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Early Emotion Knowledge and Later Academic Achievement Among Children of Color in Historically Disinvested Neighborhoods

Alexandra Ursache¹, Kathleen Kiely Gouley¹, Spring Dawson-McClure¹, R. Gabriela Barajas-Gonzalez¹, Esther J. Calzada², Keith S. Goldfeld¹, Laurie Miller Brotman¹

¹Department of Population Health, NYU Grossman School of Medicine, 227 East 30th Street, New York, NY 10016

²Steve Hicks School of Social Work, University of Texas at Austin, 1925 San Jacinto Blvd, Austin, TX 78712

Abstract

This study examined longitudinal relations between emotion knowledge (EK) in pre-Kindergarten (pre-K; mean age = 4.8 years) and math and reading achievement one and three years later in a sample of 1050 primarily Black children (over half from immigrant families) living in historically disinvested neighborhoods. Participants were part of a follow-up study of a cluster randomized controlled trial. Controlling for pre-academic skills, other social-emotional skills, sociodemographic characteristics, and school intervention status, higher EK at the end of pre-K predicted higher math and reading achievement test scores in kindergarten and second grade. Moderation analyses suggest that relations were attenuated among children from immigrant families. Findings suggest the importance of enriching pre-K programs for children of color with EK-promotive interventions and strategies.

Keywords

Emotion knowledge; academic achievement; children of color; early childhood

A growing research literature suggests that various aspects of social-emotional competence during early childhood predict a range of developmental outcomes in elementary school (Denham & Brown, 2010; Nix, Bierman, Domitrovich, & Gill, 2013; Raver, 2002; Zins, Bloodworth, Weissberg, & Walberg, 2007). Emotion knowledge (EK) is a social-emotional skill that is central to social interactions, learning, school success, and achievement during early childhood (Denham & Brown, 2010; Izard, 2002; Raver, 2002). EK development begins with the ability to recognize, understand and label verbally the basic emotional expressions of others, starting initially with happiness, sadness and anger, followed by fear (Izard, 2001; Izard, Stark, Trentacosta, & Schultz, 2008; Rhoades, Warren, Domitrovich, & Greenberg, 2011). This study focused specifically on discrete EK, the type of EK most widely investigated in early childhood (Trentacosta & Fine, 2010). Discrete EK involves

*Corresponding Author: Alexandra Ursache, 227 East 30th St, 7th Floor, New York, NY 10016, Alexandra.usache@nyumc.org.

perceiving and labeling relatively unambiguous cues of distinct emotions expressed in facial expressions, vocalizations, gestures, and social contexts (Izard, 2001; Trentacosta & Fine, 2010).

Given the importance of social-emotional skills for learning and achievement, the majority of 'high-quality' pre-K programs in the United States include a focus on social-emotional learning (SEL). For example, Head Start performance standards and many state pre-K quality standards describe the mastery of EK, along with a range of other social-emotional skills, as critical to school readiness (Kendziora, Weissberg, Ji, & Dusenbury, 2011). In supporting school readiness, pre-K programs have traditionally emphasized early literacy activities and focused on pre-literacy outcomes. Perhaps it is for this reason that past work has focused on the importance of EK in predicting early literacy skills and reading achievement (Curby, Brown, Bassett, & Denham, 2015; Nix et al., 2013).

More recently, however, there has been a growing emphasis on the importance of developing early math skills in pre-K programs in order to support later achievement and school success (NAEYC, 2010). Research investigating influences on math achievement, however, is relatively new and thus more work is needed to understand predictors of math achievement (Blankson et al., 2017; Geary, 2011). If EK during early childhood predicts *both* reading *and* math outcomes, this would provide further rationale for public investments in early childhood SEL-promoting programs, practices and policies.

Emotion Knowledge and Learning: Theoretical Foundations

The theory of social-emotional learning (Denham & Brown; 2010; Zins et al., 2007) provides one framework for understanding the mechanisms by which EK relates to both math and reading achievement. According to this theory, effective learning occurs in the context of responsive interactions with adults (especially teachers) and peers. Key social and emotional skills in five areas support these interactions: (1) self-awareness, (2) self-regulation, (3) social awareness, (4) responsible decision making, and (5) relationship skills. EK reflects, and contributes to, both self-awareness and social (other) awareness (Denham & Brown, 2010). The ability to recognize and label basic discrete emotion states in others enables young children to navigate their social world and becomes increasingly important for successful social interactions throughout early childhood (Raver, 2002; Trentacosta & Fine, 2010).

A child who accurately evaluates what a peer or adult is feeling in an interaction is more readily able to respond effectively and extend communication exchanges, supporting learning with and from others. For example, young children with high EK skills communicate and engage more effectively with teachers and peers because they have the ability to use words to communicate their negative feelings, such as anger, rather than acting on them (Raver, 2002). Children who have more difficulty identifying their own and others' emotions are more likely to misinterpret social interactions by attributing hostile motives to others' benign actions; misattributions may result in aggressive responses that are upsetting to peers; these exchanges may lead to dislike and rejection by peers (Dodge & Feldman, 1990; Raver, 2002) and likely decreases opportunities for positive communicative and

learning exchanges. Children with higher EK, on the other hand, are better able to respond to their peers in a prosocial manner during emotionally-charged situations and thus are more well-liked by peers and are perceived by their teachers as more socially adept (Denham & Brown, 2010; Izard et al., 2001).

Because they are more well liked, better able to navigate social settings, and communicate more effectively, children with greater EK are better able to engage in the type of collaborative learning activities that promote foundational academic skills. Importantly, engaged learning, especially during pre-K and early elementary school years, happens most often in small group settings rather than in large group or even individual settings in the classroom context (Downer, Rimm-Kaufman, & Pianta, 2007). Thus, children with greater EK likely have greater opportunities for more frequent, prolonged, and stimulating exchanges with teachers as well as peers (Raver, 2002; Zins et al., 2007). According to Izard's "emotion utilization model," EK skills enable children to recognize emotionally-arousing stimuli more efficiently and "channel" emotional arousal into constructive thought and action. EK skills may thus help the child "free up" cognitive resources for learning that would otherwise be used in (and slowed by) the monitoring and processing of complex social information (Izard et al., 2008). Engaged and collaborative learning activities with both peers and teachers thus set the stage for better academic achievement (Downer et al., 2007).

Another theoretical perspective about the role of EK in achievement has focused on processes related to understanding and control across the domains of emotion and cognition in early childhood (Blankson et al., 2013, 2017). This theoretical perspective draws broadly on recent advances in developmental neuroscience which have demonstrated the importance of understanding how cognitive and emotional brain systems are closely related on a biological level (Blair & Raver, 2015; Blankson et al., 2013). Specifically, neuroscience research has shown that the anterior cingulate cortex guides the anterior attention system which plays a role in both cognitive and emotion regulation (Davis, Bruce, & Gunnar, 2002). Moreover, there are reciprocal relations between the two subdivisions of the anterior cingulate cortex which support emotion and cognition, suggesting biological support for developmental relations between emotion and cognitive processes in early childhood (Blankson et al., 2013). This line of theory and research suggests that in addition to the social mechanisms by which EK facilitates learning and achievement, EK may predict math and reading achievement by supporting specific cognitive skills including theory of mind (which allows young children to know and reflect on what others are thinking) and executive functions (cognitive skills consisting of working memory, inhibitory control, and attention shifting, which are important for planning and goal-directed action), both of which are important for acquiring new knowledge.

The development of EK in early childhood is tied to the development of theory of mind (Seidenfeld, Johnson, Cavadel, & Izard, 2014), and some work suggests that early EK predicts later theory of mind skills (Blankson et al., 2017; O'Brien et al., 2011). Theory of mind skills underlie children's metacognitive abilities – including the potential to understand the process of learning – what they know and do not know as well as what their teacher knows (Kuhn, 2000) — and have been linked to both math (Blair & Razza, 2007; Blankson

et al., 2017) and reading achievement (Atkinson, Slade, Powell, & Levy, 2017; Blair & Razza, 2007). For example, children who can better understand their own as well as others' thought processes may more readily grasp what teachers are attempting to teach during math lessons that involve somewhat abstract concepts (Aunola, Leskinen, Lerkkanen, & Nurmi, 2004; Blankson et al., 2017). Consistent with this theory, one study demonstrated indirect effects of EK on math achievement through theory of mind (Blankson et al., 2017). Theory of mind has also been hypothesized as an important factor for successful reading comprehension, but there has not yet been any demonstrable evidence for this hypothesis (Blankson et al., 2017). Theoretically, theory of mind facilitates understanding of fictional characters' thoughts and behaviors, and theory of mind is linked to metacognition more generally, which is necessary in order to read and effectively organize new abstract information such as in non-fiction texts (Atkinson et al., 2017),

Finally, there is some evidence that EK may support achievement via the relation to executive function abilities. A limited number of studies examining EK and executive function has shown relations between these two sets of skills (Hughes, Dunn, & White, 1998; Nilsen & Graham, 2009), and one longitudinal study found that growth in executive function from age 3 to 4 was dependent on EK at age 3 (Blankson et al., 2013). Moreover, a further longitudinal follow up study of that sample demonstrated that executive function mediated the link between EK and reading achievement, but not math achievement, at age 5 (Blankson et al., 2017). There is extensive evidence, however, that executive function is important for *both* math and reading achievement (Blair & Raver, 2015; Blair & Razza, 2007). Thus, executive function abilities are another pathway through which EK may affect both math and reading achievement.

Emotion Knowledge and Academic Achievement: Empirical Evidence

Many cross-sectional studies with diverse samples find that EK in early childhood is associated with the acquisition of pre-academic skills and various other indicators of academic success (Voltmer & von Salisch, 2017). In a cross-sectional study of 3-year-old children, EK was correlated with scores on tests of academic competence, controlling for cognitive control, emotional regulation, and metacognition (Leerkes, Paradise, O'Brien, Calkins, & Lange, 2008). Similarly, Garner & Waajid (2008) found that pre-K EK was correlated with academic competence (concept knowledge and language competence), after controlling for age, sex and income level. In a study of children enrolled in Head Start, Curby and colleagues (2015) examined associations between a number of social-emotional competencies and pre-literacy skills among pre-K children. Results revealed that EK was associated with pre-literacy skills, above and beyond child sex, age, and attention, maternal education, and classroom emotional support. Other studies support these findings (e.g., Izard et al., 2001). Finally, a recent meta-analysis combining reports of 84 effect sizes from 22 studies of children ages 3–12 estimated a medium-positive association ($r = 0.32$) between EK and academic performance (Voltmer & von Salisch, 2017). This effect size, however, is somewhat difficult to interpret as it combines findings from cross-sectional and longitudinal studies, and from teacher reports and objective measures of achievement.

The few *longitudinal* studies among children from low-income families or children of color find associations between early EK and later academic achievement as measured by both teacher report (Izard et al., 2001) and achievement tests (Rhoades et al., 2011; Torres, Domitrovich, & Bierman, 2015; Trentacosta & Izard, 2007). In measuring achievement, however, these studies largely aggregated across the academic domains of math and reading. One study that examined math and reading separately, albeit in secondary analyses, found that EK in kindergarten predicted reading, but not math, achievement in first grade among a sample of 142 predominantly (91%) African-American children (Trentacosta & Izard, 2007). An additional study of socioeconomically- and racially-diverse families (58% White, 35% African American, 2% Latino) found that EK at age 4 was associated with teacher ratings of achievement at age 5 but not with math and reading achievement at age 5 (Blankson et al., 2017). Moreover, this study found mediational pathways from EK at age 3 to reading achievement at age 5 through executive functioning at age 4 and from EK at age 3 to math achievement at age 5 through metacognitive skills (i.e., theory of mind) at age 4, suggesting that EK may be important for both reading and math skills. Thus, of these two studies that examined longitudinal relations of EK to math and reading separately, one found evidence for relations to both math and reading while the other only found relations to reading. As theory supports relations between EK and *both* math and reading, further work is needed to clarify these inconsistent empirical findings.

Emotion Knowledge and Academic Achievement: Development of Children of Color

Increasing equitable access to high-quality early social-emotional and academic learning opportunities for children from historically disinvested neighborhoods that are segregated along racial and economic lines is a promising strategy for reducing disparities in academic achievement (Aspen Institute, 2018). Examining the role of EK in the academic achievement of children of color living and attending early childhood education programs in historically disinvested urban neighborhoods is thus particularly important given that children growing up in these environments often experience a host of social and economic stressors including poverty and under-resourced educational settings which increase their risk for underachievement (Blair & Raver, 2015). Uniquely, and most importantly for children of color, however, is the experience of discrimination and racism – multilevel stressors that have a critical impact on all aspects of the development of children of color (Coll et al., 1996; Ogbu & Simons, 1998).

In considering the role of racism and discrimination for children's development specifically in the context of the U.S. educational system, Ogbu's cultural-ecological theory of minority school performance describes a system of societal- and school-level factors that influence the way children of color are perceived, treated, and taught in school (Ogbu & Simons, 1998). As detailed by this model, the educational system is deeply rooted in, and reflective of, larger historical and enduring societal barriers faced by people of color. These *collective problems* result in children of color experiencing systematic barriers in schools including exclusionary discipline practices and policies, lack of culturally-affirming curricula and

environments, and implicit bias in school staff, which may interfere with SEL development (Ogbu & Simons, 1998).

At the same time, and within this lived experience, children of color are developing adaptive competencies including EK that can be considered both a response to the unique stressors of racism, as well as a way to thrive in their academic settings (Coll et al., 1996). Research on cultural differences in EK suggests that “basic” emotions (including happy, angry, sad, scared) are recognized across cultures at above chance levels (Elfenbein & Ambady, 2002). Nevertheless, children’s recognition of others’ emotion experience may be influenced by cross-cultural differences in values, display rules, and context cues for emotion (e.g., Matsumoto, Seung Hee, & Fontaine, 2008). Furthermore, for children facing racism and discrimination, emotion socialization is likely interwoven with racial and ethnic socialization (Dunbar, Leerkes, Coard, Supple, & Calkins, 2017; Morelen & Thomassin, 2013). In line with the theoretical perspective of adaptive competencies, low EK may contribute to risk for underachievement, and higher EK may serve as a protective factor which helps children to successfully navigate social interactions and engage with others in learning opportunities, in order to acquire important academic skills in stressful environments (Raver, 2002). Moreover, greater adaptive competency in EK would not only be expected to boost children’s individual skills but would also likely have reciprocal effects on the inhibiting or promoting nature of their classroom environment (Coll et al., 1996). For example, greater EK may change the way a child experiences their classroom environment by causing the teacher to see them as more competent, thus improving child-teacher relationships, increasing the teachers’ responsiveness to the child’s learning, and in turn facilitating the child’s academic success.

EK and Academic Achievement among Children of Color from Immigrant Families

The *collective problems* related to racism that children of color face in U.S. schools are clearly an important factor in academic achievement, but the way in which children and families of color perceive and respond to these factors, termed *community forces*, also plays a role (Coll et al., 1996; Ogbu & Simons, 1998). Importantly, there is a high level of heterogeneity among people of color and thus a high level of heterogeneity across their perceptions of and responses to schooling. Immigrant status, as one important source of diversity, is an important determinant of these community forces and therefore serves as a useful heuristic for examining differences in school experience among children of color (Ogbu & Simons, 1998). Immigrant people of color (termed voluntary minorities by Ogbu) are those who have come to the United States more or less willingly with the expectation of greater opportunities for themselves or their children. Involuntary, or non-immigrant minorities, in contrast, were forced to become a part of U.S. society. These differences in how and why minority status was acquired lead to differences in perceptions of and responses to schooling, which in turn are theorized to underlie observed differences in the achievement of children of color from immigrant and non-immigrant families.

This theoretical framework is in line with the immigrant paradox, or a widely-observed pattern in which more recent immigrants of color often have more optimal outcomes than non-immigrants of color across multiple domains of health and education. Importantly, findings with regard to potential protective effects of immigrant status are highly nuanced by developmental age, country of origin, language abilities, and socioeconomic factors, underscoring the need for more research (Crosnoe & Turley, 2011). While not minimizing the potential heterogeneity across the intersection of these factors, Ogbu's theory describes salient ways in which immigrant status categorically influences perceptions of, and responses to, schooling, which in turn affect children's academic achievement. An emerging body of research suggests a protective effect of immigrant status against risk factors for later academic underachievement (Crosnoe & Turley, 2011). For example, in a subset of the sample considered in the current study, it was found that whereas lower pre-K school readiness skills and lower pre-K classroom quality predicted lower second grade math and reading achievement test scores for children of U.S.-born parents, this predictive association was attenuated for children with at least one immigrant parent (Calzada et al., 2015). Thus, the current study also investigated whether the relation between EK and achievement differs for children of color from immigrant and non-immigrant families.

Current Study

The current study examined longitudinal relations between EK at the end of pre-K and later math and reading achievement among primarily Black children (more than half from immigrant families) living in historically disinvested neighborhoods. Specifically, we first sought to determine whether EK at the end of a full year of pre-K predicted reading and math achievement test scores one year later (end of kindergarten) and three years later (end of second grade). In investigating these relations, we controlled for pre-academic skills as well as a number of other social-emotional skills and parental education in pre-K. Pre-academic skills included early indicators of motor skills, concept knowledge, and language abilities which have been traditionally seen as highly important for children's early school-related competence (Garner & Waajid, 2008; Grissmer, Grimm, Aiyer, Murrah, & Steele, 2010). Social-emotional skills included measures of adaptive behavior, positive peer relations, and self-regulation. These covariates were chosen in order to provide a more rigorous test of the relation between EK and achievement by isolating EK from other social-emotional skills which have been previously related to EK in this sample (Ursache, Dawson-McClure, Siegel, & Brotman, 2019) and by controlling for early predictors of achievement (Calzada et al., 2015).

We hypothesized that higher levels of EK at the end of the pre-K year would predict higher math and reading achievement one and three years later, and that relations with math and reading would be of similar magnitude. We next examined whether immigrant status moderated the relation between EK and reading and math achievement in kindergarten and second grade. We hypothesized that the relations would be weaker for children from immigrant families. Finally, we examined whether EK would predict reading and math achievement in second grade when controlling for kindergarten reading and math achievement, respectively. We hypothesized that the relations between EK and math achievement, and reading achievement, in second grade would be attenuated by math

achievement and reading achievement in kindergarten, respectively, such that there would be no additional direct effect of EK on achievement in second grade after including kindergarten achievement in the model.

Methods

Sample

Participants were children who were participating in a longitudinal follow-up study of a cluster (school) randomized controlled trial of a pre-K intervention in ten schools with a largely Black, low-income population (school selection criteria: 80% Black and 70% eligible for free lunch) in a large urban school district (Brotman et al., 2013, 2016). The vast majority of students in urban school districts in the U.S. are children of color (Black, Latino and Asian). The only family-level eligibility criterion for the trial of this group-based family intervention was parent or caregiver English language proficiency. Percent Black students was included as a school selection criterion in the trial to maximize the proportion of families who would meet this family-level criterion. We refer to areas served by these schools as historically disinvested neighborhoods to recognize the structural barriers of systemic racism that have contributed to a high concentration of families of color having low incomes. These schools are representative of the elementary schools (with and without pre-K programs) in the two geographical sub-districts from which they were drawn. The original sample included 1050 students enrolled in pre-K programs in these 10 schools from 2005 to 2008. The intervention was a school-based, family-centered intervention which included (1) professional development for pre-K and kindergarten teachers, mental health professionals, and paraprofessionals and (2) programs for parents and pre-K students led by mental health professionals and teachers. The intervention aimed to help parents and teachers create safe, nurturing, and predictable environments at home and at school through the use of a specific set of evidence-based strategies, which in turn support children's self-regulation skills. These foundational skills, along with continued use of evidence-based strategies by caregivers, were expected to promote mental health and school success (Brotman et al., 2013, 2016). The study followed children through the end of kindergarten (one year later) and to the end of second grade (three years later).

The mean age of the 1050 students included in this study at the end of pre-K was 4.8 years; 49% were boys (Table 1). Child race/ethnicity was reported by parents at study entry in pre-K as Black, not Latino for 85% of children; Black, Latino for 5% of children; not Black, Latino for 6% of children; and other for 4% of children. For the 888 children with data on immigrant status (162 missing), 68% were children from immigrant families. Children came from immigrant and non-immigrant families, depending on the parents' self-reported nativity. In keeping with the widely accepted classification of children into immigrant versus non-immigrant family status (Borjas, 2011), children with at least one foreign-born parent were classified as belonging to an immigrant family, regardless of their own country of birth (though the vast majority of children in this sample were U.S.-born). Children from non-immigrant, or later-generation, families were U.S.-born like their parents. Immigrant families reported over 40 diverse countries or regions of origin, with the largest numbers coming from: Jamaica (14%), Trinidad (10%), Guyana (8%), and Haiti (7%). English was

the official language of many but not all of the immigrant families' countries of origin. A small number of immigrant families were Latino and identified countries of origin including Puerto Rico (2%) and the Dominican Republic (1%). As noted above, parent English proficiency was an eligibility criterion for the study, and only 26 children (of 996 reporting) were classified as learning English as a second language in kindergarten (this classification is not made in pre-K). Of the 600 families who reported family income, 61% were low-income based on having income-to-need ratios of less than 200% of the federal poverty level.

Procedures

This study utilized data from assessments at the end (spring semesters) of pre-K, kindergarten, and second grade. At the end of pre-K, children completed a battery of direct assessments including measures of EK and pre-academic skills. Children's academic achievement in math and reading was assessed through direct assessments in kindergarten and second grade. Trained research assistants administered tests individually to students during the school day. Additionally, when they enrolled in the study in the pre-K year, parents completed a set of survey measures about family sociodemographic characteristics including child race/ ethnicity, child age, parent and child immigrant generation status, country of origin, parent education, family income, and household size. Parent education was coded dichotomously as having a high school education or less, or as having completed at least a technical degree beyond high school. Teachers also completed survey measures of child behaviors at the end of pre-K.

Measures

Emotion Knowledge (predictor variable).—We measured EK using an established protocol, which we named the Preschool Emotion Interview, at the end of pre-K (A.L. Miller et al., 2006). The Preschool Emotion Interview (PEI) assesses children's EK using procedures adapted from Denham (1986) and Garner, Jones, & Miner (1994). First, children label pictures of facial expressions (Denham, 1986). Children see a series of four drawn feeling faces (depicting happy, sad, angry, and scared) and they identify the emotion using words (expressive recognition). Subsequently, children hear the name of an emotion and then identify it out of the series of feeling faces (receptive recognition). Next, to evaluate children's understanding of how social situations can elicit emotion, children listen to eight vignettes that typically evoke particular common emotions (Garner et al., 1994). These vignettes included two each for happy, sad, angry, and scared, and the children identify how the character in the story feels (e.g., "David got a new toy that he wanted; how do you think he is feeling?"). Children did not have specific emotion alternatives to choose from; however, they could point to the faces that were used in the facial emotion recognition section of the interview or they could respond verbally. Interviewers avoided giving any behavioral cues in order to assess whether children could report emotional responses to different situations based on social context cues alone. Finally, we assessed children's ability to understand how others are feeling by interpreting behavioral cues about emotion in different contexts. In this portion of the protocol, interviewers used puppets and emphasized behavioral emotion cues (i.e., vocal expressions and body posture) to enact stories depicting eight situations (two for each emotion) in which the main character likely would experience

happiness, sadness, anger, or fear (Denham, 1986). At the end of each story, children identified how they thought the protagonist might feel. This measure was previously used in a racially diverse sample of preschool children from low-income families (A.L. Miller et al., 2006).

The PEI assesses three aspects of EK: (1) EK of facial expressions, (2) EK about social contexts, and (3) EK with behavioral cues. Incorrect responses (e.g., “happy” for “angry”) received a score of 0; responses where the correct valence was given (e.g., “sad” for “angry”) received a score of 1; and correct responses received a score of 2 (Denham, 1986; A.L. Miller et al., 2006). We calculated mean correct responses within each emotion and then averaged across emotions to create a composite score for each subscale of the PEI. Subscale scores were significantly correlated ($r = .30 - .53$; $ps < .001$). We averaged subscale scores together to create an overall score of EK (maximum possible score = 2, Cronbach’s $\alpha = .79$).

Academic Achievement: Reading and Math (outcome variables).—The Kaufman Test of Educational Achievement (K-TEA) Brief Form-Second Edition (Kaufman & Kaufman, 2005) assesses achievement in kindergarten and second grade. The K-TEA is an individually-administered standardized test that provides reliable and valid estimates of reading and math achievement (Kaufman & Kaufman, 2005). The specific items administered are based on a child’s grade level. There are specific start points for each subtest (reading and math), based on child grade level, and students have to meet basal and ceiling rules to determine the range of subtest items administered. The reading subtest includes Word Recognition (46 items) and Reading Comprehension (27 items). The Word Recognition subtest is administered starting in kindergarten, while the Reading Comprehension subtest is only administered from first grade and beyond. For Word Recognition, students identify letters and pronounce words (many of which are irregular or unpredictable in their phonetic rules). The words increase in difficulty as the test progresses. For example, kindergarten students must identify the letter “B” and “i”, and students who pass the basal, or start the test in second grade, are prompted to read words such as “the”, “at” and “so”. Students who proceed to third to sixth grade items are asked to read words such as “most”, “hour” and “membership”. For Reading Comprehension, students first read and respond to simple instructions (e.g., “Open your mouth”). As the questions increase in difficulty, students read and respond to questions based on a short passage. During Word Recognition, administration discontinues after 4 consecutive errors, and 4 out of 5 errors in the Reading Comprehension section. The Mathematics subtest consists of 67 items of increasing difficulty, and administration discontinues after 4 consecutive errors. This subtest covers a range of number concepts, whole number operations, numerical ordering and time and money in younger grades. The student responds orally to questions requiring the application of math principles to real life situations and completes written solutions to mathematical problems presented in a booklet. Generally, each subtest took approximately 5–10 minutes. Published internal-consistency reliability coefficients are: .90 for reading in kindergarten, .88 for math in kindergarten, .94 for reading in second grade, and .90 for math in second grade (Kaufman & Kaufman, 2005). Validity of the tests is described in detail in the manual (Kaufman & Kaufman, 2005). Briefly, validity is evidenced by the detailed

rationale for selection of items, score changes with age, subtest inter-correlations, correlations with other tests, and score profiles of special-population samples (Kaufman & Kaufman, 2005). Raw scores are converted to standard scores based on a grade-normed sample ($M=100$, $SD=15$). Standard scores can range from 40 – 160.

Self-Regulation (covariate).—Using the Developmental Indicators for the Assessment of Learning (DIAL; described below) Behavioral Observations report (Mardell-Czudnowski & Goldenberg, 1998), research staff rated nine aspects of children’s behavior immediately following the direct assessment at the end of pre-K. For approximately 30% of cases, a second research staff member who observed the assessment provided a second rating. The self-regulation measure incorporates ratings on three behavior items: attention, activity level, and impulsivity (Cronbach’s $\alpha = .80$). Raters scored behaviors on a scale of 0 to 2 with higher scores indicating behaviors that were more problematic. For example, for attention, a rating of ‘2’ indicated ‘pays attention only briefly’; for activity level, a rating of ‘2’ indicated ‘excessive wiggling’; and for impulsivity, a rating of ‘2’ indicated ‘begins before directions are finished on most/all tasks’. Interrater reliabilities were $ICC = .54$ for attention, $ICC = .61$ for activity level, and $ICC = .67$ for impulsivity. As in a prior study using this measure, we dichotomized self-regulation such that children who received a rating of ‘2’ on any of the three self-regulation behavior items were coded as exhibiting dysregulation such that a score of 1 = dysregulation and a score of 0 = no dysregulation (Ursache et al., 2019).

Positive Peer Relations (covariate).—The New York Teacher Rating Scales (NYTRS; L.S. Miller et al., 1995) assesses children’s behavior and positive peer relations in the classroom in children 3–17 years of age. At the end of pre-K, teachers completed the NYTRS. Teachers rated students’ peer relations and behaviors over the past four weeks on a 4-point scale (0 = not at all; 3 = very much). In the current study, scores from the 7-item peer relations subscale (Cronbach’s $\alpha = .91$) were averaged to assess children’s peer relations (maximum score = 3). Example items include “Is considerate with friends/companions”, “Is liked by peers”, and “Helpful to others”. NYTRS scores have been shown to have adequate reliability and validity (L.S. Miller et al., 1995).

Adaptive Behavior (covariate).—The Behavior Assessment System for Children—Teacher Rating Scale (BASC-TRS; Reynolds & Kamphaus, 2004) measures social-emotional and behavioral functioning and has well-established psychometric properties. At the end of pre-K, teachers completed the BASC-TRS. Teachers rated each item in terms of how often the child engaged in a behavior during the past 4 weeks on a 4-point scale (0 = never; 3 = almost always). The adaptive behavior composite includes measures of children’s social skills (6 items; e.g., “Offers help to other children”), adaptability (7 items; e.g., “Adjusts well to change in routine”), and communication (9 items; e.g., “Communicates clearly”). Scores across the items were summed (maximum possible score = 66; Cronbach’s $\alpha = .93$).

Pre-academic skills (covariate).—The Developmental Indicators for the Assessment of Learning-Third Edition (DIAL-3; Mardell-Czudnowski & Goldenberg, 1998) is an individually-administered screen of pre-academic competencies for 3- to 6-year-olds.

Children were assessed using the abbreviated version of the DIAL-3 (the Speed DIAL-3) at the end of pre-K. The Speed DIAL-3 has well-established psychometric properties and assesses children's skills in three domains: motor (e.g., building, copying), concepts (e.g., naming colors, identifying body parts), and language (e.g., letters and sounds, naming actions). The 10 items in the measure are scored from 0 (under 3 years of age) to 4 (6 years of age) to correspond with the developmental age of the child expected to complete them. Scores across the ten items were summed to form a composite score (maximum possible score = 40; Cronbach's alpha = .73).

Analysis Methods

Means and proportions were calculated for all continuous and categorical variables, respectively. All continuous predictors (child age, peer relations, pre-academic skills, adaptive behavior, and EK) were centered at zero by subtracting the respective means. Primary analyses using linear mixed effects models were conducted to measure the strength of the relation of EK with each of the four academic test outcomes: kindergarten math and reading, and second grade math and reading. Models controlled for intervention assignment of the school (half of the schools were assigned to intervention and half were control schools), child age, sex, race/ethnicity, immigrant status, dysregulation, peer relations, parent education, adaptive behavior, and pre-academic skills. The second set of analyses included the interaction of EK by immigrant status to examine whether immigrant status moderated relations between EK and each of the four academic test outcomes. The third set of analyses included kindergarten achievement as an additional predictor of second grade achievement (for math and reading, separately) to examine whether the effect of EK on achievement at second grade was accounted for by achievement at kindergarten.

There was missing data for both predictor and outcome variables. Little's test for Missing Completely at Random (MCAR; Little, 1988) indicated that the data were not MCAR ($p < .00001$) and that we should proceed as if the data were missing at random. Thus, we used multiple imputation methods to generate ten imputed data sets and estimate our models. The main analyses models were linear mixed effects regression models. Clustering at the school level was accounted for by a school-level random effect that was assumed to be normally distributed with a mean of zero and unknown variance. The ten model estimates were pooled to generate the final point estimates and confidence intervals for each predictor and outcome. All analyses were conducted in R Version 3.5.0 (R Core Team, 2018). The multiple imputation was done using chained equations and Classification and Regression Tree methods, implemented in the R package (van Buuren & Groothuis-Oudshoorn, 2011). The linear mixed effects regression models were estimated using function *lmer* from the R package *lme4* (Bates, Machler, Bolker & Walker, 2015).

Results

Descriptive Statistics and Missing Data

Descriptive statistics and sample sizes for baseline measures are presented in Table 1. Ninety-three percent of children had EK scores at the end of pre-K; 78% had reading and math achievement test scores in kindergarten and 54% in second grade. Self-regulation was

available for 94% of the children; 74% for parent education; 98% for peer relations; 94% for pre-academic skills; and 96% for adaptive behavior. Children missing kindergarten achievement had lower teacher-rated adaptive behaviors (50.2 vs 52.0, $p = .01$) and were less likely to be from immigrant families (60% vs 69%, $p = .03$). There were no apparent meaningful differences by age, pre-academic skills, teacher rated positive peer relations, EK, intervention status, race/ethnicity, gender, dysregulation, or parent education. Children missing second grade achievement had lower pre-academic skills (25.7 vs 26.9, $p < .01$), lower teacher-rated adaptive behaviors (50.8 vs 52.3, $p = .01$), lower teacher rated positive peer relations (2.1 vs 2.2, $p < .01$), lower EK (1.6 vs 1.7, $p < .01$), and were less likely to be Black (88% vs 92%, $p = .05$). There were no apparent meaningful differences by age, intervention status, immigrant status, Latino, gender, dysregulation, or parent education. We used multiple imputation methods to deal with potential bias from missing data, as described above.

Emotion Knowledge predicts Achievement: Linear Mixed Model Results

EK at the end of pre-K positively predicted end of kindergarten math and reading achievement such that a 1 point increase in EK was associated with a 7.1 point increase in math and a 9.7 point increase in reading. EK at the end of pre-K also positively predicted math and reading achievement at the end of second grade such that a 1 point increase in EK was associated with a 9.0 point increase in math and a 7.2 point increase in reading. This is equivalent to a 1 SD difference in EK predicting a 0.1 SD difference in kindergarten math, a 0.2 SD difference in kindergarten reading, a 0.1 SD difference in second grade math, and a 0.1 SD difference in second grade reading. Table 2 displays unstandardized parameter estimates and 95% confidence ranges for the control variables. In Figure 1, to display the relative effect sizes of the predictors, we standardized all continuous predictors to have a mean of 0 and a standard deviation of 0.5. We scaled continuous predictors by dividing by two standard deviations, which allows the coefficients to be interpreted in the same way as binary predictors that also have an approximate standard deviation of 0.5 (Gelman, 2008).

Immigrant Status as a Moderator of Relations of EK to Achievement

Moderation analyses suggested that there were differences in the strength of associations between EK and achievement by immigrant status. Interaction term estimates are: for kindergarten math, $b = -7.9$, 95% CI $[-14.8, -1.1]$; for kindergarten reading, $b = -6.6$, 95% CI $[-18.3, 5.1]$; for second grade math, $b = -13.0$, 95% CI $[-21.2, -4.8]$; and for second grade reading, $b = -8.0$, 95% CI $[-17.0, 1.1]$. For children from non-immigrant families, a 1 point increase in EK was associated with an increase of 12.7, 95% CI $[6.1, 21.0]$ points and 13.9, 95% CI $[6.3, 24.6]$ points on the kindergarten math and reading achievement scores, respectively. Similarly, the estimates of EK to math and reading achievement scores in second grade were 17.9, 95% CI $[8.3, 27.3]$ and 12.2, 95% CI $[3.4, 23.4]$ points. For children from immigrant families, the estimates were 4.7, 95% CI $[0.4, 8.7]$ and 7.3, 95% CI $[0.9, 14.4]$ points for kindergarten math and reading achievement; and the estimates were 4.9, 95% CI $[-0.9, 12.5]$ and 4.3, 95% CI $[-1.6, 11.1]$ in second grade for math and reading, respectively. Figure 2 shows a plot of the raw test scores against centered-EK scores, along with an estimated regression line for each immigrant status group. The slopes of the fitted regression lines (i.e., the association) appear steeper for children from non-immigrant

families relative to the children from immigrant families across all four achievement test scores.

Relation of EK to 2nd grade Achievement when Controlling for Kindergarten Achievement

Kindergarten reading achievement positively predicted reading achievement in second grade $b = 0.4$, 95% CI [.3, .5]. This inclusion of kindergarten achievement in the model also greatly attenuated the relation between EK and second grade reading achievement and CIs crossed zero $b = 3.5$, 95% CI [-.7, 7.7]. Kindergarten math achievement positively predicted math achievement in second grade, $b = 0.5$, 95% CI [.3, .6]. Including kindergarten achievement in the model attenuated the relation between EK and second grade math achievement $b = 5.8$, 95% CI [1.9, 9.6].

Discussion

This study examined the associations between children's EK in pre-K and math and reading achievement one and three years later among primarily Black children living in historically disinvested neighborhoods. Overall, EK predicted both math and reading achievement in kindergarten and second grade. This is the largest study to examine longitudinal relations between early EK and later academic achievement and is the first to include a large proportion of Black children from immigrant families. In doing so, this study builds on the extant literature (e.g., Izard et al., 2001; Rhoades et al., 2011; Torres et al., 2015; Trentacosta & Izard, 2007) and advances understanding of the importance of early EK for later math and reading achievement in a sample and context that are underrepresented in research. Furthermore, this is the first study to examine immigrant status as a moderator of relations between EK and later math and reading achievement.

Importantly, EK at the end of the pre-K year predicted *both* math and reading achievement in kindergarten and second grade, even when controlling for a robust set of covariates including other social-emotional skills, pre-academic skills and sociodemographic characteristics. Few prior studies have distinguished between math and reading outcomes as most work has either focused on reading or utilized composite measures of achievement. Some prior work focused on pre-literacy outcomes in part because these outcomes have traditionally been emphasized in pre-K programs and because some theories have emphasized that EK may be particularly important for engaging in early literacy activities such as shared book reading (Curby et al. 2015). Moreover, intervention research has highlighted ways in which pre-K gains in social-emotional skills more generally contribute to reading achievement in kindergarten (Nix et al., 2013). This study confirms these important associations between EK and reading achievement and draws on broader theories of social-emotional learning and neurodevelopmental processes to posit that EK would support math skills as well.

In line with these theoretical perspectives, the current study demonstrated positive longitudinal associations with later math achievement that are of similar magnitude as those with reading achievement. These findings are in contrast to one earlier study which found that EK predicted reading but not math achievement (Trentacosta & Izard, 2007). One possibility for this difference may have to do with the measure of EK that was used.

Trentacosta and Izard used a measure in which children were required to verbally name the emotion when asked how someone would feel during a certain scenario, whereas the PEI measure used in this study allowed children to point to line drawings of faces depicting the emotions or to verbally respond. The greater verbal task demands of the EK measure in the Trentacosta and Izard study may have led to the larger association of EK with reading relative to math achievement. The strong relation between EK in pre-K and math achievement three years later is highly encouraging regarding the potential impact of pre-K SEL interventions on both math and reading achievement.

Furthermore, as expected, the relation between EK at the end of pre-K and achievement in second grade was attenuated when controlling for achievement in kindergarten. After controlling for kindergarten achievement, EK appeared to remain an important predictor of second grade math achievement but no longer appeared to predict second grade reading achievement. While this finding may suggest a pathway by which early EK facilitates achievement in kindergarten and then kindergarten achievement in turn facilitates second grade achievement, the results should be interpreted with caution. First, these analyses do not provide evidence of a causal pathway as neither EK nor kindergarten achievement were randomized. Second, these results do not suggest that EK no longer matters for achievement after kindergarten as it may be that advances in EK in kindergarten or first grade are important predictors of second grade achievement even after controlling for kindergarten achievement. Regardless -- as per the success begets success developmental models -- greater EK appears to provide opportunities for learning in kindergarten and these continue to the end of second grade with no evidence of fade out as associations with achievement appear as strong in second grade as they were in kindergarten. Future studies are needed to investigate relations among the developmental trajectories of EK and achievement across elementary school.

Finally, in examining differences between children from immigrant and non-immigrant families, this study built on theory and prior research which suggests that pathways from early skills to achievement may differ for children from immigrant and non-immigrant families (Calzada et al., 2015; Ogbu & Simons, 1998). Results suggest that relations of pre-K EK to math achievement in kindergarten and second grade were weaker among children from immigrant families than among children from non-immigrant families. A similar pattern was found for reading achievement in kindergarten and second grade, although the differences in the magnitude of the associations were smaller and there was more uncertainty around the estimates. These results are consistent with theory and prior research indicating that immigrant families may confer some protection against the impact of risk factors for lower achievement (Calzada et al., 2015; Crosnoe & Turley, 2011; Ogbu & Simons, 1998). For example, immigrant parents may play a more active role in promoting academic achievement at home through enrichment experiences, ensuring that children complete homework, and seeking help when their children struggle at school (Brotman, Barajas-Gonzalez, Dawson-McClure, & Calzada, 2019; Calzada et al., 2015; Roopnarine, Krishnakumar, Metindogan, & Evans, 2006). An alternate possibility, however, is that immigrant families have different norms for emotions which are not captured by the measure of EK used in this study, and that for this reason, the EK measure may not be as predictive of later achievement among children from immigrant families. Another possible explanation is

that children from non-immigrant families experience greater racism and stigma than do children from immigrant families and that this racism and implicit bias lead teachers to interpret early EK difficulties in a more negative light, which put children from non-immigrant families at risk for poorer achievement later on. Furthermore, it is important to remember that there was a high-level of heterogeneity within our immigrant family sample as families differed in country of origin, race, ethnicity, language abilities, family structure, and experiences in immigrating to the U.S. Thus, comparing children from immigrant vs non-immigrant families is only one way of examining group differences and future work is needed to understand nuances in the patterns of differences and in the potential underlying protective factors and processes.

The overall finding that pre-K EK predicted academic achievement in a sample of children of color living in historically disinvested neighborhoods adds to a growing body of work on the importance of early EK skills and underscores the potential population-level benefits of scaling interventions that promote young children's EK (Torres et al., 2015). Although several SEL evidence-based interventions delivered as enhancements to pre-K, such as The Emotions Course (Izard, Trentacosta, King, & Mostow, 2004), and Head Start REDI (Bierman et al., 2008) which includes Head Start PATHS (Promoting Alternate Thinking Strategies; Domitrovich, Cortes, & Greenberg, 2007), have been shown to promote EK during the pre-K year among low-income children of color, experimental studies with longitudinal follow-up are needed to estimate the long-term impact on reading and math achievement attributable to early gains in pre-K. Moreover, if pre-K SEL interventions are expected to meaningfully impact academic achievement outcomes for children of color, especially Black children, they must be informed by a deep understanding of the pervasive and persistent role of racism in various aspects of the U.S. educational experience (Aspen Institute, 2018).

Few interventions have been developed or evaluated considering the myriad ways in which systemic racism shapes children's development (Andrews, Parekh, & Peckoo, 2019). Systemic racism and implicit bias in our society influence the extent to which children have opportunities to learn (Aspen Institute, 2018) – thus EK is an important child-level predictor of achievement as well as a signpost, signaling and providing insight into the complicated issues of systemic racism. Incorporating an understanding of how systemic racism and implicit bias impact children's opportunities to acquire EK and other social-emotional skills is a critical next step toward reaching equity in theory and practice (Andrews et al., 2019; Aspen Institute, 2018).

Importantly, in the current study, EK was measured at the end of pre-K and thus represents the cumulative development of skills and knowledge that has occurred up to that point based on opportunities for learning at home and at school. In the home context, pathways to effective emotion socialization in children differ by race and ethnicity, and this process may be shaped by differences in norms and values for emotional expressions (Morelen & Thomassin, 2013). For African American parents in particular, and perhaps for other families of color as well, emotion socialization is likely integrally tied to racial and ethnic socialization as children must learn to understand and regulate their emotions in the face of racism and discrimination (Dunbar et al., 2017). Similarly, learning EK in the classroom is

not an individual process that simply involves paying attention to a curriculum that teaches emotion identification skills. Rather, EK in the classroom develops in the context of naturally-occurring, emotion-laden interactions with teachers and peers. When teachers support children to work through these emotionally-charged situations, children build competence in recognizing feelings in themselves and others, managing their own feelings, and empathizing with the feelings of others. When teachers dismiss children's feelings or address their behaviors without addressing, or by misinterpreting, their emotions, children miss out on opportunities to build emotional competence.

Black children are at higher risk for missing out on these EK-promotive opportunities because of negative interpretations of their normative emotional expressions, misinterpretation and disregard of the context of their emotions and emotion displays, and inequity in discipline related to emotional expression (Blake & Epstein, 2019; Epstein, Blake, & Gonzalez, 2017; Gilliam, Maupin, Reyes, Accavitti, & Shic, 2016; Malik, 2017). Recent work suggests that teachers may have implicit biases toward expecting challenging behaviors from Black boys which may mean that their emotional displays are more likely to be misinterpreted as misbehavior (Gilliam et al., 2016). Quantitative research as well as the lived experiences of Black women indicate that Black girls' actions and emotion expressions may be incorrectly interpreted as angry or sassy (Blake & Epstein, 2019; Epstein et al., 2017). Black children are additionally more likely to be suspended or expelled from pre-K than are children in any other racial or ethnic group (Malik, 2017). When Black children are seen as potential problems rather than as four-year-olds who are experiencing normatively strong emotions, they will systematically and disproportionately miss out on opportunities to develop EK – such as being “seen, heard and cared for” in pre-K classrooms in a way that affirms their emotional experience and builds their capacity to identify and manage the full range of developmentally-appropriate emotions. Moreover, by witnessing interactions that punish rather than engage with Black children's strong emotions, other children in the pre-K classroom learn that Black children's emotions are invalid and should not be attended to, or should result in punitive consequences, thus reproducing implicit biases and perpetuating systemic racism.

Limitations

This study has a number of methodological strengths including its large sample size, longitudinal design, the direct assessment of EK through child interview, and direct measurement of academic achievement using individually-administered standardized tests at two time points. Several limitations should be noted, however, all of which limit the interpretation of the findings. The population in this study was primarily Black, non-Latino and almost all of the immigrant population was Afro-Caribbean. Thus, despite the inclusion of some Latinos in this study, the findings regarding differences between children from immigrant and non-immigrant families primarily reflect different strengths of association between EK and achievement among Afro-Caribbean and African-American children. Future work is needed to replicate these findings in more diverse populations to understand the intersections of race, ethnicity, and country of origin. Additionally, as in all non-experimental designs, the possibility remains that there is some unmeasured factor that accounts for the relation between pre-K EK and achievement. We did, however, attempt to

limit this concern by controlling for earlier pre-academic skills and family sociodemographic characteristics as well as by controlling for other social-emotional skills that may be related to EK and achievement. Moreover, the measure of self-regulation was a dichotomous measure and based on observer report. As self-regulation is likely important for both EK and academic achievement, future investigations should use more nuanced measures of the multiple aspects of self-regulation, including executive functioning and emotion regulation. The amount of missing data due to attrition, primarily as a result of children moving out of the schools that were part of the study, was also a limitation of this study, increasing the level of uncertainty in the findings. We did, however, use multiple imputation which should address some of the uncertainty caused by missing data. Multiple imputation always relies on the assumption that the imputations used the proper model, which is difficult, if not impossible to know. There is always the risk that data are not missing at random which could mean that estimates of the relation between EK and math and reading achievement are biased, but it is hard to say in what direction that bias would be working. Finally, our measure of EK is limited in that some of the story situations may be less familiar for children of color and in that the cultural norms for display rules in those situations may differ by cultural values (e.g., Matsumoto et al., 2008). For example, children who are socialized to focus on others (e.g. collectivist cultures) may be better at attuning to the characters in the stories. Moreover, white U.S. culture norms for expressing happiness include high arousal positive emotion such as being excited whereas Asian norms for happiness consist of low arousal positive emotion such as being solemn (Lim, 2016). Thus, our measure may reflect white norms for EK, and learning these norms may be rewarded by teachers, leading to greater opportunities for learning and higher achievement. Future work is needed to develop EK measures that represent norms of multiple cultural groups.

Conclusion

As researchers in the field of child development, it is our individual and collective responsibility to interrupt internalized and systemic racism in our own work, and in the field broadly, through promoting equity in theory, research, practice and policy that aims to support EK and SEL-promotive opportunities more broadly for children of color (Andrews et al., 2019; Aspen Institute, 2018). This study is the largest to demonstrate longitudinal relations between pre-K EK and academic achievement in children of color living in historically disinvested neighborhoods. Importantly, EK at the end of pre-K predicted both math and reading achievement at the end of kindergarten and at the end of second grade. As such, these findings provide further rationale for enriching pre-K programs serving low-income children of color with interventions and strategies that promote EK. These enrichments may range from supports for teachers, parents, or children and all must be delivered in the context of a deep understanding of the historically pervasive and persistent role of internalized and systemic racism.

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Figure 1.

Model results including the standardized pooled estimates (graphed point estimates) and 95% confidence ranges (graphed line) for each parameter estimated in the four models – one for each outcome (kindergarten math, kindergarten reading, second grade math, and second grade reading). To compare the relative effect sizes of the predictors, we standardized all continuous predictors to have mean 0 and standard deviation 0.5. We have scaled continuous predictors by dividing by two standard deviations, which allows the coefficients to be interpreted in the same way as binary predictors that also have an approximate standard deviation of 0.5. Bolded estimates and confidence ranges indicate that the confidence range does not cross 0 and thus the estimate is significant at the conventional level of $p < .05$.

Figure 2.
Fitted regression lines for children from non-immigrant and immigrant families.

Table 1:

Baseline measures

	n	value
Age in years (avg/sd)	1050	4.8 (0.02)
Sex = Male (n/%)	1050	518 (49.3)
Race = Black (n/%)	1050	943 (89.8)
Latino = Yes (n/%)	1050	121 (11.5)
Immigrant status = Yes (n/%)	888	600 (67.6)
Dysregulation = Yes (n/%)	983	143 (14.5)
Intervention = Yes (n/%)	1050	561 (53.4)
Parent education = HS or less (n/%)	776	361 (46.5)
Peer relations (avg/sd)	1025	2.1 (0.6)
Pre-academic skills (avg/sd)	986	26.4 (5.5)
Adaptive behavior (avg/sd)	1006	51.6 (9.5)
Emotion knowledge (avg/sd)	976	1.7 (0.2)
Math kindergarten (avg/sd)	819	99.7 (12.9)
Reading kindergarten (avg/sd)	819	112.0 (20.4)
Math second grade (avg/sd)	561	97.3 (15.0)
Reading second grade (avg/sd)	562	102.4 (15.5)

Table 2.

Model results (parameters estimation and 95% CIs) predicting math and reading at kindergarten and second grade.

	Kindergarten		Second Grade	
	Math	Reading	Math	Reading
Emotion Knowledge (EK)	7.1 (3.4, 10.7)	9.7 (4.2, 15.2)	9.0 (4.7, 13.4)	7.2 (2.6, 11.8)
Immigrant status	1.2 (−0.4, 2.7)	1.6 (−1.1, 4.4)	2.6 (0.6, 4.5)	4.2 (2.0, 6.4)
Male	0.8 (−0.7, 2.2)	0.2 (−2.3, 2.7)	0.7 (−1.1, 2.5)	0.6 (−1.4, 2.6)
Age	0.1 (−2.4, 2.7)	−2.3 (−6.8, 2.3)	−2.9 (−7.3, 1.4)	−3.0 (−7.1, 1.2)
Black	−4.7 (−7.5, −1.8)	1.1 (−3.8, 5.9)	−6.7 (−10.8, −2.6)	−3.3 (−7.3, 0.7)
Latino	−2.1 (−4.5, 0.4)	0.8 (−4.0, 5.5)	−3.1 (−6.7, 0.5)	−1.8 (−5.1, 1.6)
Dysregulation	0.1 (−2.0, 2.1)	−0.9 (−4.1, 2.2)	−0.7 (−4.1, 2.8)	−1.4 (−4.7, 2.0)
Peer relations	1.2 (−0.6, 2.9)	−0.6 (−3.3, 2.1)	2.7 (0.7, 4.7)	0.8 (−1.4, 2.9)
Adaptive behavior	0.1 (0.001, 0.3)	0.4 (0.2, 0.6)	0.1 (−0.1, 0.2)	0.1 (−0.1, 0.2)
Parent education HS or less	−1.3 (−3.1, 0.5)	−3.5 (−5.9, −1.0)	−2.3 (−4.0, −0.6)	−2.3 (−4.6, 0.01)
Pre-academic skills	1.1 (0.9, 1.2)	1.2 (1.0, 1.5)	1.2 (1.0, 1.5)	1.3 (1.0, 1.6)
Intervention	−0.1 (−1.6, 1.5)	2.0 (−0.5, 4.6)	−0.7 (−2.6, 1.2)	0.4 (−1.6, 2.3)