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Teacher (Mis)Perceptions of Preschoolers' Academic Skills: Predictors and Associations With Longitudinal Outcomes

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Abstract

Preschool teachers have important impacts on children's academic outcomes, and teachers' misperceptions of children's academic skills could have negative consequences, particularly for low-income preschoolers. This study utilized data gathered from 123 preschool teachers and their 760 preschoolers from 70 low-income, racially diverse centers. Hierarchical linear modeling was utilized to account for the nested data structure. Even after controlling for children's actual academic skill, older children, children with stronger social skills, and children with fewer inattentive symptoms were perceived to have stronger academic abilities. Contrary to hypotheses, preschoolers with more behavior problems were perceived by teachers to have significantly better pre-academic abilities than they actually had. Teachers' perceptions were not associated with child gender or child race/ethnicity. Although considerable variability was due to teacher-level characteristics, child characteristics explained 42% of the variability in teachers' perceptions about children's language and pre-literacy ability and 41% of the variability in teachers' perceptions about mathability. Notably, these perceptions appear to have important impacts over time. Controlling for child baseline academic skill and child characteristics, teacher perceptions early in the preschool year were significantly associated with child academic outcomes during the spring for both language and pre-literacy and math. Study implications with regard to the achievement gap are discussed.

Keywords

teacher perceptions; preschool; academic achievement; language and pre-literacy; math

When children enter kindergarten, they are expected to demonstrate an interrelated set of skills and competencies including pre-academic skills (e.g., language, literacy, and numeracy), cognitive abilities (e.g., attention and executive control), socioemotional well-being (e.g., self-regulatory ability and social skills), and physical health (Early Head Start National Resource Center, 2003; National Research Council and Institute of Medicine,

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2000). These skills, termed “school readiness,” are independently and reciprocally related to children’s achievement trajectories (e.g., Collins & Dennis, 2009; Escalon & Greenfield, 2009). Pre-academic competencies in particular have been demonstrated to play an important role in ensuring that children are ready for school (Duncan, et al., 2007; La Paro & Pianta, 2000). Notably, a disproportionate number of children with deficits in pre-academic competencies, and thus a greater risk of later school underachievement or failure, come from low-income backgrounds (Brooks-Gunn, Rouse, & McLanahan, 2007).

Unsurprisingly, preschool plays a critical role in promoting school readiness within a child’s social ecology (Bronfenbrenner, 1979; Mashburn & Pianta, 2006), especially for children of disadvantaged groups (Magnuson, Meyers, Ruhm, & Waldfogel, 2004). The role of the preschool teacher in particular has been shown to have positive short-and long-term impacts on preschoolers’ academic outcomes (e.g., Downer & Pianta, 2006). In order to capitalize on this opportunity to foster preschoolers’ academic development, preschool teachers must have an accurate understanding of their preschoolers’ knowledge and skills, especially given the critical role that scaffolding plays in effective teaching (Pentimonti & Justice, 2010; Vygotsky, 1978).

However, preschool teachers may face particular challenges in acquiring the knowledge they need to provide differentiated instruction matched to children’s needs. The psychometric properties of formal assessments of academic achievement with young children are often weaker than school-age achievement tests (e.g., McCauley & Swisher, 1984). Techniques like criterion-referenced testing, curriculum-based assessment, and child portfolios may provide more valid methods of assessing pre-academic competencies (e.g., Van der Heyden, Broussard, & Colley, 2006), but the use of data-based decision making to inform instructional design with preschoolers lags behind such practices with school-aged children. Lastly, teachers may complete ratings of their preschoolers’ abilities or, likely more common, informally collect moment-to-moment data. Notably, considerable variation can occur between multiple reporters or between teacher-report and objective assessment, especially in low-income contexts, which suggests that teachers’ perspectives sometimes fail to represent preschoolers’ “true” abilities (Arnold & Dobb-Oates, 2013; Kilday, Kinzie, Mashburn, & Whittaker, 2012). For example, in the context of a low-income sample, Kilday and colleagues (2012) found that the associations between teacher ratings and a variety of direct assessments of preschoolers’ math skills were weaker than expected, with correlations ranging from .42 to .54.

Given that preschool teachers are poised to have a considerable impact on academic outcomes, the irreliance on in adequate assessment data is concerning. Preschool teachers, like others, are susceptible to developing and maintaining inaccurate impressions about their preschoolers based on salient information about the child (Ito, Thompson, & Cacioppo, 2004) or influenced by their own background and beliefs (Kilday et al., 2012; Mashburn & Henry, 2004). Such biases are risky because they could result in inaccurate expectations for students, lead to ineffective scaffolding during instructional interactions, and result in limited student learning during a period known to be critical in developing the pre-academic readiness essential for later school achievement (Duncan et al., 2007).

Rosenthal and Jacobson (1968; 1992) famously demonstrated the effect that teacher expectations can have on children's short - and long-term academic achievement when they randomly assigned a subset of children to be described as "late bloomers" who could be expected to excel that school year with the proper support and nurturance. No information was provided about the rest of the students, and although the students were randomly assigned to condition, the "late bloomers" demonstrated an increase in both their academic achievement, as measured by their schoolwork, and their IQ scores. This study produced a firestorm of controversy, which resulted in a realization of some weaknesses and over-interpretations of the hallmark Pygmalion study (Jussim & Harber, 2005). Nonetheless, a body of research has now accumulated that convincingly demonstrates that teacher perceptions do affect academic development, and that these effects are sometimes substantial (de Boer, Bosker, & van der Werf, 2010; Jussim & Harber, 2005; Smith, Jussim, & Eccles, 1999). For example, in their study of elementary school students, Rubie-Davies et al. (2006) found that the children for whom teachers held the lowest expectations with regard to their reading achievement showed the fewest gains over the course of the school year. This effect was shown to occur even though these children had reading achievement scores that were comparable to the highest achieving students at the beginning of the school year. Similarly, Hinnant, O'Brien, and Ghazarian (2009) found that when teachers overestimated children's mathematical abilities in first grade, these children performed better in math up to four years later. Conversely, children tended to perform more poorly in math several years later if their first grade teachers underestimated their actual abilities.

Though evidence for the effect of biased teacher perceptions on academic outcomes has been clearly documented in studies with older children (de Boer et al., 2010; Hinnant et al., 2009; Rubie-Davies et al., 2006; Sorhagen, 2013), very little is known about this phenomenon in preschool. Alvidrez and Weinstein's (1999) study is one notable exception, in which teacher perceptions of children's intelligence during the preschool years predicted both grade point average and Scholastic Aptitude Test (SAT) scores up to 14 years later. Even though pre-academic competencies are a primary focus of school readiness (La Paro & Pianta, 2000) and are directly linked to later achievement (Duncan et al., 2007), no known studies have investigated the impact of preschool teachers' perceptions of specific academic skills, such as language and pre-literacy or math. Research investigating the perceptions of kindergarten through fifth grade teachers indicates that teacher misperceptions during the early years of education not only have a heightened impact on achievement outcomes (Kuklinski & Weinstein, 2001), but are also thought to be cumulative over time (Rubie-Davies et al., 2014). Downward extension of this literature to preschool is even more pressing given that preschool teachers lack access to high-quality academic feedback commonly utilized by grade-school teachers, suggesting that the biases they hold may be even more extreme.

Notably, in a sample of kindergarteners, low socioeconomic status was associated with lower teacher expectations, which in turn predicted lower child outcomes across both language and math (Speybroeck et al., 2012). Given that pre-academic competencies are an area of known risk for low-income preschoolers (Brooks-Gunn et al., 2007), who are also particularly vulnerable to the effects of teacher expectations (Hinnant et al., 2009; Speybroeck et al., 2012; Sorhagen, 2013), extending the teacher expectation literature by

conducting a well-designed study with low-income preschoolers is critical. Better understanding this relationship has direct implications for understanding patterns of underachievement that could contribute to the foundation of the achievement gap, while also suggesting avenues for intervention to address that gap.

Given the profound effect that teacher perceptions can have on students' academic performance and achievement, the specific child and ecological characteristics that are associated with teachers' perceptions of children's academic knowledge and skills (and, consequently, their instructional interactions with preschoolers) are critical to understand.

Child-Level Predictors of Teacher Perceptions

Child gender

The stereotype that boys are more skilled in math and science while girls are better at reading and language arts is supported in the teacher expectation literature. For example, in the context of a diverse sample, Hinnant et al. (2009) found that teachers tended to think that girls were better readers than they actually were, while boys' reading abilities were underestimated. In addition, despite receiving similar to slightly lower grades in math, boys have been rated as having greater mathematical abilities than girls by their teachers (Jussim & Eccles, 1992; Tiedemann, 2000, 2002). These societal influences run deep; as early as first grade, girls have been found to rate themselves as less competent in math than boys (Eccles, Wigfield, Harold, & Blumenfeld, 1993; Fredricks & Eccles, 2002). However, the majority of these studies were conducted with middle class, mostly Caucasian samples, and relatively few studies have examined differences in teacher perceptions by child gender during the preschool years.

Child race/ethnicity

Teachers' stereotypes about ethnicity have been demonstrated to explain significant variance in the teacher-child relationship, especially negatively perceived aspects of the relationship like conflict (Saft & Pianta, 2001). Additional evidence suggests that teacher communication patterns, expectations, and responses to child behavior vary by child ethnicity (Brady, Tucker, Harris, & Tribble, 1992). Similarly, decisions to hold students back and to engage children in special education services are made differently depending on ethnicity (Cosden, Zimmer, Reyes, & del Rosario Gutierrez, 1995; Dauber, Alexander, & Entwisle, 1993). These studies included mostly low-income, ethnic minority students, but they focused primarily on older children and White teachers, and none directly evaluated teacher perceptions.

Child age

Unsurprisingly, older students generally display greater academic and social skills than their younger classmates (e.g., Breznitz & Teltsch, 1989). Unfortunately, teachers may fail to take into account children's developmental level when assessing behavior problems, social skills, and academic performance. Indeed, two recent studies found that the youngest children in a given grade were much more likely to be diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD) than their older classmates (Elder, 2010; Evans, Morrill, & Parente,

2010). Teachers' perceptions of student behavior were a driving force behind these increased diagnoses, and Elder (2010) proposed that teachers may be comparing younger children to their more mature classmates when reporting ADHD symptoms. Similarly, younger children tend to receive more referrals for special education and mental health services than their older classmates, despite few differences in objective measures of children's skills (Gledhill, Ford, & Goodman, 2002; Wallingford & Prout, 2000). These studies capitalize on large, population-based samples but focus on children who have already entered formal schooling; additional research is needed during preschool.

Child behavior problems and inattentive symptoms

Children with behavior problems often experience academic difficulties (e.g., Kaiser, Xinsheng, Hancock, & Foster, 2002) and are more likely to be referred for academic services (Stowe, Arnold, & Ortiz, 1999). Although some children with behavior problems likely struggle academically, in other cases, teachers may perceive children's academic skills as being lower due to their behavior problems (Bennett, Gottesman, Rock, & Cerullo, 1993). For example, preschool through first grade teachers who rated children as having significant behavior problems rated those same children as having lower academic ability and potential (Espinosa & Laffey, 2003). However, objective tests of mathematical skills revealed no significant differences between these "problem" children and those who were judged by their teachers as behaving appropriately in the classroom. Notably, children with inattentive symptoms seem to be at particularly high risk for poorer academic performance (e.g., Giannopulu, Escolano, Cusin, Citeau, & Dellatolas, 2008), though inattentive behavior is frequently grouped with other "problem behaviors" in the teacher expectation literature. In one of the few studies that specifically examined teacher perceptions of students with attention problems, Eisenberg and Schneider (2007) found that teachers generally rated third grade students with ADHD as having worse academic abilities than they actually had. Though these studies utilized diverse samples, additional research is sorely needed that focuses on preschool-aged children and attempts to distinguish between teacher perceptions of behavior problems and inattentive behavior.

Child social skills

Social competence can be conceptualized as a protective factor, and it has been associated with early literacy and math skills in preschool (Hindman, Skibbe, Miller, & Zimmerman, 2010), academic success in kindergarten (McClelland & Morrison, 2003), and the ability to sustain positive relations with both peers and adults (e.g., Eisenberg & Fabes, 1998). The positive impact of social skills is long-lasting; teacher-reported social skills during kindergarten have been found to predict academic performance in reading and math up to six years later (McClelland, Acock, & Morrison, 2006). Notably, in the context of a diverse sample, teachers overestimated the reading and math skills of those children that they believed to be more socially competent throughout the elementary school years (Hinnant et al., 2009). Again, research that focuses on these relationships within a preschool sample is lacking.

Ecological Covariates of Teacher Perceptions

In line with developmental-ecological theory, contextual factors are important in understanding the impact of teacher perceptions on children's academic development across the preschool years (Bronfenbrenner, 1979). Teacher, classroom, and center characteristics have been linked both to teacher behavior in the classroom and to child outcomes within ethnically diverse, low-income preschool settings (Baker, Kupersmidt, Voegler-Lee, Arnold, & Willoughby, 2010; Kuklinski & Weinstein, 2001; McWayne, Cheung, Green Wright, & Hahs-Vaughn, 2012; Pianta et al., 2005). Conceivably, these important ecological variables also play a role in teachers' perceptions of children's skills and, moreover, might affect teachers' accuracy relative to objectively measured child skills (Kilday et al., 2012).

The Current Study

The current study utilizes hierarchical linear modeling to better understand the role of teacher perceptions in the language and pre-literacy and mathematics skill development of ethnically diverse, low-income preschoolers. This study evaluates the following research questions and hypotheses:

1. Is there a discrepancy between teachers' perceptions and preschoolers' pre-academic abilities, and can this discrepancy be predicted by child characteristics and ecological covariates? We hypothesized that there would be a discrepancy between teachers' perceptions and preschoolers' abilities, and that, across preschoolers, these mismatches would include both over-and underestimates of pre-academic skills. With regard to child-level predictors of teacher perceptions, we hypothesized that teachers would perceive boys to be more skilled in math and less skilled in language arts than girls, even controlling for actual achievement, while the opposite pattern was predicted for girls. We predicted that children who identified as ethnic minorities would be perceived as being less academically skilled than their White peers. We predicted that older children would be perceived as being more academically skilled than their younger peers. Also, we predicted that teachers would perceive children with more behavioral and attention problems as less skilled, and children with better social skills as more skilled. Finally, we hypothesized that the addition of ecological covariates to the models would result in a further reduction of unexplained variance.
2. Do teachers' perceptions have short-term longitudinal effects on preschoolers' pre-academic outcomes? We hypothesized that teacher perceptions of children's academic skills during the fall of the preschool year would be associated with preschoolers' academic achievement during the following spring, even after controlling for initial achievement, child characteristics, and ecological covariates. We also explored the possible impact of teachers' perceptions when they over-and underestimated preschoolers' academic abilities.

Better understanding these relationships has the potential to inform, and therefore guide efforts to address, the persistent underachievement pattern associated with the achievement gap.

Method

The current study is part of a larger research project involving the evaluation of a kindergarten readiness program (Baker et al., 2010). The study received University IRB approval and approval from the relevant center programs. Centers were identified as low-income and eligible to participate in the study if they were Head Start centers or if they were community child care centers with at least 50% low-income students or students enrolled in subsidized slots, as identified by the center director. In order to be eligible to participate, at least one classroom within the center must have been comprised of at least 50% 4-year-old children. Eligible community child care centers were required to have at least a three-star rating, based on a five-star quality rating system (North Carolina Division of Child Development, 2005). Four of the five Head Start programs, with 24 centers/buildings, agreed to participate. Fifty-two of the 98 eligible community child care programs agreed to participate; 47 fully participated and provided data required for inclusion in this study. The Head Start program was undergoing administrative changes that precluded participation. The community child care programs most often cited the following reasons for not participating: they were busy with another intervention program, expected that their enrollment in the coming year would fail to meet the inclusion criteria, were focusing on obtaining or renewing their license, were overwhelmed with staff or other structural changes, or could not accommodate the study's training schedule. Matched sets of centers were then randomly assigned to one of two treatment conditions or the control comparison condition. Treatment conditions were the Workshops Plus condition, which included workshops, materials, and on-site classroom consultation, and the Workshops Only condition, which included workshops and materials only. Participants were enrolled across three years in three cohorts; procedures were the same for all cohorts. The study, including details about the intervention and the teacher training, has been elaborated elsewhere (Baker et al., 2010).

Participants

Participants in the current study included the 760 3 to 5-year-old preschoolers who participated in the child assessment portion of the larger research project, along with their 123 mostly female (98%) teachers from 70 low-income centers. Of the parents/children invited to participate, 50.3% consented. Most teachers identified as either African-American (64%) or White (32%), and the median degree attained by teachers was an Associate's degree. Most children (50% male) identified as either African-American (52%) or White (33%), and children were on average about 4.6 years old. See Table 1 for teacher and child demographic information.

Procedure

Teacher data collection—Project staff members individually interviewed teachers and collected teacher ratings on each of the children in their classrooms. Teachers provided demographic information and ratings across a variety of academic, social, and behavioral dimensions for each child. Teachers also reported their own demographics during this interview. The interviews, including the ratings, occurred during the fall of the intervention

year (M_{date} = November 15th) and took 60–90 minutes to complete. Teachers were compensated $15.

Child data collection—Parents consented for their children to participate in the project. The child assessment targeted academic development and lasted approximately 30–45 minutes. All children were assessed by trained project staff in a private setting at the child's center. Children were provided with verbal praise, a book, and stickers for their participation. Child assessments were conducted during the fall (M_{date} = November 29th) and spring (M_{date} = April 5th) of the intervention year. The average interval between fall and spring assessments was 128.03 days (*SD*= 29.43).

Measures

Children's behavior problems and inattentive symptoms—Teachers completed the IOWA Conners Teacher Rating Scale (IOWA CTRS; Loney & Milich, 1982), a 10-item teacher-report inventory consisting of two five-item subscales designed to assess oppositional/defiant behavior and inattention/overactivity in children. Items include problematic behaviors such as "Defiant" and "Fidgeting," and teachers are asked to rate each child's behaviors along a 4-point Likert scale ranging from "not at all" to "very much." Subscale scores have theoretical ranges of 0–3 and are created by averaging items. Norms for the IOWA CTRS exist for kindergarten to fifth grade children and are based on a sample of 608 children, with internal consistency of .89 (Pelham, Milich, Murphy, & Murphy, 1989). Though internal consistency for this form version has not been reported with preschoolers, similar versions have reported internal consistency upwards of .87 with preschoolers (McGoey, DuPaul, Haley, & Shelton, 2007). In addition, there are strong validity data on this widely-used scale (e.g., Casat, Norton, & Boyle-Whitesel, 1999; Nolan & Gadow, 1994; Pelham et al., 1989), and findings suggest that construct equivalence applies across children from different ethnic groups (Reid, Casat, Norton, Anastopoulos, & Temple, 2001). Internal reliability for this sample was adequate ($\alpha_{oppositional}$ = .87, $\alpha_{inattentive}$= .82).

Children's social skills—Teachers' perceptions of children's social skills were measured using the preschool version of the Social Skills Rating System (SSRS; Gresham & Elliott, 1990), a 30-item teacher-report measure of positive social skills and conduct problems. Teachers are asked to report the frequency of behaviors like "makes friends easily" and "accepts peers' ideas for group activities" on a 3-point Likert scale including "never," "sometimes," and "very often." The overall social competency score of the teacher-report version of the SSRS has been found to be both reliable and valid within a variety of child populations including preschoolers, children with diverse ethnic and racial backgrounds, and children with a variety of clinical and non-clinical presentations (Fantuzzo, Manz, & McDermott, 1998; Lyon, Albertus, Birkinbine, & Naibi, 1996; Van der Oord et al., 2005; Walthall, Konold, & Pianta, 2005). In this sample, alpha was .87.

Teacher perceptions of child academic achievement—Teachers' perceptions of children's language skills were assessed using an abbreviated version of the Adaptive Language Inventory (ALI; Feagans & Farran, 1994), a 7-item teacher-report inventory

consisting of items designed to assess children's verbal abilities as evidenced in the classroom. Teachers responded to items such as "recalls and communicates personal experiences he/she has had to teachers in a logical way" on a 5-point Likert scale ranging from "well below average" to "well above average." Adequate reliability (Feagans & Farran, 1994) and concurrent validity have been reported for this measure (Feagans, Fendt, & Farran, 1995). In this sample, alpha was .93. In addition to the ALI, teachers reported on two subscales of the Academic Rating Scale (ARS; Perry & Meisels, 1996). The Language and Literacy subscale (9 items; e.g., "Produces rhyming words – for example, says a word that rhymes with 'chip,' 'shop,' 'drink,' or 'light'") measures teachers' perceptions of children's language and literacy skills. The Mathematical Thinking subscale (7 items; e.g., "Shows an understanding of the relationships between quantities – for example, knowing that a group of ten small stones is the same quantity as a group of ten larger blocks") measures teachers' perceptions of children's mathematics skills. Teachers rate a variety of skills for each child compared to other children the same age level on a 5-point Likert scale ranging from "Not Yet" to" In Progress" to "Proficient "or "N/A" for ideas that have not yet been introduced in the classroom setting. Adequate reliability and validity data exist for the ARS (Perry & Meisels, 1996). Internal reliability for this sample was adequate ($\alpha_{language}$= .89, α_{math}= .93). The ALI and the ARS Language & Literacy sub scale were standardized and combined to create one measure of children's perceived language and literacy skill. The ALI and the ARS Language & Literacy subscales were normally distributed and were related as expected (r= .56), supporting the use of a composite variable (Cohen, 1990). Creation of a composite variable using Principal Components Analysis (PCA) was explored; the correlation between the composite and the factor score was r= .99, and sensitivity analyses replicated findings. The ARS Mathematical Thinking subscale was also standardized and used as the measure of teachers' perceptions of children's math skills.

Children's objective academic achievement—First, children were administered the Peabody Picture Vocabulary Test, Third Edition, Form A (PPVT-IIIA; Dunn & Dunn, 1997a, 1997b), a clinician-administered measure that requires children to pick the appropriate picture from a four-picture array. The PPVT is a well-normed and extensively validated measure of receptive vocabulary. Split-half reliability has been reported as .80 (Dunn & Dunn, 1981), and scores on the PPVT-Rand PPVT-III have shown good concurrent (Hodapp & Gerken, 1999; Zucker & Riordan, 1988) and predictive (Zucker & Riordan, 1990) validity, including among diverse populations of children (Campbell, Bell, & Keith, 2001; Washington & Craig, 1999). Second, children completed three of the subtests of the Woodcock-Johnson III Tests of Achievement (WJ-III; Woodcock, McGrew, & Mather, 2001) targeting language development (Letter-Word Identification and Sound Awareness) and math development (Applied Problems). Both the reliability and validity of the WJ-III are adequate (Woodcock et al., 2001), and construct validity has been demonstrated for diverse groups of children (Edwards & Oakland, 2006). Finally, children were administered the Story and Print Concepts (SPC; Administration on Children, Youth, and Families [ACYF], 2003), which measures book and print knowledge as well as story comprehension. The SPC provides nine items for children to respond to in the context of a shared reading interaction (e.g., "show me the front of the book"). This test was used in the FACES Head Start study with diverse preschoolers. Each SPC item is rated dichotomously

and all SPC scores are summed to create the scale score. Reliability estimates for subscales of this measure ranged from .43 to .74, with demonstrated predictive validity with respect to kindergarten literacy development (ACYF, 2003). In this sample, alpha was .68 in the fall and .69 in the spring. Together, the PPVT-III, WJ-III, and the SPC capture a range of language and pre-literacy skills that have been well-linked to future reading achievement (e.g., Whitehurst & Lonigan, 1998). The PPV T-III, WJ-III Letter-Word Identification and Sound Awareness, and SPC were standardized and averaged to create one language and pre-literacy skill score. These subscales were normally distributed, with the exception of the WJ-III Sound Awareness subscale, which evidenced modest positive skew and floor effect. The PPVT-III, WJ-III Letter-Word Identification and Sound Awareness, and SPC were related as expected ($r > .40$), supporting the use of a composite variable (Cohen, 1990). Creation of a composite variable using PCA was explored; the correlation between the composite and the factor score was $r = .93$ at both timepoints, and sensitivity analyses replicated findings. The WJ-III Applied Problems subtest was also standardized and was utilized as the measure of math skill.

Ecological Covariates

Teacher education level and months of experience in early childhood education served as teacher-level covariates. Average age of the preschoolers in each classroom was calculated and included as a classroom-level covariate. Lastly, center type (e.g., Head Start or community child care) was used as a center-level covariate.

Analytic Approach

First, we calculated discrepancy scores by subtracting objectively assessed academic skill from teachers' perception sat the fall timepoint for both academic outcomes; discrepancy scores were used to classify children into groups based on number of standard deviations over-and underestimated. Because children were grouped within classrooms, we then examined two-level random-intercepts mixed linear models using hierarchical linear modeling with full maximum likelihood estimation (HLM; Raudenbush & Bryk, 2002). Fitting models using HLM allows the associations between the predictors and outcomes to be evaluated accounting for the hierarchical data structure of children within classrooms. Our first set of models was cross-sectional; we tested the hypothesized associations between child gender, age, race/ethnicity, behavior problems, inattentive behavior, and social skills and teachers' perceptions of children's language and pre-literacy and math skill at the fall timepoint, controlling for objectively assessed academic skill level at the fall timepoint. We then added the ecological covariates to the model at Level 2 and evaluated the reduction in unexplained variance. Our second set of models was longitudinal; we examined the hypotheses that teachers' perceptions at the fall timepoint would be associated with children's academic skill as measured by objective testing at the spring timepoint. The longitudinal model controlled for the following: 1) objectively assessed academic skill level at the fall assessment; 2) child characteristics at the fall timepoint (e.g., child gender, age, race/ethnicity, behavior problems, inattentive symptoms, and social skills) in order to preclude the alternative hypothesis that child characteristics, rather than teachers' perceptions, shape children's learning over time; and 3) intervention group and group by teacher perception interactions in order to preclude the alternative hypothesis that at least

one of the intervention groups in the study may have actively addressed teacher perceptions or buffered their effect. We then added the ecological covariates to the model at Level 2 and evaluated the reduction in unexplained variance. We also explored the possible impact of teachers' perceptions when they over-and underestimated preschoolers' academic outcomes by conducting a comparison of subgroup slopes.

Analyses were run separately for language and pre-literacy outcomes and math outcomes. Unless otherwise noted, scale scores were calculated by averaging raw scores and then standardizing the mean; as a result, all coefficients are also standardized. Group by teacher perception product terms were computed to serve as interaction variables. HLM 7.0 (Raudenbush & Bryk, 2002) was used to fit multi-level models. Dichotomous variables and interaction terms were entered uncentered; continuous variables were grand-mean centered. We chose grand-mean (rather than group-mean) centering because we were primarily interested in how teacher perceptions influenced individual students relative to the average student, rather than relative to their own classroom average. All variables at Level 1 were tested for randomly varying slopes; final models estimated variance components only when terms were associated with significant variability (Raudenbush & Bryk, 2002). The variances of the intervention group dummy variables and the group by teacher perception interaction variables were fixed. In the cross-sectional model, Level 2 variables were modeled on the intercept and the child characteristic variables; in the longitudinal model, Level 2 variables were modeled on the intercept, child characteristic variables, and teacher perception variable. Across the variables included in this study, missing data averaged 3.94% (*SD* = 6.09). Seventy-three (9.61%) of the original 760 preschoolers were lost to follow-up and lack spring assessment data. Pairwise deletion was used to maximize sample size. Sample sizes for cross-sectional analyses were $n_{\text{lang and pre-lit}} = 713$ and $n_{\text{math}} = 581$; samples sizes for longitudinal analyses were $n_{\text{lang and pre-lit}} = 647$ and $n_{\text{math}} = 528$.

Results

Descriptive Statistics

Means and standard deviations of the study variables, and intercorrelations between these variables, are presented in Table 2. In this sample, boys were likely to be rated as having more behavior problems, more inattentive behavior, and weaker social skills than girls. Children from ethnic minority groups were likely to have fewer social skills and to be identified as English language learners. Older children were rated as having stronger social skills than younger children. Behavior problems and inattentive symptoms were likely to be comorbid, and they were also both likely to co-occur with social skill deficits. Statistically significant relationships ranged in effect size from small to large. Relationships between teacher perception sand objective assessments of academic skill were consistently strongly positive and ranged from medium to large in effect size. Important relationships between child characteristics and child academic skills existed at the beginning of the preschool year. For example, children who were White, were older, had fewer inattentive symptoms, had stronger social skills, and were native English speakers had more academic skills on average. Effect sizes were small to medium.

Exploring the Discrepancy between Teacher Perceptions and Objective Assessments

Discrepancy scores were normally distributed. With regard to language and pre-literacy, 124 preschoolers were considerably overestimated by their teachers, with 99 (13%) having discrepancy scores between 1 and 2 standard deviations above the mean and 25 (3%) having discrepancy scores over 2 standard deviations above the mean. A similar number of preschoolers were underestimated by their teachers (104 total: 92 (12%) between 1 and 2 standard deviations below the mean, 12 (2%) over 2 standard deviations below the mean). Patterns for math were similar, with 93 preschoolers considerably overestimated (75 (12%) between 1 and 2 standard deviations above the mean, 18 (3%) over 2 standard deviations above the mean) and 91 considerably underestimated (80 (13%) between 1 and 2 standard deviations below the mean, 11 (2%) over 2 standard deviations below the mean).

Cross-sectional Model: Associations between Child Characteristics and Teacher Perceptions

First, in order to determine if HLM was appropriate, we calculated the intra-class correlations (ICC) for the null models. In both cases, large ICCs indicated that the use of HLM was appropriate, $ICC_{lang\ and\ pre\text{-}lit} = .54$ and $ICC_{math} = .88$. These large ICCs suggest that individual teachers tend to rate preschoolers within their classrooms very similarly.

The cross-sectional model tested the hypothesized associations between child gender, age, race/ethnicity, behavior problems, inattentive behavior, and social skills and teachers' perceptions of children's academic skill at the fall timepoint, controlling for objectively assessed academic skill level at the same timepoint. Several hypotheses were supported; see Table 3. Significant effects are also noted in Figure 1. The standardized coefficients presented in the table and figure can be interpreted similarly to standardized regression weights. For example, every standard deviation increase in social skills was associated with a half a standard deviation increase in teacher perceptions of language and pre-literacy ability and a quarter of a standard deviation increase in teacher perceptions of math ability. Older children were perceived by teachers as having stronger academic abilities, while children with inattentive symptoms were perceived by teachers as having weaker academic abilities. Contrary to hypotheses, preschoolers with more behavior problems were perceived by teachers to have significantly stronger pre-academic abilities than they actually had. Teachers' perceptions of children's academic abilities were not associated with child gender or race/ethnicity. Comparisons between null models including control variables and full cross-sectional models show that 42% of the variability in teachers' language and pre-literacy perceptions and 41% of the variability in teachers' math perceptions at Level 1 were explained by the addition of child characteristics to the cross-sectional models. The estimates of the teacher-level variance components at Level 2 suggest that there remains significant variability between teachers on average teacher perceptions, and that the addition of Level 2 variables may improve the explanatory power of the model. As hypothesized, the addition of the ecological covariates at Level 2 explained an additional 6% of the variability in both teachers' language and pre-literacy and math perceptions.

Longitudinal Model: Predicting Academic Achievement Outcomes from Teacher Perceptions

First, in order to determine if hierarchical modeling was appropriate, we calculated the ICCs for the null models. In both cases, the ICCs indicated that the use of HLM was appropriate, $ICC_{lang\ and\ pre\text{-}lit} = .30$ and $ICC_{math} = .25$. The magnitude of these ICCs indicates that 25–30% of the variability in preschoolers' respective academic scores was due to teacher or classroom effects, while 70–75% was due to individual differences between preschoolers.

The longitudinal model evaluated whether preschoolers' academic achievement, as measured at the spring timepoint, was predicted by teachers' perceptions of children's abilities at the fall timepoint. The longitudinal model controlled for objectively assessed academic skill level at the fall assessment, child characteristics, intervention group, and intervention group by teacher perception interaction variable s. As hypothesized, higher teacher perceptions of children's language and pre-literacy abilities in the fall were associated with significantly higher achievement in the spring for both language and pre-literacy and math (see Table 4 and Figure 1). Specifically, in a highly controlled model and over a time period of only about four months, every standard deviation increase in teacher perceptions was associated with about a tenth of a standard deviation increase in preschoolers' objective assessment scores in the spring. Even in the context of this highly controlled model, comparisons between fully controlled null models and full longitudinal models show that 1% of the variability in children's spring language and pre-literacy outcomes and 4% of the variability in math outcomes were explained by teachers' perceptions in the fall. The findings presented in the longitudinal model also suggest that White students were likely to have higher language and pre-literacy and math scores in the spring. Girls and children with more behavior problems, fewer inattentive symptoms, and better social skills were likely to have better math scores at the spring timepoint. The estimate of the teacher-level variance component at Level 2 for language and pre-literacy suggests that there remains significant variability between teachers on average child language and pre-literacy score, and that the addition of Level 2 variables may improve the explanatory power of the model. As hypothesized, the addition of the ecological covariates at Level 2 explained an additional 2% of the variability in children's language and pre-literacy outcomes and 3% of the variability in children's math outcomes.

Exploring the Impact of Teachers' Over-and Under estimations on Preschoolers' Academic Outcomes

Lastly, we evaluated the possible impact of teachers' perceptions when they over-and underestimated preschoolers' academic outcomes. For language and pre-literacy, the group of preschoolers who were underestimated by at least two standard deviations by their teachers had considerably weaker relationships between their fall and spring academic skills than peers whose skills were neither over- nor underestimated, suggesting perhaps that their growth was dampened by these considerable teacher underestimations, $z_{lang\ and\ pre\text{-}lit} = -2$, $p = .045$, see Figure 2. The relationship was similar for math outcomes, but the difference in slopes was not significant, $z_{math} = -1.8$, $p = .07$, see Figure 3. Slopes for those preschoolers whose abilities were overestimated did not differ significantly from their peers.

Discussion

The current study utilized hierarchical linear modeling to better understand the role of teacher perceptions in the language and pre-literacy and mathematics skill development of ethnically diverse, low-income preschoolers. We found support for the hypothesis that teachers both under-and overestimate the academic abilities of their preschoolers compared to objective assessments of skills, using widely accepted tools in the field. Several child characteristics were predictive of these discrepancies, including child age, inattentive behavior, and social skills. Child gender and race/ethnicity were not associated with differential teacher perceptions of pre-academic skill, and behavior problems were associated with teacher overestimation of skills, rather than teacher underestimation as predicted. Strong support was also found for the importance of ecological covariates, or teacher and classroom variables, in predicting teacher ratings of preschoolers' skills. In addition, we found that teacher s' perceptions of children's academic skills during the fall of the preschool year were associated with preschoolers' academic achievement the following spring, even after controlling for initial achievement, child characteristics, and ecological covariates. We also found that preschoolers who were severely underestimated by their teachers had considerably weaker relationships between their fall and spring academic skills compared to their peers, suggesting perhaps that their academic growth was dampened by their teachers' misperceptions.

The distribution of the discrepancy scores in this study suggests that the academic abilities of many children are either under-or overestimated by their teachers. This finding is in line with previous research suggesting that teachers vary considerably in the accuracy of their judgments (Kilday et al., 2012). This study also replicated previous research indicating that a considerable amount of the variance in teacher ratings of preschoolers' skills is due to teacher characteristics rather than characteristics that are inherent to the child, including academic ability. For example, Kilday and colleagues (2012) concluded that approximately 40% of the variance in teacher ratings of math skill stemmed from teacher-level characteristics. Our findings report even higher values, with 54% of the variability in teachers' ratings of language and pre-literacy and 88% of the variability in math associated with teacher rather than child characteristics.

Support was found for the hypothesis that several child characteristics, including child age, inattentive behavior, and social skills, might influence teacher perceptions. The addition of these child characteristics explained about 40% more variability in teacher perceptions across both outcomes, above and beyond children's objectively evaluated academic skill. Although these relationships are important, their interpretation must be tempered by the fact that many of the factors that are related to teacher perceptions are at the teacher level, rather than the child level. Even after adding plausible teacher-level variables (Baker et al., 2010; Kuklinski & Weinstein, 2001; McWayne et al., 2012; Pianta et al., 2005), which enhanced model fit by about 6% across both outcomes, there remained significant unexplained variability at the level of the teacher. Though the background, training, and context specific to individual teachers clearly play a central role in what perceptions teachers develop about their preschoolers' academic skills, these explanatory factors remain understudied (Sudkamp, Kaiser, & Moller, 2012).

Unsurprisingly, teachers perceived older children as being more skilled academically than their younger peers, which is consistent with previous findings indicating that younger children are referred more frequently for academic support than their older peers, even when they are functioning at a developmentally appropriate level (Elder, 2010; Gledhill et al., 2002; Wallingford & Prout, 2000). Though this finding could be considered in the broader discussion of early vs. late school entry (e.g., West, Meek, & Hurst, 2000), negative effects due to teacher misperceptions are unlikely to be stronger than the benefits of attending a high-quality preschool program (Garces, Thomas, & Currie, 2000). Also congruent with similar research with older children (Hindman et al., 2010), our findings suggest that social skills may protect against low teacher expectations for academic performance. Center-wide social emotional learning (SEL) programming has the potential to strengthen this protective factor for all preschoolers (Bierman et al., 2008). Finally, in line with the limited previous research that investigated the relationship between inattentive behavior and teacher perceptions (Eisenberg & Schneider, 2007), teachers perceived children with inattentive behavior as less academically skilled than they actually were. “Competent” profiles of preschool school readiness (e.g., high social skills and low inattentive behavior), have been linked to academic performance in kindergarten (McWayne et al., 2012). Our findings support this idea and suggest that, in addition to direct relationships with achievement, competent profiles of school readiness may also impact child outcomes through teacher perceptions.

Though previous research suggested that children with behavior problems are perceived by teachers as having weaker pre-academic skills (Bennett et al., 1993; Espinosa & Laffey, 2003), we found the opposite. One possible explanation for previous findings might relate to the common use of a composite “problem behavior” variable in the teacher expectation literature, which includes both behavior problems and inattention. Combining behavior problems and inattention in analyses limits researchers’ ability to piece apart the correlates and longitudinal effects of these different, though overlapping, profiles. In addition, research suggests that teachers may perceive poor academic performance in different ways depending on child gender (e.g., as a lack of ability in girls and a lack of trying in boys; Jones & Myhill, 2006); this phenomenon could explain our unexpected finding as many of the children with behavior problems in our sample were boys.

Also contrary to hypotheses, neither child gender nor race/ethnicity was associated with differential teacher perceptions of pre-academic skill. Although the literature suggests that teachers view boys and girls (Hinnant et al., 2009; Tiedemann, 2002) and White and African American children (Pigott & Cowen, 2000) differently in terms of their pre-academic skills, we failed to find evidence that teachers formed significantly discrepant opinions based on either child characteristic. It is possible that stereotypes related to gender and race/ethnicity are becoming less prevalent with time, the training teachers received addressed these stereotypes, or teachers were aware of potential stereotypes and gave compensatory desirable responses. With regard to race/ethnicity, the literature suggests stereotyping is less pronounced in African American than in Caucasian communities (Bardwell, Cochran, & Walker, 1986; Filardo, 1996; Pigott & Cowen, 2000). In addition, levels of bias are known to be consistently greater toward outgroup rather than in group members (Brewer, 1999). In this study, the majority of the teachers and children were African American, which could

result in either of these alternative explanations. Clearly, child characteristics like gender and race/ethnicity and their relation to academic achievement are relevant to consider in school contexts; future research should continue to evaluate this area.

Teachers' perceptions about preschoolers' academic skills were not only associated with certain child characteristics, but also significantly predicted children's pre-academic outcomes measured later in the preschool year, replicating previous research (Alvidrez & Weinstein, 1999; de Boer et al., 2010; Hinnant et al., 2009; Rubie-Davies et al., 2006; Sorhagen, 2013). This study contributes to the literature by providing a downward extension of the teacher expectation research into preschool in the context of a diverse, low-income sample. Specifically, in the context of a highly controlled models panning a longitudinal period of only four months, we found that each standard deviation increase in teacher perceptions was associated with about a tenth of a standard deviation increase in preschoolers' objective assessment scores in spring. Comparisons between the fully controlled null models and the longitudinal models show that 1% of the variability in children's spring language and pre-literacy outcomes and 4% of the variability in math outcomes were explained by teachers' perceptions in the fall.

Though these longitudinal effects seem small, their size is in line with similar research (Sorhagen, 2013). Across fourteen or more years of schooling, these small but practically meaningful effects would be substantial (Rubies-Davies, et al., 2014). In addition, because we are finding these effects during the earliest years of education, they may be acting upon skills that are foundational to later educational experiences (Kuklinski & Weinstein, 2001). Our exploration of achievement patterns of the subgroups of preschoolers whose skills were significantly over-and underestimated by their teachers may further contribute to understanding this pattern. Specifically, preschoolers who were severely underestimated by their teachers had considerably weaker relationships between their fall and spring academic skills compared to their peers, suggesting perhaps that their academic growth was dampened by their teachers' misperceptions. Unlike other studies (e.g., Rubie-Davies et al., 2014; Sorhagen, 2013), we did not find any patterns related to teacher overestimations.

Prior achievement is a consistently strong predictor of academic skill in the literature, which we replicated in this study. Notably, prior achievement can be protective against potentially harmful teacher perceptions (Gill & Reynolds, 2000). Unfortunately, low-income children are likely to have lower levels of prior achievement (Brooks-Gunn et al., 2007) and also appear to be the most vulnerable to the effects of negative teacher perceptions (Speybroeck et al., 2012; Sorhagen, 2013). Low-income children may also be more likely to attend overburdened, under resourced child care centers, where the teachers may struggle more than their colleagues at resourced centers to access and interpret high-quality academic feedback about their preschoolers. These effects, when they begin in preschool and cascade across subsequent school years, can explain one foundational process of the achievement gap (Becker & Luthar, 2002).

Study Limitations

This study benefited from longitudinal data collection with a large and diverse sample. In addition, statistical analyses took nesting into account. Even given these strengths, there are

a number of limitations. First, although the longitudinal nature of this study does suggest a possible causal link between teacher perceptions and child outcomes, this study was not experimental in design, which limits our ability to make strong causal inferences. Relatedly, though the conceptual model underlying this study implies mediation, we did not formally test mediation. Future researchers may wish to investigate teacher perceptions as a mediator between child characteristics and academic skill development. Second, this study focused mostly on child characteristics. The characteristics of the teacher or the broader social ecology, including the preschool and community, are worthy of attention and closer investigation (Bronfenbrenner, 1979; Mashburn & Pianta, 2006). The fact that such a large amount of variability was explained at the teacher level further emphasizes this point and also cautions against interpreting the child-level effects without also attending to the ecological context.

Third, although we used well-established measures, achievement testing and behavioral reporting are known to be less reliable with young children. Additionally, we opted to use composite scores rather than a latent variable modeling approach, which could further reduce measurement error. Theoretically, however, the introduction of more error in the assessment data would have worked against our hypotheses. Fourth, language and pre-literacy were bundled into one outcome. Future work could select achievement outcomes to specifically tap into certain skills, such as skills dependent upon instruction. Fifth, the results of this study were impacted by our analytic decisions. Specifically, future researchers may choose different centering approaches within HLM, or future scholars may opt to manage missing data using multiple imputation within HLM or full maximum likelihood estimation of missing values instead of using pairwise deletion (Allison, 2009). Finally, we did not investigate the processes by which teacher perceptions may impact child academic outcomes. Important process variables to consider may include the frequency and quality (e.g., affective tone, instructional content) of teacher-child interactions during scaffolding. Such an investigation would illuminate whether teachers actually provide different instructional experiences to children based on the accuracy of their perceptions.

Study Implications and Future Directions

This is the first study we are aware of that investigates the correlates and longitudinal associations of teacher perceptions of pre-academic competencies in language and pre-literacy and math within a diverse, low-income sample of preschoolers. The findings of this study contribute to our growing understanding of the empirical and theoretical underpinnings of the achievement gap and point to areas that may be avenues for intervention. Though clearly a phenomenon as complex as the achievement gap is multiply-determined, several areas are ripe for further exploration. First, researchers should continue to explore teacher background, training, and contextual factors that are associated with teacher behavior which might also plausibly influence teacher perceptions, such as the preschool work environment (Baker et al., 2010). Further investigation into whether and how these perceptions could be addressed in teacher training and professional development is also recommended (Kilday et al., 2012), with particular attention to assisting teachers in learning how to appropriately scaffold children's learning and best determine which children require extra support or referrals for additional services.

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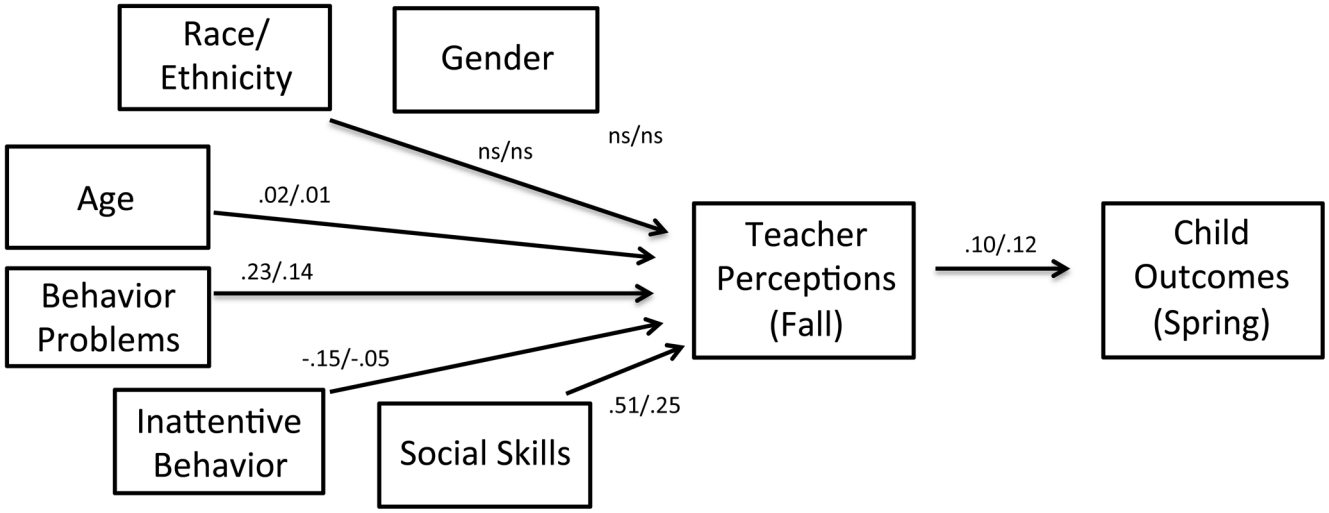

Figure 1.

Conceptual model including significant effects from the cross-sectional model (e.g., child characteristics predicting teacher perceptions) and the longitudinal model (e.g., teacher perceptions predicting child outcomes). Values indicate standardized coefficients for language and pre-literacy/math. All coefficients are statistically significant at $p < .05$ or smaller.

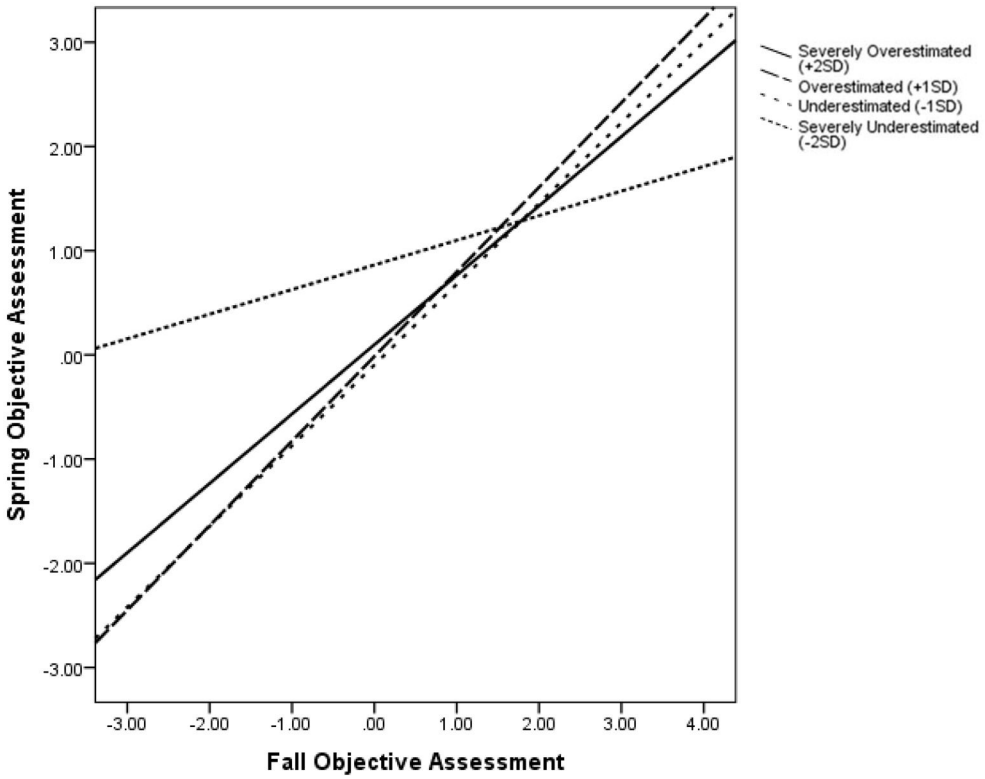

Figure 2.

Relationship between fall and spring objective assessment score by discrepancy group for language and pre-literacy outcomes.

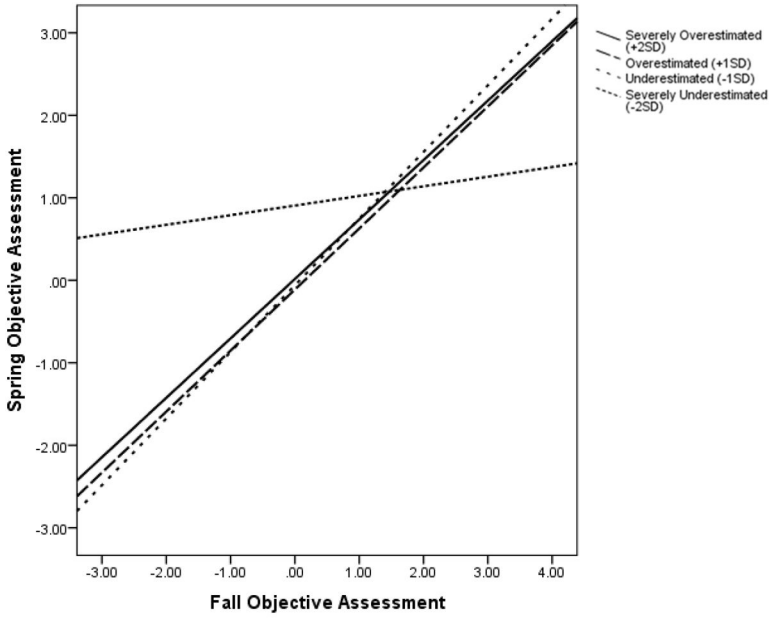

Figure 3.

Relationship between fall and spring objective assessment score by discrepancy group for math outcomes.

Table 1

Teacher and Child Demographic Information

Variable	*N* (%)
Teacher Gender	
Female	121 (98%)
Male	2 (2%)
Teacher Ethnicity	
African-American	79 (64%)
White	39 (32%)
Hispanic	3 (2%)
Native American	1 (1%)
Mixed Race/Ethnicity	1 (1%)
Teacher Education	
Some/Completed High School	5 (4%)
Some College	37 (30%)
Associate's Degree	27 (22%)
Bachelor's Degree	42 (34%)
Graduate Coursework/Degree	12 (10%)
Child Gender	
Male	382 (50%)
Female	378 (50%)
Child Age (in months)	*M* = 55.41 (*SD* = 4.27)
Child Ethnicity	
African-American	390 (52%)
White	246 (33%)
Hispanic	44 (6%)
Asian	10 (1%)
Mixed Race/Ethnicity	56 (8%)
Child English Language Learner	
No	708 (96%)
Yes	31 (4%)

Note. N_{teachers} = 123 and N_{children} = 760. Missing data across demographic variables ranged from 0–3%; valid percentages are presented.

Table 2

Descriptive Statistics for and Intercorrelations Between Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Child Gender (50% Male (0); 50% Female (1))	--	−.06	−.002	−.21**	−.21**	.17**	−.04	.08*	−.01	.07	.06	.08*	.10*	−.03	.07	.01	.03	.01	.02
2. Child Race/ Ethnicity (67% Not White (0); 33% White (1))		--	−.07	.03	−.03	.13**	−.14**	.15**	.21**	.39**	.36**	.41**	.37**	.09*	.39**	−.13**	.09*	−.17**	−.52**
3. Child Age (*M* = 55.41, *SD* = 4.27)			--	−.02	−.07	.08*	−.001	.20**	.05	.28**	.32**	.22**	.20**	−.10**	−.04	.07	−.09*	.60**	.14**
4. Child Behavior Problems (*M* = .67, *SD* = .77)				--	.63**	−.46**	−.06	−.14**	−.03	−.05	−.03	−.07	−.002	.03	.02	−.04	−.03	−.08*	−.08*
5. Child Inattentive Symptoms (*M* = .96, *SD* = .70)					--	−.51**	−.01	−.31**	−.16**	−.18**	−.16**	−.18**	−.18**	−.02	−.03	.02	.03	−.07	−.02
6. Child Social Skills (*M* = 1.45, *SD* = .27)						--	.003	.48**	.34**	.23**	.18**	.25**	.19**	.14**	.19**	−.15**	.18**	.03	−.09*
7. English Language Learner (96% No (0); 4% Yes (1))							--	−.07*	−.01	−.14**	−.08*	−.13**	−.03	.03	.03	.05	.09*	−.01	.10**
8. Teacher Perceptions Language and Pre-literacy (Fall)								--	.67**	.44**	.39**	.44**	.38**	.04	.10*	−.13**	.02	.08*	−.11**
9. Teacher Perceptions Math (Fall)									--	.29**	.26**	.32**	.26**	.06	.19**	−.24**	−.002	−.03	−.17**
10. Objective Assessment Language and Pre-literacy (Fall)										--	.71**	.83**	.69**	.01	.22**	−.09**	−.002	.17**	−.29**

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
11. Objective Assessment Math (Fall)											--	.68**	.72**	.03	.13**	−.06	−.02	.17**	−.25**
12. Objective Assessment Language and Pre-literacy (Spring)												--	.73**	.05	.18**	−.13**	.08*	.14**	−.29**
13. Objective Assessment Math (Spring)													--	.03	.15**	−.10**	.07	.13**	−.26**
14. Teacher Gender (2% Male (0); 98% Female (1))														--	.10**	−.13**	.16**	−.17**	−.14**
15. Teacher Race/Ethnicity (68% Not White (0); 32% White (1))															--	−.12**	−.01	−.08*	−.42**
16. Teacher Highest Level of Education (*M* = 2.06, *SD* = .95)																--	−.33**	.11**	.23**
17. Teacher Months Experience in Early Childhood (*M* = 11.00, *SD* = 8.42)																	--	−.14**	.05
18. Class Average Age (*M* = 55.57, *SD* = 2.71)																		--	.24**
19. Program Type (51% Community Child Care (0); 49% Head Start (1))																			--

Note.

*$p < .05$,

**$p < .01$. $N_{teachers} = 123$ and $N_{children} = 760$. Missing data across demographic variables ranged from 0–3%; valid percentages are presented. Teacher perception and objective assessment variables are standardized ($M = 0$; $SD = 1$).

Table 3

Fixed and Random Effects for Cross-sectional Models Predicting Teacher Perception in Fall

	Language and Pre-Literacy			Math		
Fixed Effects	**Coefficient**	**se**	***t*-ratio**	**Coefficient**	**se**	***t*-ratio**
Intercept	.06	.07	.80	−.03	.09	−.35
Child Characteristics						
Gender	−.05	.04	−1.21	−.05	.03	−1.64
Race/Ethnicity	−.06	.07	−.83	−.02	.04	−.51
Age	.02**	.01	3.09	.01*	.00	2.32
Behavior Problems	.23***	.05	4.79	.14***	.03	4.62
Inattentive Symptoms	−.15***	.04	−3.73	−.05*	.02	−2.14
Social Skills	.51***	.06	7.93	.25***	.05	4.99
Control Variable						
Objective Assessment in Fall	.24***	.03	7.45	.07***	.01	4.89

Random Effects	**Variance Component**	***SD***	***X*²**	**Variance Component**	***SD***	***X*²**
Teacher-level variance	.45***	.67	998.71	.75***	.86	2436.42
Behavior Problems slope	.04***	.20	176.36	--	--	--
Social Skills slope	--	--	--	.07***	.26	274.01
Level 1 Residual variance	.20	.45	n/a	.06	.25	n/a

Note.

*$p < .05$,

**$p < .01$,

***$p < .001$.

Table 4

Fixed and Random Effects for Longitudinal Models Predicting Objective Assessment in Spring

	Language and Pre-Literacy			Math		
Fixed Effects	**Coefficient**	**se**	***t*-ratio**	**Coefficient**	**se**	***t*-ratio**
Intercept	−.05	.05	−1.02	−.19**	.07	−2.71
Teacher Perception						
Teacher Perception in Fall	.10***	.03	3.30	.12*	.05	2.36
Control Variables						
Objective Assessment in Fall	.75***	.04	20.85	.62***	.04	16.83
Child Characteristics						
Gender	.03	.04	.65	.15*	.06	2.40
Race/Ethnicity	.20***	.05	3.86	.30***	.06	5.34
Age	.00	.01	−.49	−.01	.01	−1.16
Behavior Problems	−.03	.03	−.85	.09*	.04	2.34
Inattentive Symptoms	−.03	.03	−.95	−.13**	.05	−2.70
Social Skills	.00	.03	−.11	.05	.04	1.40
Treatment Conditions						
Workshops Only	−.07	.07	−.97	−.12	.09	−1.34
Workshops Plus	−.03	.06	−.41	.05	.08	.64
Interaction Terms						
WOxTchr Perception Fall	.06	.04	1.58	−.05	.10	−.54
WPxTchr Perception Fall	−.06	.04	−1.33	−.15*	.07	−2.14

Random Effects	**Variance Component**	***SD***	X^2	**Variance Component**	***SD***	X^2
Teacher-level variance	.03***	.17	191.64	.02	.14	114.18
Level 1 Residual variance	.26	.51	n/a	.41	.64	n/a

Note.

* $p < .05$,

** $p < .01$,

***$p < .001$. Treatment Conditions were dummy coded (1 = participated in condition); together, the two dummy codes reflect the three conditions.