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Peer Effects in Preschool Classrooms: Is Children's Language Growth Associated With Their Classmates' Skills?

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With an increasing number of young children participating in preschool education, this study determined whether peer effects are present in this earliest sector of schooling. Specifically, this work examined whether peer effects were influential to preschoolers' growth in language skills over an academic year and whether peer effects manifest differently based on children's status in reference to their peers. Peer effects were assessed for 338 children in 49 classrooms. A significant interaction between the language skills of children's classmates and children's fall language skills indicated that peer effects were strongest for children with low language skills who were in classrooms that served children with relatively low skill levels, on average. Findings further showed that reference status, or children's relative standing to their peers, has the greater consequence for children with very low language skills in relation to their peers.

The academic achievement of children and adolescents is positively associated with the skills and competencies of peers within their classrooms (Henry & Rickman, 2007) and their schools (see Thrupp, Lauder, & Robinson, 2002). For instance, third through sixth graders' mathematic achievement is significantly linked to the average math scores of their grade-based peers, even after accounting for numerous school- (e.g., socioeconomic status [SES], ethnic, and race composition) and child-level factors (e.g., race/ethnicity and gender; Hanushek, Kain, Markman, & Rivkin, 2003). A variety of accounts exist to explain how such ''peer effects'' manifest themselves. For instance, perhaps children's learning is directly affected by their peers during student-to-student interactions, such as those that occur in cooperative learning groups. If children do indeed learn directly from one another, higher achievement levels among one's peers should have a positive and direct effect on a child's learning (Thrupp et al., 2002). Alternatively, some speculate that peer effects operate via indirect pathways (Bryk, Lee, & Holland, 1993; Thrupp et al., 2002). As an example, if the overall level of student achievement within a classroom is high, teachers may use higher quality teaching methods when compared to a classroom in which overall achievement is low (see Wilkinson & Fung, 2002). Such circumstances would contribute to positive albeit indirect relations between a child's learning and the skills of his or her peers.

That children's peers appear to have influence on their learning, irrespective of whether these effects operate along direct or indirect pathways, has had direct and pervasive impacts on educational practices within the United States and elsewhere (Hattie, 2002). Tracking, for instance, is the commonly employed practice of assigning students to classes, schools, or instructional groupings on the basis of similarities in their skill levels. There is considerable controversy regarding the effects of tracking and other approaches that organize students into

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skill- and ability-based groupings (Slavin, 1987). In part, this is due to the fact that peer effects may influence some students more than others. For instance, peer effects may manifest themselves differently for students who are very highly skilled, such as gifted students, or students who are less skilled, such as students with disabilities. The potential for such has been played out, for instance, in research and policy on the practice of inclusion, whereby children with disabilities participate in general education classrooms; peer effects are central to constituent concerns about possible ''spillover effects'' in which more highly skilled or capable students are negatively affected by the participation of less skilled or capable students in their classrooms (e.g., see Fletcher, 2010). On the contrary, the results of one recent rigorous investigation of peer effects suggested that peer effects are most influential for children who are less skilled or who have average skills, whereas highly skilled students seem ''somewhat less responsive to peer achievement'' (Hanushek et al., 2003, p. 541).

At the same time, researchers have also suggested the need to consider peer effects not only in consideration of children's absolute skill levels but also their skills in relation to his or her peers, referred to as a child's reference-group status (Hanushek et al., 2003). Within a given classroom, for instance, there are students who are relatively *low status* in comparison to the reference group (i.e., they have low skills relative to the classroom average), whereas others are relatively *high status* (they have high skills relative to the classroom average). Both research and theory have linked peer effects to students' reference-group status within a classroom; low-status students, in particular, appear to receive the most benefit from peer effects, as their learning is supported through their ongoing exposure to more highly skilled students within their classrooms (Webb, 1991). Nonetheless, high-status students within a classroom, in comparison, may not stand to benefit from peer effects, because their skills exceed those of many of their peers (Cohen & Lotan, 1995). At least by some accounts, high-status students may be ''bored or slowed down'' by being in the company of less skilled students (see Hattie, 2002, p. 451), whereas low-status students may benefit particularly from being surrounded by more highly skilled peers.

Building upon this framework, the present study examined whether peer effects are present within a sector of public schooling in which these have only rarely been examined but where tracking is commonplace: the preschool classroom. Today, more than 80% of American children participate in preschool in the year prior to beginning formal schooling (Barnett, Epstein, Friedman, Boyd, & Hustedt, 2008). About one half of these children attend preschool programs that are subsidized through state or federal dollars, the vast majority of which enroll only children who reside in homes at or below federal poverty levels (Barnett et al., 2008). An obvious consequence of targeting enrollment to lower SES pupils is that children with relatively low skill levels are clustered within many of the nation's public preschool classrooms. This practice restricts these youngsters' exposure to more advantaged peers who, on the average, exhibit significantly higher preacademic skills and who may provide an important source of stimulation if peer effects do operate (see Schechter & Bye, 2007). In this study, we assessed whether peer effects are apparent within public preschool classrooms characterized by tracking (i.e., enrollment is based on SES), focusing specifically on whether peer effects manifest themselves with respect to children's language growth.

We selected language skills as our outcome of interest for several reasons.

First, language development is one of the foremost developmental accomplishments of early childhood, not only an important achievement in its own right but also one that is foundational to much of children's later learning (Shonkoff & Phillips, 2000). Importantly, individual differences in young children's language growth have been linked to features of the preschool classroom, even in linguistic domains believed to be particularly resilient to environmental influence, such as grammar (Hoff, 2006). For instance, 3- and 4-year-olds' syntactic comprehension is associated with the volume of grammatically complex utterances that their preschool teachers produce (Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002). We might presume, in turn, that other features of the preschool classroom, such as the language skills of one's peers, may also be influential to children's language growth (Mashburn, Justice, Downer, & Pianta, 2009). Second, although language acquisition is recognized as a generally robust developmental process (Shonkoff & Phillips, 2000), it is also true that children reared in poverty exhibit significant lags in language development. Children attending public preschool receive standardized language scores that are, on average, about 1 *SD* lower than national norms (Wasik, Bond, & Hindman, 2006). If peer effects are operating within the earliest sector of schooling, on a developmental domain that

seems particularly affected by variables on which children are tracked (e.g., SES), this may have important implications for educational practices regarding preschool education and classroom composition (Schechter & Bye, 2007). Third, there is emerging evidence to suggest that peer effects do influence children's language growth within the preschool classroom. For instance, we recently tested the hypothesis that the average level of language skill exhibited by preschoolers' classmates would predict children's spring language skills when accounting for individual learner characteristics and language skills at the beginning of the school year (Mashburn et al., 2009). Based on a sample of 1,812 four-year-olds nested in 453 preschool classrooms, children had significantly higher receptive and expressive language skills in the spring of the year when their classmates' expressive language skills were higher.

In this study, our goal was to both replicate and extend the literature on peer effects within the preschool classroom. The first aim was to determine whether peer effects were associated with children's language growth, generally replicating Mashburn et al.'s (2009) findings using an independent sample that allowed two methodological improvements. First, we had information about more children within the classrooms we studied, thus providing a better estimate of peer language skills; second, we had a greater number of variables representing the outcome of interest (language skills), thus allowing us to use a latent construct as our outcome measure. In addressing this aim, we tested both the main effect of peers' language skills on children's language growth and the interaction between peers' language skills and children's own language skills. As we discussed previously, it may be that peer effects manifest themselves differently based on whether a child is highly skilled or less skilled. The second aim was to assess the potential bearing of children's reference-group status on language growth, providing an important complement to research on peer effects. This second aim, which to our knowledge has not yet been studied within the realm of the preschool classroom, draws upon discussions in the primary- and secondary-schooling literature as to whether peer effects affect some students more than others depending on their status within a classroom in relation to their peers. On the basis of this literature, we speculated that low-status children (i.e., children whose language skills are low relative to their classmates) would receive particular benefit from their peers' language skills and that high-status children (i.e., children whose language skills are high relative to their classmates) would be generally resilient to (unaffected by) their peers' language skills. In addressing this aim, we tested the main effect of children's reference status on their language growth as well as the interaction between reference status and children's own language skills.

Method

Sample

We analyzed data representing 338 children enrolled in 49 preschool classrooms; the children (and their teachers) were participants in a study of instructional practices within publicly funded preschool programs. As is common in such programs, these classrooms prioritized enrollment based on certain family- or child-level risk factors, primarily annual household income at or below the poverty threshold. The children were primarily from English-speaking homes (94%) and were racially and ethnically diverse (50% White, 36% Black, 6% Latino, 8% Multiracial or Other). Further descriptive characteristics of the participating children appear in Table 1.

Table 1
Summary of Participant Characteristics

	Fall			Spring		
Variable	*N* (%)	*M*	*SD*	*N*	*M*	*SD*
Child/family demographics						
Maternal education	269					
≤ High-school diploma	142 (53)					
Some college/2-year degree	117 (43)					
College degree (≥ 4 years)	10 (4)					
Primary language in home	274					
English	258 (94)					
Spanish	17 (6)					
Child age in months	291	52.0	5.5			
Gender	338					
Male	178 (53)					
Female	160 (47)					
Language measures						
CELF Sentence Structure	291	7.60	3.13	269	8.53	3.15
CELF Word Structure	285	6.91	3.02	265	7.70	3.26
CELF Vocabulary	283	7.60	3.11	264	8.31	3.22
PPVT	288	42.32	19.2	270	54.31	19.98
NAP	261	14.09	8.14	239	17.84	8.14

Note. CELF = Clinical Evaluation of Language Fundamentals Preschool, Second Edition (Wiig, Secord, & Semel, 2004); PPVT = Peabody Picture Vocabulary Test, Third Edition (Dunn & Dunn, 1997); NAP = Narrative Assessment Protocol (Justice et al., 2010).

Table 2
Summary of Teacher and Classroom Characteristics

Variable	*N* (%)	*M*	*SD*
Teachers' years of teaching experience	49	11.8	7.4
Teachers' highest educational level	47		
Some college but no degree	2 (4)		
2-year degree	18 (38)		
College degree (4-year or higher)	27 (58)		
Program affiliation			
Public PreK (state supported)	12 (25)		
Head Start	37 (75)		
Instructional Support	41	3.1	1.0

Note. Instructional Support represents the average rating for this composite across fall and spring.

The involved classrooms typically served 16 children and all adhered to an 8:1 teacher–child ratio (16 children, 1 teacher, 1 assistant). Table 2 provides additional details about these classrooms, including information regarding teachers' experience and educational levels. As is common in classroom-based research for which classrooms are the larger sampling unit (e.g., National Center for Early Development and Learning's Multi-State Study of Pre-Kindergarten), this study involved the random selection of 5–8 children from each classroom and implementation of in-depth assessments for the selected children. On average, there were 7 children sampled from each classroom (range = 5–8; the exact number sampled was based on the number of consents received from children in a classroom). Therefore, the data available on the language skills of children within the 50 classrooms represented about 44% of each classroom's enrollment, exceeding that of prior studies of peer effects in preschool settings (Henry & Rickman, 2007; Mashburn et al., 2009).

Measures

Children's language skills. Assessments of children's language skills were conducted in the fall and spring of the academic year during 4-week windows. These were conducted in children's programs in private locations by trained research staff. A comprehensive battery of standardized measures was used to assess children's receptive and expressive language skills encompassing grammar, vocabulary, and narrative discourse. Three subtests of the Clinical Evaluation of Language Fundamentals Preschool, Second Edition (CELF:P–2; Wiig, Secord, & Semel, 2004) were administered: Sentence Structure, Word Structure, and Expressive Vocabulary. Sentence Structure, a receptive measure, examines children's abilities to comprehend various sentence structures (e.g., ''The boy has a ball''). Word Structure, an expressive measure, examines children's morphological skills, such as production of plural markings, tense markings, prepositions, and pronouns. Expressive Vocabulary (maximum score = 20), also an expressive measure, examines children's ability to name objects, actions, and people.

Two additional measures were also administered. The third edition of the Peabody Picture Vocabulary Test, Form A (PPVT–III; Dunn & Dunn, 1997) was used to assess children's single-word receptive vocabulary. Also, the Narrative Assessment Protocol (NAP; Justice, Bowles, Pence Turnbull, & Gosse, 2010) was used to assess children's narrative discourse. A narrative sample was elicited using a wordless picture book and was videotaped for lab-based scoring of sentence structure, phrase structure, modifiers, nouns, and verbs. Children receive points for use of certain forms (e.g., complex sentences; maximum score = 54).

Instructional quality of classrooms. Assessment of the instructional quality of children's classrooms was conducted in the fall and spring of the academic year using the Classroom Assessment Scoring System-PreK (Pianta, La Paro, & Hamre, 2006). Coding was conducted by individuals who had completed formal training on this tool and had achieved reliable use in its implementation. An Instructional Support (IS) composite was created at each time point by averaging scores for three dimensions (Concept Development, Quality of Feedback, and Language Modeling) and then averaging these over the two observations to derive a mean IS score for each classroom (see Table 2).

Analytic Framework

Given the multiple measures of children's language skills, we created latent scores to represent children's language skills based on the five measures for both the fall and spring assessment points. Use of latent scores is advantageous over use of individual measures as they overcome measurement error issues that are germane to all assessments; consequently, the latent score is a better representation of children's overall language skills than any of the individual measures. The process for creating latent scores initially involved confirmatory factor analysis (CFA) using MPlus (Muthén & Muthén, 2007) to generate scores for children at both the fall and spring. A test of configural invariance for the factor loadings, using guidelines

by Muthén and Asparouhov (2002), was conducted to determine the extent to which the relations between the variables and latent score were similar at both assessment periods. Because the same factor structure was tenable across the two time points, $\Delta\chi^2(12) = 8.32$, $p = .151$, the factor loadings for the language variables were constrained to be equal across time points. Therefore, any differences in the latent skill score could be attributed to actual language differences rather than measurement differences between the assessment periods (i.e., differential loadings).

Following the recommendations of Hoyle and Panter (1995), we then evaluated the fit of the CFA using a combination of absolute and incremental indices, including the root mean square error of approximation (RMSEA; Brown & Cudeck, 1993), comparative fit index (CFI; Bentler, 1988), and Tucker and Lewis index (TLI; Tucker & Lewis, 1973). Models that fit the data are typically indicated by an RMSEA < .05 and CFI and TLI indices > .95 (Hu & Bentler, 1999). These model indicators of fit suggested appropriate fit of the model to the data (RMSEA = .04, CFI = .98, TLI = .97). The factor scores at the fall were set to a mean of 0 and an *SD* = 1 and freed for estimation in the spring. Such a configuration in the latent variables allowed for meaningful detection of growth across the two time points.

To assess the main research aims, and given the nested data structure, we used multilevel modeling (mixed procedure in SAS; SAS Institute Inc., Cary, NC) to estimate differences in language skills among classrooms and children. As part of the mixed modeling procedures, we created two new variables from the CFA. First, a *class language skills* variable was created to represent the mean language score of all children in a classroom at the fall assessment point; this variable, which represents the language skills of a child's peers, was used to address the first research aim regarding whether peer effects are associated with children's language growth. Second, a *child reference status* variable was created to represent an individual child's language skills *relative* to his or her peers (the classroom mean) in the fall. Necessary for addressing the second research aim regarding the potential bearing of children's status within a classroom on peer effects, this variable was constructed as a residual index of children compared with the classroom mean, based on the difference between a child's fall language score and the class language score: Positive values indicated that the child's language skills were higher than his or her peers, on average compared to the reference group; negative values indicated that the child's language skills were, on average, lower than his or her peers. These two variables, in conjunction with the estimated child's fall latent skill score, were used in separate multilevel models to predict children's spring language skills to address the two research aims. (Equations are available from the second author.)

Results

A summary of the descriptive statistics for the observed variables (the five language measures) appear in Table 1. The means show that children made gains from the fall to spring on all five measures, with effect sizes demonstrating that practically important changes were made on the CELF Sentence Structure ($d = .30$), Word Structure ($d = .26$), and Expressive Vocabulary ($d = .23$) subtests, and for the PPVT ($d = .62$) and the NAP ($d = .46$). Correlations among scores on these measures were generally moderate in nature (see Table 3), and no multicollinearity was observed from the bivariate correlations.

Table 4 summarizes results from the unconditional means model. The predicted mean language scores across all classes in the spring was 0.50, indicating that, on average, students made a 1½ *SD* gain in language scores from the fall to the spring. The language scores in the fall ranged from −2.73 to 2.31, and in the spring, they ranged from −2.51 to 3.03. The variance components from the model showed that classrooms significantly varied with respect to children's fall mean language scores (1.27, $Z = 11.72$, $p < .001$), with 89% of the total variation in children's spring language scores found between students within classrooms. The remaining 11% was attributed to differences between classrooms (0.15, $Z = 2.02$, $p = .02$). These findings suggested that meaningful differences among the classrooms existed in children's spring language skills. Therefore, we turned to a conditional means model to explore the extent to which child- and classroom-level predictors explained these differences.

To address the first research aim, a mixed model tested whether peer effects were associated with children's language growth. Variables included in this model (RQ1 Final Model; Table 4) included class language skills, child initial status (i.e., fall language score), instructional support, and the interaction between class language skills and child initial status. The instructional support variable

Table 3
Correlations Among Observed Variables at Fall and Spring

	Fall					Spring				
Variable	SS	WS	EV	PPVT	NAP	SS	WS	EV	PPVT	NAP
Sentence Structure (SS) fall	1.00									
Word Structure (WS) fall	.57	1.00								
Expressive Vocabulary (EV) fall	.61	.68	1.00							
PPVT fall	.61	.58	.74	1.00						
NAP fall	.31	.41	.37	.45	1.00					
Sentence Structure spring	.57	.56	.55	.49	.33	1.00				
Word Structure spring	.51	.69	.63	.58	.41	.69	1.00			
Expressive Vocabulary spring	.51	.63	.78	.64	.40	.57	.72	1.00		
PPVT spring	.52	.56	.70	.75	.46	.59	.59	.65	1.00	
NAP spring	.31	.34	.36	.39	.53	.28	.37	.41	.38	1.00

Note. Sentence Structure, Word Structure, and Expressive Vocabulary from the Clinical Evaluation of Language Fundamentals Preschool, Second Edition (CELF: Wiig, Secord, & Semel, 2004); PPVT = Peabody Picture Vocabulary Test, Third Edition (Dunn & Dunn, 1997); NAP = Narrative Assessment Protocol (Justice, Bowles, Pence Turnbull, & Skibbe, 2010)

Table 4
Multilevel Effects Summary of the Initial and Final Models

	Unconditional Model		RQ1 Final Model		RQ2 Final Model	
Effect	Coefficient (*SE*)	*df*	Coefficient (*SE*)	*df*	Coefficient (*SE*)	*df*
Fixed effects						
Intercept	0.50 (0.08)*	49	0.51 (0.006)*	48	0.50 (0.006)*	48
Class language skills (fall)			−0.009 (0.01)	48	—	—
Child initial status (fall)			1.09 (0.004)*	275	1.09 (0.01)*	275
Child reference status (fall)			—	—	1.09 (0.005)*	275
Instructional support			−0.004 (0.002)	275	−0.003 (0.002)	275
Class Language Skills × Child Initial Status			−0.02 (0.006)*	275	—	—
Child Initial Status × Child Reference Status			—	—	−0.02 (0.008)**	275
Random effects	Variance	ICC	Variance	Pseudo-R^2	Variance	Pseudo-R^2
Intercept	0.15 (0.07)	0.11	0.0009 (0.0004)	0.99	0.0008 (0.0003)	0.99
Residual	1.27 (0.11)	0.89	0.006 (0.0005)	0.99	0.006 (0.0004)	0.99

Note. ICC = intraclass correlation coefficient.
*$p < .001$. **$p < .05$.

was included to control for the general quality of children's classrooms, thereby assuring that any peer effects observed were not simply representing selection factors (i.e., families place children with higher fall language skills in higher-quality programs). If this were the case, peer effects could reflect not only classroom skill levels but also any tendency of their peers' families to select into higher-quality programs.

The results of the final model (i.e., RQ1 Final Model; see Table 4) used to address the first research aim indicated that class language skills were not a significant predictor of children's spring language scores (−0.009, $p = .236$) when children's initial status was included in the model (1.09, $p < .001$). This result is not surprising as the correlation between initial status and classroom means was strong ($r = .51$), suggesting that low-ability students were typically in low-ability classes and high-ability students were in high-ability classes. In this sample of relatively homogeneously skilled students within classrooms, given the targeted enrollment practices of participating classrooms, it would be difficult for classroom means to uniquely predict student's spring language scores when student's fall language scores was included in the model. Nonetheless, important to note is that there was a significant interaction between class language skills and child initial status (−0.02, $p < .001$), even when controlling for instructional support of

children's classrooms. Figure 1 graphs the nature of this interaction.

For the purposes of graphing these interactions, we refer to children as low initial status (child's language skills are 1 *SD* lower than the mean of all students), and high initial status (child's language skills are 1 *SD* higher than the mean of all students). These values represent children's absolute skill levels in fall of the year and therefore allow us to determine whether peer effects manifest differently for students who are highly skilled compared to those who are less skilled. So as to ensure that the estimated means in the graph represent actual ranges observed in the data, indicators of classroom means were chosen as a function of the 25th and 75th percentile values that occurred for low-initial-status or high-initial-status children. For low-initial-status children, the 25th percentile score for reference status was −0.71 and the 75th percentile score was −0.08, indicating that low-status students were typically enrolled in low- or average-ability classrooms. Conversely, high-initial-status students were primarily enrolled in average-ability (25th percentile mean = 0.04) or high-ability classrooms (75th percentile mean = 0.77).

As shown in Figure 1, findings suggest that peer effects (i.e., class language skills) have the greatest bearing upon those children whose fall language skills are −1 *SD* of the mean of all students. In fact, the interaction demonstrates that low-initial-status children who are in the lowest ability classes (class mean = 25th percentile) lose ground in the development of their language skills when compared to their peers who are in average-ability classes. The mean predicted spring language score for low-initial-status children in generally low-ability classes was −1.60, which represents an approximate 1½ *SD* decrease in average language scores from the fall to the spring (−1.60 − −1.00 = −0.60). Conversely, low-initial-status children in average-ability classrooms maintained the same level of language ability in the spring compared to the fall, increasing their language skills from −1.0 to −0.98. As for the high-initial-status children (i.e., children whose fall language skills are +1 *SD* of the mean of all students), the average ability of their peers did not impact the predicted spring language score, as students in both average- and high-ability classes had estimated language skills of 2.05 and 2.18, respectively.

A separate model was used to address the second research aim, which explicitly pursued the question of children's reference status so as to examine whether peer effects affected some students more than others depending on their status within a classroom (vs. their absolute skill levels, as tested in the prior model). Variables included in this model (RQ2 Final Model; Table 4) included child initial status, child reference status, instructional support, and the interaction between child initial status and child reference status. This main effects mixed model, which tested whether children's reference status was associated with children's language growth, indicated that fall language scores positively predicted children's spring language scores (1.09, $p < .001$), as we would expect. This model also showed that children's reference status in the fall positively predicted spring language scores (1.09, $p < .001$); this indicated that children whose language skills were relatively high compared to their classmates in the fall had higher language skills in the spring, when compared to children whose language skills were relatively low compared to their classmates. Finally, there was a significant interaction between child initial status and child reference status (−0.02, $p < .001$), the nature of which is displayed in Figure 2.

As with the prior models, low and high initial status are indicated by language skills lower or above the student mean (−1 *SD* and +1 *SD* of the mean, respectively), and indicators of children's ref-

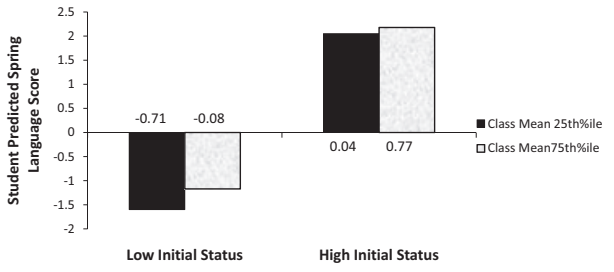

Figure 1. Relation between children's initial status (low status, high status) and classroom mean (based on fall averages per classroom).

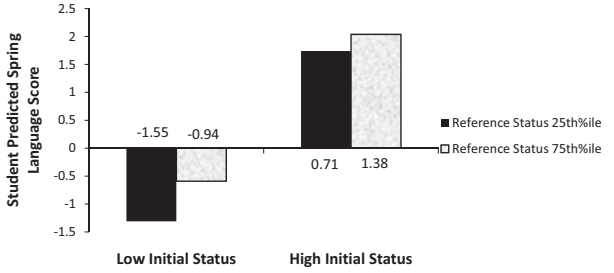

Figure 2. Relation between children's initial status (low status, high status) and children's reference status (deviation from the classroom mean, based on fall averages per classroom).

erence status were chosen as a function of the 25th and 75th percentile values that occurred for low-initial-status or high-initial-status children. For low-initial-status children, the 25th percentile score for reference status was −1.55 whereas the 75th percentile score was −0.94, compared to 0.71 and 1.38, respectively, for high-initial-status children. Figure 2 illustrates several key findings. First, children's reference status appears to have the greatest consequence for low-initial-status children, as we hypothesized and as the literature might suggest. Second, however, the influence of one's peers for low-initial-status children appears to be dependent upon how far children's language skills are from the classroom mean. As Figure 2 shows, there is a larger gap in spring language scores for low-initial-status students who were approximately (1.5 *SD*) below the classroom mean when compared to low-initial-status students who were slightly < 1 (*SD*) below the classroom mean ($\Delta z = 0.72$). Conversely, a much smaller gap in predicted spring language scores was observed between high-initial-status children who were 0.71 *SD* above the mean when compared to those who were 1.38 *SD* above the mean ($\Delta z = 0.30$).

By accounting for the child- and classroom-level predictors in the conditional means model, 99% of the variance in classroom means was explained by the model covariates.

Discussion

The examination of peer effects upon student achievement has been a common focus in both educational theory and research, particularly their manifestation within the primary and the secondary grades. Theoretical treatments of this topic are primarily concerned with describing the mechanisms through which peer effects are exerted, to include the consideration of whether these effects occur through direct or indirect pathways (e.g., Lazear, 2001). Empirical treatments are concerned, at least in part, with identifying ways to provide unbiased estimates of peer effects as they operate in different sectors of schooling and determining whether peer effects affect some groups of students more than others (Hanushek et al., 2003). The examination of peer effects is important for reasons that extend well beyond such theoretical and empirical treatments, however: The reality and rhetoric of peer effects are influential to families' decisions about where to buy homes, to schools' decisions on how to track students, and to states' decisions about whether to permit school choice. Nonetheless, despite the intensity of rhetoric over the matter of peer effects, there have been ''few direct investigations of the impact of peer groups on student performance'' (Hanushek et al., 2003).

In the preschool sector of schooling, the consideration of peer effects has seldom been a topic of discussion and has received notably little empirical treatment, despite the fact that tracking is customary practice within public preschool programs. Head Start and state-funded prekindergarten programs, for instance, are the largest source of public expenditure for public preschool, and both funding streams prioritize the enrollment of low-SES children. Within such classrooms, therefore, children with relatively low skill levels are clustered with similarly performing peers. For this reason alone, it is important to understand whether peer effects do indeed operate within the preschool sector and, if so, whether some children seem to be particularly influenced by these effects. Specifically, it may be that children who are relatively less skilled either in absolute terms or because of their reference-group status may be more affected by their peers' skills than children who are more highly skilled. For instance, we might speculate that children whose language skills are low in relation to their classmates (i.e., they have low status) might receive specific benefit from peer effects, particularly when their peers exhibit a relatively high level of skill, as has been suggested in the peer effects literature in the later grades (e.g., Hanushek et al., 2003).

In this study, the findings indicated that peer effects do operate within the preschool classroom, as shown by several related findings. First, the significant interaction between peers' language skills and children's fall language skills (initial status) indicated that young children's language growth during an academic year of preschool is associated with the average level of language skills exhibited by their classmates, although this was the case primarily for the less skilled pupils (i.e., children whose fall language skills are −1 *SD* of the mean of all students). This relation existed even when controlling for the instructional quality of children's classrooms. Consistent with other recent reports from preschool (Mashburn et al., 2009), primary (Hanushek et al., 2003), and secondary/postsecondary sectors (Sacerdote, 2001), peer effects operate in a positive direction and seem to be less influential to the most highly skilled pupils (Hanushek et al., 2003). Consequently, for those children who arrive at preschool with low language skills, the present results suggest that it may be desirable for these

youngsters to attend preschool classrooms in which their classmates have strong language skills. Although no experimental studies are available that support this conclusion, our findings converge well with results of a recent quasi-experimental study showing that low-SES preschoolers exhibited greater growth in language skills over an academic year when their classmates included both low- and mid- to high-SES peers versus only low-SES peers (Schechter & Bye, 2007).

Although our intent was not to study the effects of tracking, per se, that peer effects do appear to operate within the classrooms of our nation's youngest pupils (and are most influential to those children with more limited skills) should be a part of policy discussions regarding the targeted enrollment practices of preschool classrooms, which typically results in the clustering of lower skilled students. The average level of language skills displayed by children in preschool classrooms serving only low-SES pupils differs by about 1 *SD* from classrooms serving mid- to high-SES pupils (Schechter & Bye, 2007). The presence of peer effects would suggest that efforts to raise the average skill level within preschool classrooms may have positive impacts on children's development in general and language skills in particular (Henry & Rickman, 2007).

A unique focus of this study was its attention to examining whether peer effects may operate differently for children as a function of their status within the classroom, as suggested in some of the literature on the primary and secondary grades but yet unexplored in preschool settings. Some study findings have suggested that high-status children may be somewhat unresponsive or resilient to the effects of their peers, whereas low-status children may be particularly benefited (Hanushek et al., 2003; Thrupp, 1999). Thus, in this study, we considered peer effects on children's language skills in both absolute and relative terms, the former by examining the interaction between classmates' language skills and children's initial status and the latter by examining the interaction between children's reference status and children's initial status. Findings for both analyses were convergent, with the latter showing that children whose language skills were low in relation to their peers seemed particularly affected by the language skills of their classmates. In fact, low-status children surrounded by relatively highly skilled peers had much higher spring language skills when compared to low-status children surrounded by peers with relatively low skill levels. Moreover, as we had hypothesized, high-status children seemed relatively resilient to the language skills of their peers irrespective of their positioning in their classrooms.

To conclude, our results show that young children's language growth is associated with the average level of language skills exhibited by their peers, and more specifically that peer effects appear particularly influential to children whose language skills are low when considered in absolute terms or as measured in relation to their classmates. On the contrary, highly skilled pupils, namely, those children who arrive at preschool with high levels of language skill, seem fairly impervious to peer effects. These findings converge well with the results of prior reports assessing peer effects in preschool settings (Henry & Rickman, 2007; Mashburn et al., 2009) and a larger body of work concerning primary and secondary schooling (see Hanushek et al., 2003). Consequently, educational policy makers and practitioners should recognize the importance of peers—and peers' language skills—to young children's early learning and development, particularly for those children with low language skills for whom preschool participation is seen as an important mechanism for promoting school readiness (Justice, Bowles, Pence Turnbull, & Skibbe, 2009). Moreover, the present findings provide several compelling avenues for future research.

First, this study did not attempt to understand the mechanisms through which peer effects are exerted in preschool classrooms. It is unclear whether peer effects manifest themselves through direct pathways, such as child-to-child interaction, or indirect pathways, such as teacher expectation and efficacy. Future research that identifies the mechanisms underlying peer effects will be an important addition to this line of work. Second, further investigation of peer effects would benefit greatly from experimental manipulations. To date, most work on peer effects have used correlational methodologies. Studies that experimentally examine the impacts of increasing the average level of language ability in public preschool programs on children's language growth and teachers' educational practices would be quite influential to both educational practice and theory.

References

Barnett, S., Epstein, D. J., Friedman, A. H., Boyd, J. S., & Hustedt, J. T. (2008). *The state of preschool 2008*. New Brunswick, NJ: National Institute for Early Education Research.

Bentler, P. M. (1988). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*, 238–246.

Brown, M. W., & Cudeck, R. (1993). Alternatives ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural models* (pp. 136–162). Newbury Park, CA: Sage.

Bryk, A., Lee, V. E., & Holland, P. B. (1993). *Catholic schools and the common good*. Cambridge, MA: Harvard University Press.

Cohen, E. G., & Lotan, R. A. (1995). Producing equal-status interaction in the heterogeneous classroom. *American Educational Research Journal*, *32*, 99–120.

Dunn, L. M., & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test—Third Edition (PPVT–III)*. Circle Pines, MN: American Guidance Service.

Fletcher, J. (2010). Spillover effects of inclusion of classmates with emotional problems on test scores in early elementary school. *Journal of Policy Analysis and Management*, *29*, 69–83.

Hanushek, E. A., Kain, J. F., Markman, J. M., & Rivkin, S. G. (2003). Does peer ability affect student achievement? *Journal of Applied Psychometrics*, *18*, 527–544.

Hattie, J. A. C. (2002). Classroom composition and peer effects. *International Journal of Educational Research*, *37*, 449–481.

Henry, G. T., & Rickman, D. K. (2007). Do peers' influence children's skill development in preschool? *Economics of Education Review*, *26*, 100–112.

Hoff, E. (2006). Environmental supports for language acquisition. In D. K. Dickinson & S. B. Neuman (Eds.), *Handbook of early literacy research* (Vol. 2, pp. 163–172). New York: Guilford.

Hoyle, R. H., & Panter, A. T. (1995). Writing about structural equation models. In R. H. Panter (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 158–176). Thousand Oaks, CA: Sage.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1–55.

Huttenlocher, J., Vasilyeva, M., Cymerman, E., & Levine, S. (2002). Language input and child syntax. *Child Psychology*, *45*, 337–374.

Justice, L. M., Bowles, R. P., Pence Turnbull, K., & Gosse, C. (2010). A scalable tool for assessing children's language abilities within a narrative context: The NAP (Narrative Assessment Protocol). *Early Childhood Research Quarterly*, *25*, 218–234.

Justice, L. M., Bowles, R. P., Pence Turnbull, K., & Skibbe, L. (2009). School readiness among children with varying histories of language difficulties. *Developmental Psychology*, *45*, 460–476.

Lazear, E. P. (2001). Educational production. *Quarterly Journal of Economics*, *116*, 655–679.

Mashburn, A. J., Justice, L. M., Downer, J. T., & Pianta, R. C. (2009). Peer effects on children's language achievement during pre-kindergarten. *Child Development*, *80*, 686–702.

Muthén, B., & Asparouhov, T. (2002). *Latent variability analysis with categorical outcomes: Multiple group and growth modeling in Mplus*. Retrieved December 12, 2009, from http://www.statmodel.com/download/webnotes/CatMGLong.pdf

Muthén, L. K., & Muthén, B. O. (2007). *Mplus user's guide* (5th ed.). Los Angeles: Authors.

Pianta, R. C., La Paro, K., & Hamre, B. (2006). *Classroom Assessment Scoring System-PreK*. Charlottesville, VA: Center for Advanced Study of Teaching and Learning.

Sacerdote, B. (2001). Peer effects with random assignment: Results for Dartmouth roommates. *Quarterly Journal of Economics*, *116*, 681–704.

Schechter, C., & Bye, B. (2007). Preliminary evidence for the impact of mixed-income preschools on low-income children's language growth. *Early Childhood Research Quarterly*, *22*, 137–146.

Shonkoff, J., & Phillips, D. (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington, DC: National Academy Press.

Slavin, R. (1987). Ability grouping and student achievement in elementary schools: A best-evidence synthesis. *Review of Educational Research*, *22*, 351–367.

Thrupp, M. (1999). *Schools making a difference*. Buckingham, UK: Open University Press.

Thrupp, M., Lauder, H., & Robinson, T. (2002). School composition and peer effects. *International Journal of Educational Research*, *37*, 483–504.

Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*, *38*, 1–10.

Wasik, B. A., Bond, M. A., & Hindman, A. (2006). The effects of a language and literacy intervention on Head Start children and teachers. *Journal of Educational Psychology*, *98*, 63–74.

Webb, N. M. (1991). Task related verbal interaction and mathematics learning in small groups. *Journal for Research in Mathematics Education*, *22*, 366–389.

Wiig, E. H., Secord, W. A., & Semel, E. (2004). *Clinical Evaluation of Language Fundamentals Preschool—Second Edition*. San Antonio, TX: Harcourt Assessment.

Wilkinson, I., & Fung, I. Y. Y. (2002). Small-group composition and peer effects. *International Journal of Educational Research*, *37*, 425–447.