

# Third Grade Achievement Predictors in Urban Poverty Settings: End of Kindergarten Behavioral and Performance Indicators

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## Abstract

Structural equation modeling was used to investigate the predictive associations between end of kindergarten academic, social behavioral, and biotic influences on end of third grade academic achievement among a nationally representative sample of low-socioeconomic (SES) children residing in urban areas. Findings validate the understanding that developmental and learning trajectories start early and are influenced by multifaceted factors. Understanding factors that positively and negatively affect learning and development among urban low-SES children informs intervention strategies potentially moderating the gaps that exist in these areas among SES groups.

**Keywords:** Urban, Poverty, Early childhood, Achievement

## 1. Introduction

In urban areas there are often large and concentrated pockets of under-resourced neighborhoods and schools. From a developmental perspective, we know that chronic poverty can have cumulative adverse effects on childhood physical growth, cognitive and social emotional development, and academic learning...*so long as there is urban poverty, there will be a need for expertise in urban education* (Kotzin-Slaughter, 2017, p. 1).

From a bio-ecological perspective, children's educational and socio-emotional outcomes are marked by multiple influences. These include their neighborhoods, family life, schools, and the resources that are available to them both personally and through schools and communities (Bronfenbrenner, 1979; Dalton, Elias, & Wandersman, 2007; Elias & Haynes, 2008). Many children emerge from adversities with encouraging outcomes notwithstanding living in urban neighborhoods where there is oftentimes prevailing poverty that results in social, emotional, and economic hardships.

There is a body of research indicating that there is considerable variability of classroom quality in educational environments located in urban neighborhoods. Early childhood classroom quality and its impact in ameliorating the negative effects of living economically disadvantaged has been the focus of this research. High quality classroom environments have been shown to yield equal academic outcomes during primary school for students coming from a variety of economic backgrounds (Camilli et al., 2010; Hamre & Pianta, 2005). In one study, children who were identified as at-risk in kindergarten based on behavioral and academic problems due to their demographic characteristics were followed through the end of first grade. Some attended first-grade classrooms with strong emotional and instructional support, others attended first-grade classrooms that were less supportive (Hamre & Pianta, 2005). At the end of first grade, the children who were in classrooms with high support had achievement scores comparable to low-risk peers; those who were in classroom with low support had lower achievement and more behavioral difficulties.

High-quality early childhood classroom environments are also linked to promoting improvements in home environments (McCartney et al., 2007). It was found that high quality early childhood served as a naturally occurring intervention for low-socioeconomic (SES) children and their families. Children from low-SES homes benefitted from classroom learning supports and cognitive stimulation. Families benefitted from formal and informal parental support. Despite these impacts, extant literature supports that high-quality classroom environments are extremely variable within low-resourced or under-resourced urban neighborhoods (Zill & Resnick, 2006; Zill et al., 2003).

Many studies have investigated SES differences; fewer studies have examined within class differences among children in poverty. Still fewer have considered within class differences among children residing in urban poverty, especially children of early childhood age. This is an important area to study, as the effects of poverty are different depending on environmental circumstances (Tine, 2014). It has been well documented that ameliorating the negative effects of poverty early, will have long lasting and sustainable benefits.

The purpose of this study is to investigate end of kindergarten academic performance and socio-behavioral attributes of low-SES urban kindergarten children to identify the effects of these on third-grade achievement. In early childhood education, the end of kindergarten and the end of third grade are critical benchmarks in children's early learning experiences. The end of kindergarten learning-related skills significantly predict growth in children's academic performance (McClelland et al., 2006). The end of third grade typically signifies children's entry into the world of standardized testing and the co-related influences of these tests on

their academic future (Jordan, Kaplan, Ramineni, & Locuniak, 2009). It also connotes the beginning of children's shift from acquiring the basic concepts and skills associated with literacy and mathematics learning, to operationalizing them to acquire higher level conceptual and problem-solving proficiencies. Performing on grade level by third grade has been shown to be of critical importance for predicting future school success (Annie E. Casey Foundation, 2010, 2013). This was found to be particularly true for children in poverty.

## **2. Poverty, Early Learning, and Development**

Poor children begin school well behind their more affluent age mates and, if anything, lose ground during the school years (Duncan, Magnuson, Kalil, & Ziol-Guest, 2012, p. 88). The gaps in achievement and learning trajectories between low-SES and more affluent children are evident in kindergarten and widen as children advance through the grades (Bassok et al., 2016). According to Brooks-Gunn and Duncan (1997), poverty status is a more powerful predictor of children's development and academic trajectories than mothers' educational or marital status or other demographic characteristics. SES is one of the most focused upon life conditions investigated among researchers attentive to understanding conditional differences in young children's developmental and learning trajectories (Gullo, 2018; Isaacs, 2012; Janus & Duku, 2007). Studies from developmental psychology and brain science suggest that poverty's debilitating effects may be especially enduring and harmful during the period from prenatal to age five (Magnuson, 2013). Studies' findings have prompted research to be conducted that examine the effects of poverty on school readiness (e.g., Engle & Black, 2008; Gullo, 2018; Isaac, 2012; Janus & Daku, 2007; Lee & Burkham, 2002; Magnuson & Waldfogel, 2005). These studies examined disparities in school readiness traits between children who reside in poverty and those who do not. Results have shown that children who reside in poverty do not perform as well on the metrics used to measure school readiness traits compared to children living in middle- or upper middle-class homes (Reardon, 2011).

Studies making comparisons in the long-range predictive associations of end of kindergarten academic and behavioral competencies on children's learning trajectories found that as children progress through school, the gap between low-SES and more affluent children widens (Entwisle, Alexander, & Olson, 2005; Lee & Burkham, 2002). When risk factors associated with poverty are present during preschool and kindergarten, they shape the course of school readiness and children's achievement trajectories. School readiness potential sets the path for future school performance and success (Zigler et. al., 2006), and is predictive of most education benchmarks including test scores, grade retention, special education placement, and dropout rates. Overwhelming, these studies used SES as an independent variable, investigating between-group differences. Educational and developmental researchers have not fully studied within-group differences that exist among low-SES children. Understanding this could ameliorate certain risk factors associated with poverty and potentially close long-range educational achievement gaps.

## **3. Kindergarten Predictors of later School Performance**

There are broad spectrums of research trends investigating the impact of children's end of kindergarten learning and behavioral traits on subsequent school achievement. In the present

study, race, children's academic performance (language/literacy and math), children's behaviors and dispositions associated with approaches to learning (AtL), and children's positive and negative social behaviors were investigated.

### *3.1 Race*

Associations between SES, race/ethnicity, and academic performance are well-established (Nesbitt, Baker-Ward, & Willoughby, 2013). Minority status and SES are often confounded in studies that compared child outcomes between racial and SES groups. It is often difficult to parse out differences in children's academic performance due to race from those differences due to SES (Cabrera et al., 2019; Lubienski, 2002), since children in lower SES groups are overwhelmingly of minority status. Nevertheless, both SES and minority status significantly influence academic achievement. The present investigation sought to moderate the confounding element observed in previous studies by examining predictive associations between race and academic outcomes within a group of low-SES children.

Achievement gaps attributed to race and/or SES are evident as early as kindergarten, particularly in the areas of language/literacy and math (Arnold & Docrocoff, 2003; Mistry, Benner, Biesanz, Clark, & Howes, 2010; Nesbitt, Baker-Ward, & Willoughby, 2013; Reardon, Kalogrides, & Shores, 2019). Racial/ethnic disparities in achievement test scores are large when children enter kindergarten and remain large as children progress through high school (Reardon, Kalogrides, & Shores, 2019). It is purported that "racial and ethnic disparities in children's academic performance are a stubborn feature of the U.S. educational landscape, an indicator of continued racial inequality of educational opportunity" (Reardon, Kalogrides, & Shores, 2019, 1164-1165).

Differences in teachers' perceptions of young children's abilities based on race and ethnicity have been observed (Minor, 2014; Ready & Wright, 2011). Teachers tend to underestimate children's abilities when they are members of racial minority groups, particularly if they are low-SES. This is an important area to investigate knowing that early childhood teachers' perceptions of student performance are influential factors on long and short-range achievement (Baker et al., 2015; Gullo & Impellizeri, 2021; Gut, Reimann, & Grob, 2013).

When examining educational outcomes, racial disparities have remained fundamentally unchanged since the 1970s (Merolla & Jackson, 2019). Merolla and Jackson argue that resulting achievement gaps are primarily due to structural racism. The recognition of this can lead to a coalescing agenda and a context for interpreting study findings and for providing mechanisms for establishing policies and practices designed to reduce these negative influences.

### *3.2 Kindergarten Language/Literacy and Mathematics*

There is not one set of kindergarten language/literacy or mathematics skills that all researchers favor as authoritative predictors of later academic performance. There are broadly held viewpoints, nonetheless, that certain kindergarten language/literacy and mathematics competencies portend later academic achievement more than others (Clements & Sarama, 2011; Jordan, Kaplan, Nabors Oláh, & Locuniak, 2006; Sađkes, 2013).

Language/literacy development includes both verbal language as well as emergent literacy. Verbal language is reflected in children's ability to listen, use language effectively, and effectively manage the social conventions of language. Emergent literacy skills are the prerequisite competencies necessary for reading and writing development. These include such attributes as interest in books and stories, print awareness, and emergent writing. The importance of linguistic competencies for early academic performance is well documented in the literature (Kastner, May, & Hildman, 2001; Walker et al., 1994). Research shows that differences in language development are predictive of differences in academic achievement as measured by standardized assessments from kindergarten through third grade.

The National Early Literacy Panel identified six competencies that highly correlate with later literacy skills, exerting substantial predictive power even when potentially confounding variables were controlled (Cross & Conn-Powers, 2011; Lonigan & Shanahan, 2009):

- 1) alphabet knowledge (knowing the names and sounds that letters make);
- 2) phonological awareness (awareness of the sounds that letters make and ways to segment words);
- 3) rapid automatic naming (RAN) of letters or numbers (naming random numbers and letters fluently);
- 4) RAN of objects and colors (naming random objects and colors fluently);
- 5) writing of writing one's name; and
- 6) phonological memory (using working memory to remember spoken information).

Early numeracy skills, such as counting (one to one correspondence), number knowledge (discriminating quantities), number transformation (transforming using addition and subtraction), estimation (subitizing), and number patterns (discerning numerical relationships) are core skills that research has shown predict children's later success in school (Duncan et al., 2007; Jordan et al., 2006; Jordan et al., 2009; Passolunghi, Lanfranchi, Altoè, & Sollazzo, 2015). In a study of how kindergarten children's numeracy skills predict mathematical performance in first grade, it was found that children who were competent in relational skills and counting before they entered kindergarten were more adept in learning basic and applied arithmetic skills (Aunio & Niemivirta, 2010). This was also predictive of children's later overall mathematical performance, even when controlling for age, gender, and parents' educational levels. It was also found that early mathematical skills are more powerful predictors of reading achievement than early reading is of later mathematics achievement (Cross & Conn-Powers, 2011; Duncan et al., 2007; Hooper, Roberts, Sideris, Burchinal, & Zeisel, 2010; Welsh et al., 2010).

### *3.3 Approaches to Learning*

AtL is a broad term describing a set of children's learning related behaviors and dispositions that reflect their enthusiasm for and engagement in learning activities (Hyson, 2008). These behaviors and dispositions result in children's being able to follow directions, persist in

difficult tasks, engage in creative problem-solving, be independent while engaged in the tasks of learning, and work both independently as well as cooperatively with their classmates (Razza, Martin & Brooks-Gunn, 2015). AtL, assessed in kindergarten, has been shown to be predictive of both literacy and mathematics performance through the elementary years (Li-Grining, Votruba-Drzal, Maldonado-Carreño, & Haas, 2010). Interestingly, AtL assessed in kindergarten also had the greatest impact on children's future school performance throughout the elementary school years. The positive impact of early AtL was seen for those whose initial achievement scores in kindergarten and the earliest grades were the lowest (Bodovski & Farkas, 2007; Li-Grining et al., 2010).

### *3.4 Positive and Negative Social Behaviors*

Over 30 years ago, educational researchers studied children's social behaviors to examine how the quality of these behaviors played a role in providing the basis for children's subsequent developmental and achievement trajectories (Vygotsky, 1987). For low-SES students, having positive social-emotional skills in the early grades is important for achieving later school success (Elias & Haynes, 2008). The negative influences of poverty on children's social competence is well documented as is the resulting negative impact of these influences on achievement (Perry et al., 2018). Children who reside in poverty are more likely to score lower on social/emotional assessments (Broekhuizen et al., 2016).

Research on the predictive potential of children's early socioemotional skills on their achievement trajectories is ambiguous. Studies show that early prosocial competence has a positive influence on future achievement, while negative or problem social behaviors have no influence (Caprara et al., 2000). Other studies show that behaviors associated with social competence have positive influences on future achievement, while problem social behaviors have a negative influence (Rabiner, Godwin, & Dodge, 2016). Denham et al. (2013) found that those with higher levels of both cognitive control and social-emotional skills performed more successfully in academic settings when compared to their less competent peers, concluding that a combination of cognitive skills and social competence was the most efficacious for predicting future achievement. Many of these studies did not examine these variables within groups of children residing in poverty. The present study would examine how these variables respond within a socioeconomic context often associated with risk. Findings may elucidate intervention strategies that may be effective in ameliorating the negative outcomes often associated with poverty.

## **4. The Present Study**

Structural equation modeling (SEM) was used to examine the predictive associations among latent and measured kindergarten and third-grade performance variables. The hypothesized model was proposed to explain the mechanisms by which kindergarten children's biotic (race) and performance (approaches to learning, academic achievement, and positive/negative social behavior) indicators directly and indirectly predicted third grade achievement. In using SEM, a simultaneous analysis of the entire system of variables is conducted (Byrne, 2016). While prior research has shown that many of the kindergarten variables tested in this study independently affect future school academic performance, it is not known how the synergistic

relationships among them can have a mediating effect on achievement. Also, little is known how the synergy of these predictors affect outcome measures in low-SES urban children. Kindergarten variables were assessed at the end of the kindergarten; third grade achievement was assessed at the end of third-grade. The hypothesized model, shown in Figure 1, displays both the direct and indirect effects among the constructs described below.

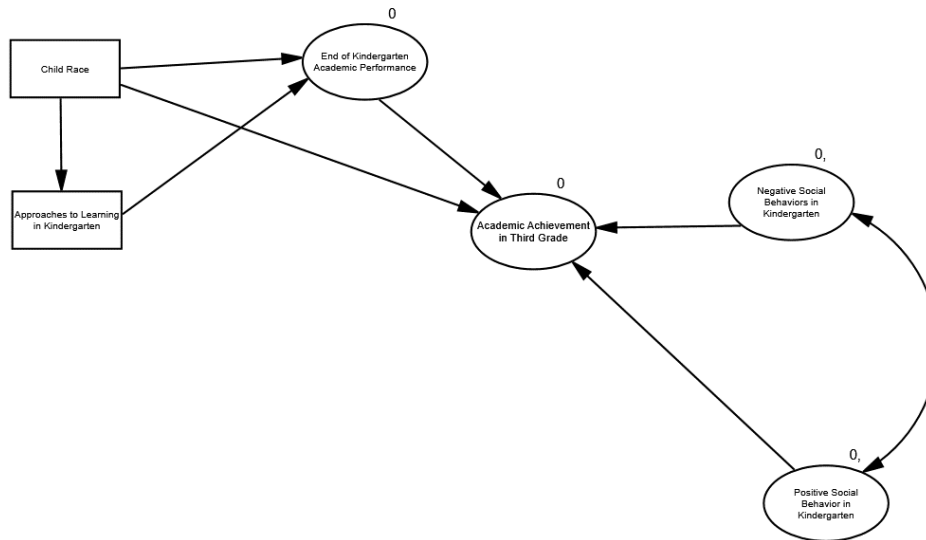


Figure 1. Hypothesized model

It was hypothesized that:

- 1) race of the child predicts kindergarten AtL and achievement.
- 2) AtL predicts kindergarten achievement.
- 3) kindergarten achievement predicts third-grade achievement.
- 4) positive social behaviors in kindergarten predict increased third-grade achievement.
- 5) Negative social behaviors in kindergarten predict decreased third-grade achievement.

## 5. Method

### 5.1 Sample

This study analyzed un-weighted data from waves 2 and 7 of the Early Childhood Longitudinal Survey-Kindergarten Class of 2010-11 (ECLS-K:2011) (Tourangeau et al., 2018) dataset. The ECLS-K: 2011 tracked children entering kindergarten in the 2010-11 school year through the 2015-16 school year when they would have completed fifth grade. Unweighted data were used due to the limitations of weighting data when more complex statistical analyses are used (Gelman, 2007). Additionally, Hahs-Vaughn and Lomax (2006) suggest that sampling weights had negligible effects on parameter estimates. Moreover, since the weights for the ECLS-K were computed from the full data set, and in this study only a subset of these

data were analyzed, calculated weights may no longer be applicable.

Approximately 18,000 children were included in the initial nationally representative sample. The sample included children and families from diverse socioeconomic and racial/ethnic backgrounds. Data were collected from multiple sources of information, including children, parents/caregivers, childcare providers, teachers, and school administrators. Wave 2 data were collected when children completed kindergarten; Wave 7 data were collected when children completed third-grade.

The present study analyzed ECLS-K: 2011 data on children who attended kindergarten for the first time, who resided in urban areas, and who were from families identified as low-SES whose household income was below the poverty level. Families having household incomes below the poverty level met the income criteria of federal poverty guidelines. Annual income and number of individuals in the household were taken into consideration. A second SES variable was also used. It was a composite variable computed at the household level. It included: parent occupation prestige scores, household income level, and parent education level. A continuous SES variable was computed, and quintiles were calculated. Children in the lowest SES quintile and whose family's income met the federal guidelines for being below the poverty level were included in the study. Since the focus of this study was on the predictive influence of kindergarten variables, only Wave 2 SES identifiers were used as the socioeconomic variable.

At Wave 2, there were 780 children meeting SES and poverty criteria, who resided in urban areas, and who attended kindergarten for the first time (402 boys; 378 girls). Mean age at kindergarten entry was 67.48 months (SD = 4.34). Racial/ethnic groups included: 19.6% White, non-Hispanic; 19.8% Black/African American, non-Hispanic; 50.0% Hispanic, race specified; 1.4% Hispanic, no race specified; 4.4% Asian, non-Hispanic; 0.5% Native Hawaiian/Pacific Islander, non-Hispanic; .9% American Indian or Alaska Native; 3.4% two or more races, non-Hispanic.

## *5.2 Latent Variables*

### *5.2.1 Achievement in Kindergarten and Third Grade*

The latent construct "achievement" was made up of two measured variables, reading and math achievement. The reading and math assessments for kindergarten and third-grade included a two-stage process. The first stage was a routing section that included items ranging broadly in difficulty. The child's score on the routing items determined which second stage assessment they would receive (low difficulty, middle difficulty, high difficulty). This procedure was used to maximize assessing the child's full potential in a limited amount of time (Tourangeau et al., 2018).

The kindergarten assessment in language and literacy included 18 items in the routing section assessing basic skills (print familiarity, letter recognition, beginning and ending sounds, rhyming words, word recognition), vocabulary, and comprehension. Reading comprehension items required the child identify information included in the text and make inferences within and across texts. The third-grade reading assessment included 19 routing items. Reading



performance at the end of third-grade was assessed in three broad areas: basic word skills, including sight-word recognition, vocabulary knowledge, and reading comprehension. Reading comprehension questions were generated through short passages requiring students to respond to factual and inferential questions. Internal consistencies for kindergarten and third-grade reading assessments were .95 and .87, respectively.

Children's end of kindergarten mathematics achievement measured children's abilities in conceptual knowledge, procedural knowledge and problem solving. This assessment included items on "number sense, properties, and operations; measurement; geometry and spatial sense; data analysis, statistics, and probability; and patterns, algebra, and functions" (Tourangeau et al., 2018, p. 40). Eighteen items were included in the routing section.

End of third-grade mathematics achievement was assessed in the following areas: conceptual knowledge; procedural knowledge; and problem-solving knowledge. The assessment focused on number sense, properties, operations, measurement, geometry and spatial sense, data analysis, statistics and probability, patterns, algebra, and functions. Children completed a routing section consisting of 17 items that varied in difficulty, and then students were evaluated by level of ability. The text for word problems or graph labels was read orally to the students by a trained assessor, and paper and pencil were offered (Tourangeau et al., 2018). Cronbach's Alpha internal consistency for kindergarten and third-grade mathematical assessment were .94 and .92, respectively.

Item Response Theory (IRT) scores for both the reading and mathematics assessments were used for analysis. IRT scores make it possible to compare children's strengths regardless of which items were administered. IRT considers right or wrong answers to the items and the difficulty of item and can estimate a child's ability based on the same continuous scale. IRT scoring allows for longitudinal measurement gains in achievement to be analyzed regardless of when a child completed the assessments (Bortolotti et al., 2013).

### 5.2.2 Positive and Negative Social Behavior

Each latent variable, "Positive Social Behaviors/Negative Social Behaviors," contained two measured variables. The measured variables were items taken from the *Social Skills Rating System* (Gresham & Elliot, 1990) portion of the ECLS-K: 2011 child-level teacher questionnaire. Teachers rated each child on a four-point frequency scale ranging from (1) "never" to (4) "very often.

"Positive Social Behavior," included two measured variables: *self-control* and *interpersonal skills*. *Self-control* contained four items; *interpersonal skills* contained 5 items. Scores for each measured variable were represented by mean ratings on the items comprising the scale. The reliability coefficients (Cronbach's alpha) were .82 and .87 for *self-control* and *interpersonal skills*, respectively.

"Negative Social Behaviors," included two measured variables: *internalizing* and *externalizing problem behaviors*. *Internalizing problem behaviors* contained 4 items; *externalizing problem behaviors* included 6 items. Scores for each variable were represented by mean ratings on the items comprising the scale. The Cronbach's alphas for *internalizing*

and *externalizing problem behaviors* were .78 and .89, respectively.

### 5.3 Measured Variables

#### 5.3.1 Race

A composite variable for the child's race was created by using information from the Field Management System (FMS) and from the parent interview. Data were collected from parents during the Fall interview of their child's kindergarten year. Parents were asked to indicate to which of five race categories (White, Black or African American, Asian, Native Hawaiian or other Pacific Islander, American Indian or Alaska Native) their child belonged. Data from the FMS were used only if the data from the parent were missing.

#### 5.3.2 Approaches to Learning

Teachers' ratings of children's AtL were assessed using seven items in the child-level teacher questionnaire: (keeps belongings organized; shows eagerness to learn new things; works independently; easily adapts to changes in routine; persists in completing tasks; pays attention well; and follows classroom rules). Teachers reported how often each child exhibited the learning behaviors delineated above. Items were based on items in the Social Skills Rating System and scored using the same frequency rating system described in the section on social competence and problem behaviors. The AtL scale for teachers has a Cronbach's alpha reliability estimate of .91.

### 5.4 Data Analysis

The Statistical Package for the Social Sciences AMOS 25 (Arbuckle 2017) was used to test the goodness of fit of the hypothesized model. The goal of this study was to evaluate a specific hypothesized model; therefore, no modifications to the model were made. Missing data were handled using an expectation-maximization (EM) method within the SEM context. This method has been found to be superior to other regularly used methods of handling missing data, such as likewise deletion and pattern response imputation (Allison, 2003).

## 6. Goodness of Fit

Three goodness of fit indices were used as recommended by Hu and Bentler (1999) and Hooper, Coughlan, and Mullen (2008) to determine how well the hypothesized model fit the data: RMSEA (root mean square error of approximation), NFI (normed-fit index), and CFI (comparative fit index). RMSEA values of less than 0.08 indicate the model's good fit (Amorim et al., 2010; Hu & Bentler, 1999; MacCallum, Browne, and Sugawara 1996). For NFI and CFI, values greater than 0.90 are considered a good fit. All three of the fit indices indicated an acceptable fit of the model to the data. The RMSEA fit statistic obtained was .066, below the .08 cut-off for good fit. The NFI and CFI were .965 and .973, respectively, indicating an acceptable fit of the model to the data.

$R^2$  was calculated to ascertain the strength of the relationships between the predictor variables and the outcome variables.  $R^2$  indicates the percentage of variance of the outcome variables accounted for by the predictor variables.

## 7. Results

Table 1 contains the intercorrelations among the measured variables used in this study; those used as measured variables and those used to construct latent variables. Table 2 contains the descriptive statistics for all the variables in the study.

Table 1. Correlations among the measured variables in the model

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1 Child Sex	1.00											
2 Child Race	-.02	1.00										
3 T-AtL	.24**	.06	1.00									
4 EK-Read	.12**	-.02	.37**	.19**	1.00							
5 EK-Math	.05	.06	.40**	.14**	.68**	1.00						
6 E3-Read	.12**	.06	.39**	.15**	.65**	.70**	1.00					
7 E3-Math	.02	.12**	.43**	.11**	.56**	.75**	.74**	1.00				
8 Interpersonal	.03	-.04	.01	-.02	-.03	-.00	-.02	-.00	1.00			
9 Self-Control	.05	-.02	.04	-.08*	-.03	-.01	-.02	-.01	.79**	1.00		
10 Internalizing	.06	.04	-.01	.01	-.02	-.04	.01	-.05	-.37**	-.31**	1.00	
11 Externalizing	-.04	.02	.04	.03	.01	-.05	.02	.01	-.59**	-.73**	.28**	1.00

Notes: Child Sex (sex of the child); Child Race (race of the child); T-AtL (teacher ratings of approaches to learning); EK-Read (end of kindergarten reading achievement score); EK-Math (end of kindergarten math achievement score); E3-Read (end of third grade reading achievement score); E3-Math (end of third grade math achievement score); Interpersonal (interpersonal skills score); Self-control (self-control scale score); Internalizing (internalizing problem behaviors); Externalizing (externalizing problem behaviors).

\*Correlation is significant at the .05 level

\*\*Correlation is significant at the .01 level

Table 2. Means, standard deviations, and range of all variables by sex

Variable	Boys			Girls		
	Mean	SD	Range	Mean	SD	Range
Age in Months	67.62	4.20	58.29 – 84.26	67.33	4.27	57.90 – 82.42
T-AtL	2.80	0.69	1 - 4	3.13	0.64	1 – 4
EK-Read	57.75	11.30	32.78-98.26	60.30	10.71	32.78-101.83
EK-Math	40.77	11.64	10.14-76.49	41.98	10.85	10.21-74.30
E3-Read	103.34	14.96	65.34-137.22	106.82	12.83	62.95-140.31
E3-Math	91.09	15.49	40.87-125.51	91.64	14.17	43.95-126.49
Social Competence						
Interpersonal Skills	3.03	0.62	1.40 – 4.00	3.06	0.65	1.40 – 4.00

Self-control	3.05	0.61	1.00 – 4.00	3.12	0.63	1.25 – 4.00
Problem Behaviors						
Internalizing	1.52	0.48	1.00 – 4.00	1.58	0.54	1.00 – 3.75
Externalizing	1.73	0.61	1.00 – 4.00	1.67	0.65	1.00 – 4.00

Notes: Age in Months (age of child when entering kindergarten); T-AtL (teacher ratings of approaches to learning); EK-Read (end of kindergarten reading achievement score); EK-Math (end of kindergarten math achievement score); E3-Read (end of third grade reading achievement score); E3-Math (end of third grade math achievement score); Interpersonal (interpersonal skills score); Self-control (self-control scale score); Internalizing (internalizing problem behaviors); Externalizing (externalizing problem behaviors).

As can be seen in Table 1, each group of indicators used as a measure of a latent variable was significantly correlated in the expected direction. End of kindergarten academic achievement variables were highly correlated ( $r = .68$ ). End of third grade academic achievement variables were also highly correlated ( $r = .74$ ). Positive social behavior variables were highly correlated,  $r = .79$ , while negative social behavior variables were moderately correlated,  $r = .28$ . All the correlations were significant at the  $p < .01$  level. These relationships provide evidence to support their use as measured indicators of latent variables used in the structural analysis.

The variables in the hypothesized model reflect the research on the long-range effects of kindergarten behavioral and learning factors on subsequent academic achievement. Figure 2 shows the standardized estimates of the full model.

As indicated by the  $R^2$ , 22% of the variance of end of kindergarten academic achievement was accounted for by the race of the child and teacher end of kindergarten ratings of children's approaches to learning. The  $R^2$  for end of third grade academic achievement indicates that 92% of its variance was accounted for by the race of the child, teacher ratings of children's approaches to learning, children's positive and negative social behaviors in kindergarten, and end of kindergarten academic achievement.

### 7.1 Race

Race was not related to academic achievement at the end of kindergarten ( $\beta = .02, p = \text{NS}$ ). Race was also not significantly associated with end of kindergarten approaches to learning ( $\beta = .06, p < \text{NS}$ ). Race was, however, significantly related to academic achievement at the end of third grade ( $\beta = .07, p < .01$ ).

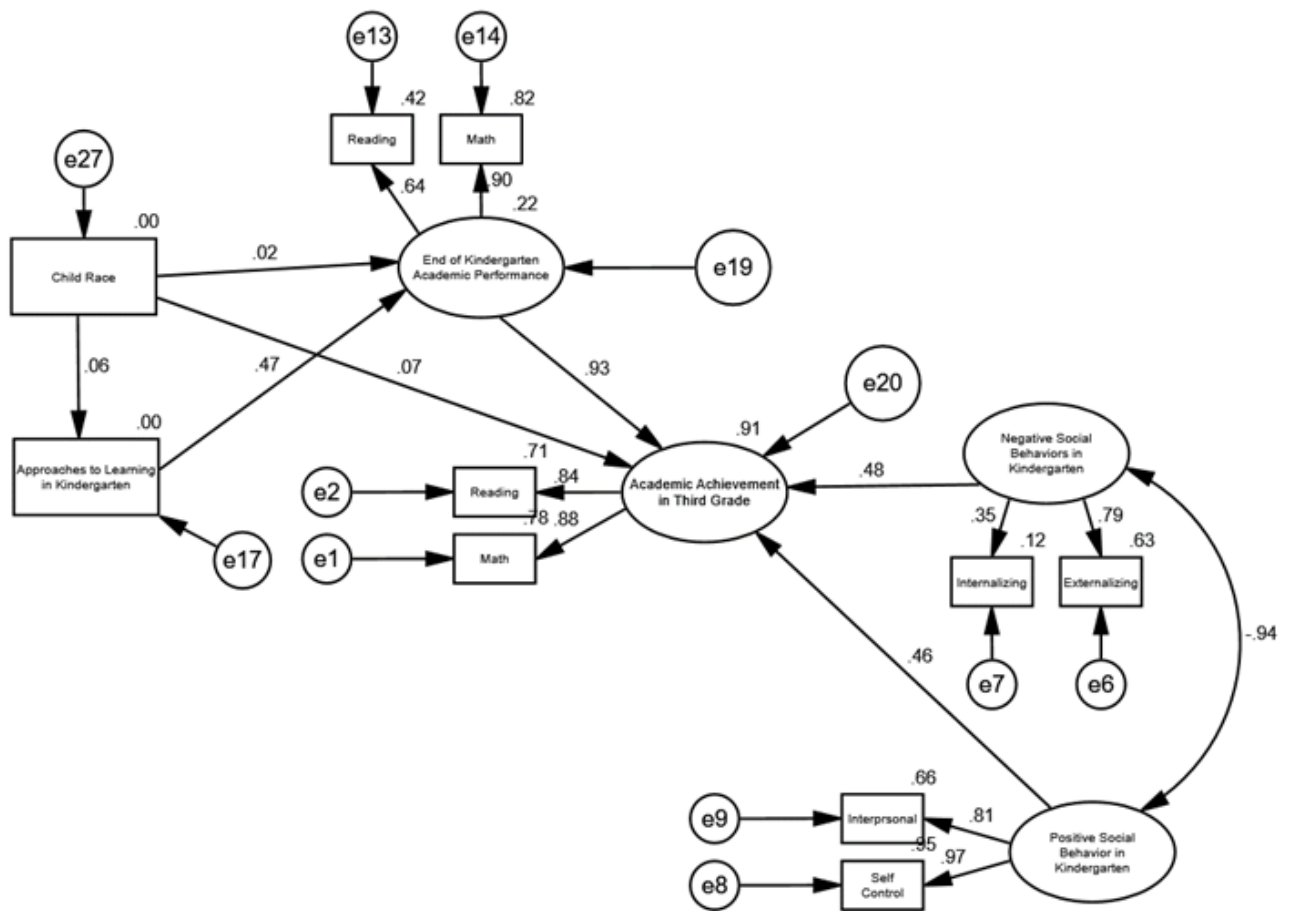


Figure 2. Standardized estimates

### 7.2 Approaches to Learning

Teacher ratings of end of kindergarten approaches to learning were related to end of kindergarten academic achievement ( $\beta = .47, p < .01$ ). Children rated higher in approaches to learning tended to score higher in academic achievement.

### 7.3 End of Kindergarten Academic Achievement

End of kindergarten academic achievement was significantly associated with end of third grade academic achievement ( $\beta = .94, p < .01$ ) in the expected manner. Children who performed at higher levels in reading and math in kindergarten, also performed higher in reading and math in third grade.

### 7.4 Positive Social Behaviors

Teachers' ratings of children's positive social behaviors at the end of kindergarten were not related to end of third grade achievement performance ( $\beta = .45, p = NS$ ).

### 7.5 Negative Social Behaviors

Teachers' ratings of children's negative social behaviors were not related to children's end of third grade academic achievement performance ( $\beta = .48, p = \text{NS}$ ).

## 8. Discussion and Implications

The purpose of this study was to investigate kindergarten academic, socio-behavioral, and biotic influences on third grade achievement within a group of low-SES children residing in urban neighborhoods drawn from a nationally representative sample of children. Much is known about kindergarten academic and socio-behavioral influences on subsequent academic performance when SES factors are controlled or not considered. Little is known about the discrepancies among kindergarten influences on future achievement within a low-SES group of children. Even less is known about younger children who reside in areas of urban poverty. Kindergarten variables were indicated by teachers' ratings of children's AtL, positive and negative social behaviors, and children's achievement scores in reading and math. Race was also used as a variable.

Findings validate the understanding that developmental and learning trajectories start early in children's lives and are influenced by multifaceted factors, regardless of SES or living location. This study also elucidated areas where these predictive influences were different among low-SES urban children than they were for children in the over-all population. While studies comparing SES groups of children have shown that there are significant distinctions between SES groups regarding learning and development, this study's findings have established that within a group of urban low-SES children, disparities also exist. Understanding the factors that positively and negatively affect learning and development trajectories among urban low-SES children can inform instructional and intervention strategies that may moderate the learning and development gaps that exist between SES groups. There were several noteworthy findings related to within-SES differences that potentially impact children's academic trajectories.

### 8.1 Race

Race did not significantly predict kindergarten AtL or achievement. Race did, however, predict children's third-grade achievement. This indicates that there were no differences in achievement among racial groups at the end of kindergarten but as they progressed through the grades, racial differences emerged. Other studies have also found that there were differences among racial groups' achievement, but these were largely studies examining the combination of social class and racial differences in achievement and child development (Elias, M. & Haynes, N., 2008; Pungello, E., Iruka, I.; Dotterer, A., Mills-Koonce, R., & Reznick, S., 2009; Schlee, B.; Mullis, A, & Shriner, M., 2009). In these studies, race and social class could have been confounded in that there is a higher percentage of minority children represented in lower-SES groups. In the present study, all the children were low-SES and the finding that race was not predictive of achievement in kindergarten but was predictive of achievement in third-grade warrants further study. What happens between kindergarten and third grade to either the children or to teaching or teachers that would create these racial differences over time? This finding contradicts other studies' finding showing that teachers tend to rate African American kindergarten children lower than they do children of other

racism regarding academic behaviors and dispositions and social competence (Minor, 2014). The findings from this investigation also found that there were no racial differences in kindergarten teachers' ratings of approaches to learning, components of which included both social and academic elements. These are noteworthy differences in findings and are worthy of further investigation. Could these differences be due to changes in classroom quality (Hamre & Pianta, 2005; Camilli et al., 2010), or be due to the negative influences of structural racism (Minor, 2014).

### *8.2 Approaches to Learning*

Findings from the present study show that teacher rated AtL was predictive of children's end of kindergarten and third-grade achievement. AtL assessed in kindergarten, has been shown to be predictive of both literacy and mathematics through the elementary years (Li-Grining, Votruba-Drzal, Maldonado-Carreño, & Haas, 2010). In addition, AtL assessed in kindergarten had the greatest impact on children whose initial achievement scores were the lowest (Bodovski & Farkas, 2007; Li-Grining et al., 2010). When assessed in first grade, Bodovski and Youn (2011), found that AtL was the single most influential variable in predicting end of fifth grade reading and math scores, and was most predictive for children who were from low-SES family backgrounds.

It is evident that AtL is a critical construct influencing children's academic performance in the short-term as well as into the future. This may be distinctly true for low-SES children. This assumption is supported by other research findings (Razza, Martin, & Brooks-Gunn, 2015) that observed when AtL was assessed in kindergarten, it was predictive of academic achievement and social competence indicators at nine-years-old within a group of at-risk students. Risk status was defined by income and minority status.

These findings indicate that early AtL, particularly for low-SES children, are important for academic and perhaps social success and may be influential in narrowing the achievement gap for at-risk children. It is critical that the kindergarten curriculum include emphasis on the knowledge, skills, and dispositions associated with AtL in addition to those that are associated with academic areas, such as reading and math. Findings suggest that AtL may be a protective factor for low-SES at-risk children residing in urban neighborhoods.

### *8.3 End of Kindergarten Achievement*

Children's end of kindergarten achievement was a robust predictor of children's third-grade achievement. End of kindergarten achievement was a latent variable comprised of the measured components literacy and mathematics achievement. This finding is consistent with extant research findings not focused exclusively on low-SES children. Previous research revealed that early and emerging literacy (alphabet knowledge, letter-sound correspondence, word recognition) and mathematics skills (counting, number knowledge, number transformation, estimation, number patterns) are indicative of later reading achievement, mathematics achievement, and school success in general (Duncan et al., 2007; Duncan, et al., 2018; Jordan et al., 2006; Jordan et al., 2009; Morris, Bloodgood, & Perney, 2003; Passolunghi, Lanfranchi, Altoè, & Sollazzo, 2015). It has also been shown that listening to

and decoding language while being read to are related to neural physiological activation (Jacobs, 2015). Kidd and Castano (2013) suggest that this activation leads to a positive effect on children's academic performance. These findings emphasize the significant role that kindergarten plays on children's later school academic success, providing the foundation for later achievement skills. Every effort should be made to ensure that all children, particularly those from low-SES environs, have the opportunity to attend high-quality kindergarten programs.

These findings are critical for teachers and other professionals working with children from urban, low-SES neighborhoods. It is imperative that children from low-SES urban neighborhoods attend high-quality kindergarten programs as the advantages they receive from these programs project their future academic trajectories. It is also essential that these children attend schools and kindergarten programs that monitor their performance throughout kindergarten in order to make appropriate modifications for them and increase their chances for optimal learning and development.

#### *8.4 Positive and Negative Social Behaviors*

End of kindergarten teacher ratings of children's positive social behaviors (interpersonal interaction; self-control) and negative social behaviors (internalized problem behaviors; externalized problem behaviors) were not significantly associated with third grade academic achievement performance. This was an unexpected finding. It was anticipated that positive social behaviors in kindergarten would be associated with increased academic performance in third grade while negative social behaviors in kindergarten would be associated with lower academic achievement in third grade. This assumption would be consistent with previous research (e.g., Elias & Haynes, 2008; Henricsson & Rydell, 2006; Rabiner, Godwin, & Dodge, 2016). As previously stated, the long-range impact of early socioemotional development on academic achievement is ambiguous. It may be that this finding is simply a spurious finding or an indication of a true urban social class difference. More research should be undertaken to investigate this phenomenon.

#### *8.5 Strengths, Limitations and Future Directions*

Strengths and limitations should be considered when interpreting finding from this study. A primary strength of this study was the SEM framework within which the data were analyzed. This approach allowed the researchers to take advantage of the longitudinal nature of the data. SEM was also highly operative in elucidating the direct and indirect effects of the predicting factors defined by either latent or measured variables. SEM also revealed the complexity of the relationships among the variables that contribute to or negatively affected other variables. In previous studies many of the factors in this investigation have individually been shown to have impact on children's subsequent achievement. In this investigation, the identified variables are elements of a predictive model that explicates the synergistic impact of these factors in combination.

While pathways to children's future achievement potential were drawn from these findings, other pathways are yet to be constructed. The biotic and behavioral framework that guided



the design of this investigation could be considered a strength, but perhaps also a limitation. Factors not identified in this study may positively or negatively affect children's future achievement potential and further investigations should be undertaken to elucidate the direct and indirect effects of other variables. In the present study, third grade achievement was a latent variable. Future studies should consider the effects of kindergarten biotic and behavioral variables on subsequent achievement variables that are individually measured. This may uncover the variation of effects that kindergarten variables have on individual achievement areas.

Few studies exist that examine within group differences among low-SES children regarding kindergarten variable predictions of later school achievement, particularly children who reside in urban neighborhoods. More questions, therefore, need to be answered. Future studies should strive to understand the complexities and uniqueness of SES and urban neighborhoods. How do these complexities and unique qualities affect development and learning trajectories in children over time? What are the individual characteristics of children within this social class group that might further explain risk factors, resiliency, and protective factors? What are the factors, child/family characteristics, or situations that lead to successful accomplishments for some and difficulty for others? This investigation uncovered what may prove to be social class and/or differences because of the urban environment. These elements are worthy of exploration in future research and/or be considered when planning for instruction or intervention. They include:

- the increase in the predictive association between race and achievement from kindergarten to third-grade.
- the lack of predictive association between race and kindergarten teachers' ratings of AtL.
- the lack of predictive associations between positive and negative social behaviours and third-grade achievement.

A limitation regarding the interpretation of the findings was that the data were not weighted, thus limiting the generalizability to the sample studied rather than to the population. While the unweighted data yielded a sample size smaller than that of the weighted data, the sample was large enough and representative enough to allow for generalizable conclusions. This is evidenced by the fact that the findings from this study corroborated the findings of similar studies that examined comparable variables.

Results from this study have shown that understanding the factors that affect school achievement trajectories and potential are complex. They include both biotic and behavioral elements. There are factors that directly and indirectly affect learning trajectories. Findings from this study have shown that there may also be social class and environmental differences in what those influences are. By having a better understanding of these factors and the relationships among them, we can inform both practice and policy.

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