	-.11	.06	-1.67 ⁺	-.09	.06	-1.61
Family income-to-needs	-.05	.02	-2.08 [*]	-.04	.02	-2.08 [*]	-.05	.02	-2.15 [*]	-.03	.02	-1.75 ⁺

⁺ $p < .10$;
^{*} $p < .05$;
^{**} $p < .01$;
^{***} $p < .001$

Note. WJ = Woodcock-Johnson; W3 = Wave 3; W4 = Wave 4; SE = school effectiveness; HTKS = Head-Toes-Knees-Shoulders. All models are adjusted for child age at time of assessment.