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ORIGINAL PAPER

Children's Attendance Rates and Quality of Teacher-Child Interactions in At-Risk Preschool Classrooms: Contribution to Children's Expressive Language Growth

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Abstract The present research examines whether children's daily attendance rates would be predictive of gains in expressive language within the context of high-quality preschool classrooms. The quality of preschool classrooms was assessed by measuring the quality of the teacher's interactions with the children in his or her classroom. Hierarchical linear models, nesting children within classroom, were used to examine children's growth in expressive language in two independent samples ($n = 129$ children in 14 classrooms; $n = 160$ children in 46 classrooms). Results showed positive relations between daily attendance and language gains for children enrolled in higher quality preschool classrooms. Findings suggest that at-risk children who are rarely absent from high-quality preschool classrooms show accelerated expressive language growth, thus indicating that preschool attendance is an important factor to consider in future research and policy decisions.

Keywords Preschool · Expressive language · Attendance

There is a well documented disparity in the language development of children who are reared in poverty relative to their more advantaged peers (Fazio et al. 1996; Hart and Risley 1995; Stanton-Chapman et al. 2004; Whitehurst 1997). The magnitude of this difference varies depending on the specific language outcome being studied but generally averages about one standard deviation unit on norm- and criterion- referenced measures

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of language ability (e.g., Justice et al. 2005; Locke et al. 2002; Walker et al. 1994; Washington and Craig 1999; Whitehurst 1997). This difference has been largely attributed to the disparate quality of language available to children within their home environments (see Hoff 2003). For instance, research findings suggest that the language-learning experiences of children living in lower socioeconomic status (SES) homes are qualitatively and quantitatively different than children in higher SES homes, particularly with respect to the diversity and complexity of language to which they are exposed (Hart and Risley 1995; Lee et al. 1997; Rush 1999). These differences transcend not only the content of language (i.e., vocabulary) but also its form (i.e., grammar) (e.g., Hart and Risley 1995; Hoff 2003). By some accounts, differences in features of mothers' talk to their children (viz., total number of words, total number of different words, mean length of utterance) is a key mechanism explaining differences in the lexical growth of middle- versus higher-SES children (Hoff 2003).

There is a large amount of research-based evidence demonstrating positive relations between children's language skills and features of their language-learning environments; most are interpreted through social-interactionist theories of language development (Chapman 2000), such as the learning-from-input hypothesis (Hoff 2003). Social-interactionist approaches to explaining variability in children's rate of language acquisition generally propose that socially embedded interactions, mediated by a more knowledgeable conversational partner, provide children with the linguistic input necessary for language growth. The extant literature provides generally strong support for social-interactionist theories of language acquisition, particularly with respect to parent–child interaction (e.g., Hart and Risley 1995; Hoff 2003; Landry et al. 1997; Rush 1999; Tamis-LeMonda et al. 2001).

However, some literature has also focused specifically on the importance of teacher-child interactions and their relations with language acquisition (e.g., Huttenlocher et al. 2002; Justice et al. 2008b; Mashburn et al. 2008). Huttenlocher et al. (2002), for instance, showed a significant relation between preschool teachers' use of complex syntax (e.g., clause density, rate of noun use) and preschool-aged children's comprehension of complex syntax at the end of the instructional year. Such findings are particularly compelling because teachers and children are biologically un-related yet may spend a great deal of time together. Recent findings from the field of behavioral genetics have indicated that individual differences in language arise from both genetic and environmental influences (see Plomin and Kovas 2005), but that language outcomes in early childhood show particularly strong environmental influences (Petrill and Plomin 2007). Together, such findings lend support to the idea of the important role that high-quality teacher interactions can play in a child's language development.

Drawing upon social-interactionist perspectives of language acquisition, it is reasonable to suggest that one way of mitigating the language gap attributable to SES, particularly for children reared in very low income homes, is through the provision of high-quality language environments outside of the home setting through preschool participation. Though many of the child care options available to low-income families are relatively poor in quality (National Research Council [NRC] 2001), in recent years many state and federal resources have been allocated to the establishment and expansion of high-quality early-childhood programs. For instance, there was a 40% increase in the number of 4-year-old children served by state-funded preschool programs over a recent 5-year period (Barnett et al. 2006). These programs are developed largely to support the school readiness of preschool-aged children who exhibit vulnerability for later school failure, with a majority of participants being reared in low-income homes. While there are many characteristics of

high-quality preschool classrooms, in the present study we focus on the linguistic quality of the interactions between teachers and children. Such interactions are believed to provide these children with an important resource for many aspects of language growth (Girolametto et al. 2003; Huttenlocher et al. 2002; Justice et al. 2008a).

In practice, research generally shows positive relations between general indicators of preschool program quality and children's language outcomes. Children, particularly those children from disadvantaged backgrounds, who are enrolled in high quality preschool programs, often make significant gains in language skills during the preschool year, whereas children who attend low-quality programs often do not show the same advances (Campbell et al. 2001; Loeb et al. 2004; Magnuson et al. 2007; NICHD ECCRN 2003a, b; NRC 2001). For example, Mashburn et al. (2008) recently found that classroom scores on an observational measure of instructional quality (*Classroom Assessment Scoring System*; Pianta et al. 2006), were positively associated with standardized vocabulary scores for a sample of 2,439 children enrolled in 671 preschool classrooms. Further, direct observational measures of classroom quality were the only statistically significant unique predictors of children's vocabulary scores from among a number of program indicator variables studied (e.g., teacher-child ratio, teacher credentials). Also warranting note are findings presented by Tabors et al. (2001) for a sample of 74 preschoolers; in this study, the quality of children's preschool programs had a greater impact on children's vocabulary, narrative, and emergent literacy skills than the children's home environment. Specifically, children from higher quality homes who were enrolled in lower quality preschool centers had poorer language skills than children from poorer quality homes enrolled in higher quality centers.

These studies suggest that several types of children's language skills, and growth in these language skills, can be impacted by the quality of their preschool program. However, as suggested by the social-interactionist theory, critical to this relation is the amount of time spent in the classroom. In other words, to be exposed to the teacher interactions that the social-interactionist theory proposes as necessary for language growth, students must come to school. Several studies have lent support to this hypothesis, showing significant relations of several types of cognitive outcomes with individual differences in the amount of time enrolled in their classrooms (Christian et al. 1998; Hubbs-Tait et al. 2002; Justice et al. 2008b; Loeb et al. 2004; Votruba-Drzal et al. 2004).

For example, Votruba-Drzal et al. (2004) examined data drawn from two waves of the Welfare, Children, and Families: A Three-City-Study, namely, a randomly selected sample of 204 2- to 4-year-old children living in homes below 200% of the poverty line and who were enrolled in some type of non-parental childcare. The researchers found that an increased number of hours enrolled in childcare were significantly related to children's quantitative skills (as measured by a standardized assessment of early math achievement). Christian et al. (1998) used path modeling to examine the relations between several demographic variables, including childcare participation measured in months, and the academic outcomes of 317 children at kindergarten entry. They found that the number of months of participation in center-based child care was positively associated with alphabet recognition, and that those children from low maternal education homes also showed a significant relation between preschool participation and math outcomes. Although reading and verbal outcomes were also measured, no significant relations were found with center participation. Finally, Loeb et al.'s (2004) study of 451 low-income mothers with children between 1 and 4 years old involved comparing the language and cognitive outcomes of children participating in several types of childcare situations. After controlling for a number of key demographic variables (e.g., child age, child race, maternal language,

maternal education), the authors observed an overall significant relation between the amount of participation in center-based programs and nearly all child-level outcomes.

Most studies examining the linkages between participation in preschool programs and children's language growth have not attempted to account for variations that occur with respect to children's actual exposure to language-facilitating qualities of the preschool classroom. Rather, these studies have generally looked at overall participation and enrollment rates, and have not looked at variations in child impacts among children attending preschool who vary in the amount of time they are present. That is, children's daily attendance rates in preschool classrooms can vary substantially, with typical daily attendance rates around 85% (Hubbs-Tait et al. 2002). Theoretically, we might presume that for children who participate in high-quality preschool programs, daily attendance rates (serving as a proxy for the extent to which children are exposed to relatively rich language-learning environments) would be positively associated with language growth over an academic year. With respect to the present study, we might expect that the magnitude of children's language growth would be associated with high daily attendance rates for children who attend preschool, particularly when their classrooms are characterized by high levels of language facilitation.

To date, we have identified only one study that offers indirect support for this hypothesis (Hubbs-Tait et al. 2002); this study specifically sought to determine whether the actual amount of time children spent within their preschool classrooms contributed to individual differences in child vocabulary outcomes among a group of 94 Head Start attendees. The specific hypothesis tested in the Hubbs-Tait et al. study was that the actual amount of preschool participation (as measured by attendance rate) would provide a value-added benefit to those children who experienced more adverse circumstances in the home environment (e.g., lack of cognitive stimulation, overly intrusive parenting). As a main effect, attendance did not exhibit a significant positive association with children's vocabulary scores ($r = .09$); however, as the researchers had hypothesized, family risk was found to moderate the relation between preschool attendance rates and children's receptive vocabulary skills. Specifically, a higher rate of attendance in the context of a higher level of family risk served as a significant predictor of children's receptive vocabulary skills, suggesting that daily attendance in Head Start was an important mechanism for compensating for cumulative family risk.

In the present set of studies, we contribute to the limited research base concerning children's daily attendance rates in preschool classrooms by determining whether daily attendance in classrooms with high-quality teacher-child interactions is associated with increased rates of language growth among children from lower-SES homes. The specific hypothesis tested in Study 1 and replicated in Study 2 was that higher daily attendance rates would be positively associated with children's language growth over an academic year within the context of higher quality classrooms. Moreover, as an extension of previous findings reporting a positive effect of daily attendance and children's vocabulary scores only in the context of elevated family risk (Hubbs-Tait et al. 2002), Study 2 tested the hypothesis that the interplay between daily attendance, language growth, and classroom quality may be most significant for children from highly disadvantaged homes. Consequently, the present work expands upon the extant literature in two important ways. First, prior work examining the potential relations between daily attendance rates and children's vocabulary outcomes have failed to consider the potential moderating role of classroom quality. In the present work, we hypothesized that any positive relations between daily attendance rates and language gains would be realized in the context of higher quality

classrooms; conversely, we presumed that language gains would be negatively associated with high daily attendance rates in lower quality classrooms.

Second, the previous literature has focused nearly exclusively on children's receptive vocabulary skills as indicators of language ability. In the present study, we utilized measures of expressive language skills, focusing specifically on indices of syntax as measured within semi-structured language activities (i.e., semi-structured play, story generation). Children's expressive language skills are an important aspect of language acquisition within the preschool years and have been positively correlated with participation in quality preschool programs (Mashburn et al. 2008). Additionally, research demonstrates that indices of syntactic complexity may be more resilient to the impacts of environment relative to other domains of language, particularly vocabulary (see Whitehurst 1997). Thus, the measures of expressive language utilized in the current study provide a particularly rigorous test of our hypothesis that daily attendance rates will be associated with language gains among children participating in higher-quality preschool programs. In the present work, we conducted two independent tests of our hypothesis using two distinct samples of preschoolers; in Study 1, we conducted an initial test of the hypothesis in a sample of 129 children and in Study 2, we conducted a replication of the hypothesis test in an independent sample of 160 children.

Study 1

The project from which the Study 1 sample was drawn involved 197 children enrolled in 14 public needs-based preschool classrooms that were enrolled in a large-scale curriculum evaluation (for details, see Justice et al. 2008b). The participating classrooms were affiliated with the state-funded pre-kindergarten initiative ($n = 2$), Title I supported pre-kindergarten ($n = 6$), and Head Start ($n = 6$).

Method

Participants

Participants in Study 1 included only those children with complete data on the key set of variables required for analyses. In addition, children attending fewer than 50 days were considered to be outliers, and were excluded from the analysis ($n = 5$ children excluded for low attendance, mean number of days in attendance for these children = 18). A total of 68 children did not meet the inclusion criteria, leaving a sample of 129 children for analysis in Study 1. The children excluded from the present sample were not significantly different than those included in the sample on age, gender, ethnicity, language spoken in the home, mother's education, household income, beginning-of-year expressive language scores, or gain on expressive language scores, ($ts < 2$, $ps > .10$). Students did significantly differ on average number of days attended (127 days in the excluded group and 135 in included group, $p = .003$), but this was to be expected as attendance was used in the inclusion criteria. Descriptive data for this sample (Sample 1) is provided in Table 1. All children were between 3- and 5-years of age, and 50% were female. The majority of children were White (71%); 21% were Black, 5% were Hispanic/Latino, and 2% were of mixed or unspecified races or ethnicities. Most children spoke English as their primary language at home (97%); 3% spoke Spanish.

Table 1 Descriptive characteristics of child participants

	Study 1			Study 2		
	(n = 129 children in 14 classrooms)			(n = 160 children in 46 classrooms)		
Variable	Mean	SD	Range	Mean	SD	Range
Child level variables						
Age in months	53.19	3.80	45–59	52.18	5.53	41–66
Maternal education[a]	1.33	.96	0–3	2.28	1.12	0–6
Household income[a]	26,550	17,840	2,500–87,500	3.48	3.79	0–17
BOY language score[b]	8.77	3.03	0–13	14.77	8.37	0–34
Language gain[b]	.89	2.76	−8–9	3.73	8.15	−15–22
Days of attendance	134.37	13.29	79–156	117.05	21.01	67–145
Classroom level variable						
CLASS-IS	3.55	.98	2.11–5.44	3.07	1.07	1.33–5.67

[a] Measures are not directly comparable across samples, as reported in-text

[b] MUBI served as the language measure in Study 1; NAP score served as the language measure in Study 2

BOY beginning of year, *CLASS-IS* CLASS: instructional support

The preschool teachers serving these children were White, non-Hispanic females, ranging in age from 24 to 53 years (M = 41.9; SD =9.1). The majority of teachers had a bachelor's or graduate degree (78%). Reported teaching experience ranged from 3 to 27 years, with a mean of 11.4 years (SD = 8.3). All classrooms were also served by a full time teaching assistant.

Teachers used one of two curricula, either the *Language-Focused Curriculum* (LFC; Bunce 1995) or the *High/Scope Curriculum* (Hohmann and Weikart 1995), and all had received district-supported intensive professional development to support use of the curricula. Both curricula present a general codified framework for delivering developmentally appropriate instruction across a range of developmental domains (e.g., language, social/emotional, cognitive), and emphasize the use of high-quality interactions in the context of both child-directed and teacher-led activities to foster children's language achievements.

Measures

Across one full school year, participating children and teachers completed a number of project-related tasks. Directly relevant to the current study were parent surveys, child language assessments, classroom observations, and attendance records.

Parent Surveys Parents completed a demographic questionnaire concerning their children in the beginning-of-year of the year. Two items from the questionnaire, maternal education and household income, were used to code SES and contributed data to the present study. Maternal education and household income frequently serve as indicators of SES and there is generally little agreement as to which is the better proxy for estimating SES. Consequently, in this study we used both indices. For maternal education, parents were asked to select one of four options to indicate the highest level of education obtained: (0) indicated a lack of a high school degree (19% of sample), (1) high school diploma or equivalency (46%), (2) some college or vocational training but no degree (20%), or (3) college degree

at the Associates level or higher (15%). Household income was also reported, and ranged from $2,500 to $87,500 ($M$ = $26,550, SD = $17,843). When used in analyses, income was rescaled by thousands (i.e., ranging from 2.5 to 87.5) to be more consistent with the scales of other variables.

Child Language Assessments Children were individually assessed on a battery of measures at the beginning and end of their preschool year. All assessments were administered by trained research staff in a quiet area in their preschool centers. Directly relevant to the present study were the 10-minute spontaneous language samples elicited from the children during one-on-one interactions with examiners. Examiners were trained in language sampling procedures, including the use of specific strategies (e.g., limited yes/no questions) and props (e.g., Play-doh, a plastic picnic basket and food, a farm set with animals, stuffed animals) to elicit a maximum amount of language from children (i.e., a goal of 50 utterances, obtained by 84% of the sample) with a 10-min period. Conventional guidelines for eliciting language samples from children were followed (e.g., Paul et al. 2002), and these are available from the third author. All language samples were either videotaped or audiotaped for later transcription and coding in a lab setting. After their collection, language samples were transcribed and segmented at the utterance level by research assistants trained to 90% accuracy in transcription and segmentation procedures; transcripts were prepared using the Systematic Analysis of Language Transcripts (SALT) Research Version 8.0 software program. All transcripts were checked by a second trained transcriber to ensure accuracy and correct discrepancies.

Following transcription, the SALT software program was used to calculate a measure of syntactic complexity, the *Median Upper Bound Index* (henceforth referred to as MUBI), from each child language sample. MUBI represents the median value of the five most grammatically complex utterances (identified as those utterances with the greatest number of morphemes) within the language sample. Brown (1983) suggested that the best estimate of a child's language competence in a naturalistic language sample is a measure of the most syntactically complex utterances. A similar metric recently described by Pankratz et al. (2007) was shown to be strongly related both concurrently and predictively to other measures of children's language skills, including receptive vocabulary.

Classroom Observations A one-hour classroom observation was conducted at the beginning, middle, and end of the academic year by trained research staff within each of the 14 classrooms. The *Classroom Assessment Scoring System-PreK* (CLASS; Pianta et al. 2006) was used to assess the classroom quality experienced by participating children. The CLASS uses a time-sampling technique to document classroom quality on nine dimensions representing three domains, classroom organization, emotional support, and instructional quality. Dimensions are rated on a scale of 1 (low quality) to 7 (high quality). CLASS scores have been shown to be reliable and valid, correlating with other measures of classroom quality such as the *Early Childhood Environmental Rating Scale* (ECERS; Harms et al. 1998; La Paro et al. 2004) and relating to student performance both concurrently and predictively (Mashburn et al. 2008). CLASS coding in the present study was conducted by research staff following completion of training modules led by CLASS authors, which involved achieving a criterion level of coding reliability across multiple classroom observations. That is, scoring was performed by coders who had completed training on use of the CLASS PreK instrument and had achieved 80% reliability against gold standard tapes (see La Paro et al. 2004, for a description of reliability procedures).

A composite measure of Instructional Quality, comprising scores from the Language Modeling, Quality of Feedback, and Concept Development scales, was used as an index of classroom quality for the current study; this composite represents the extent to which teachers model and foster conceptual and language development in children. The Instructional Quality composite was computed by averaging the scores for each of the three scales across the three observation time points. Instructional quality in the present sample averaged 3.55 (SD = .98). Such scores indicate moderate levels of instructional quality which are nearly 2 standard deviation units higher than seen in reports of large-scale preschool studies (Mashburn et al. 2008), indicating that the classrooms in this study offered relatively higher levels of instructional support to children than may be typical.

Attendance Records Monthly attendance records were maintained by teachers and periodically collected by research staff. The total number of days each child attended preschool was computed.

Analysis

As each classroom contained approximately 14 children, with eight being the fewest number students in any given class, shared within-classroom variability needed to be accounted for to reduce the probability of Type 1 error. Thus the nested structure of the data was modeled using hierarchical linear modeling (HLM) in the program HLM 6.0 (Raudenbush and Bryk 2002) using full maximum likelihood estimation. In each model, all variables were centered at their grand-means. Random effects of variables were allowed when such effects were empirically demonstrable (i.e., significant between-classroom variance and overall improved model fit; Hox 2002).

There are two basic approaches to examining growth or change when data are collected at two time points. The first is the simple difference score approach, wherein the pretest score is subtracted from the posttest score. The second is the autoregressive or residualized change approach, wherein the pretest score is used as a predictor of the posttest score. Though they are often used interchangeably, the two approaches have vastly different interpretations. The simple difference score represents the amount of change from pre-test to post test, while the autoregressive or residualized change model is an estimate of how different the actual post-test score is from the expected post-test score (based on the pre-test). Thus, the residualized gain score and autoregressive models are very appropriate for identifying over- or under-performing children based on expectation, while the simple difference score is more appropriate for measuring amount of change. Rogosa (1995) argued that difference scores are the most appropriate choice when used to represent individual differences in the true amount of change from pre to posttest. As this was the goal of the present study, the simple difference score was used.

Children's language gains, assessed as differences between beginning- and end-of-year MUBI scores, were predicted from attendance and classroom instructional quality. Because language gains could potentially be impacted by children's age and SES, measures of these constructs were included as control variables. Analyses were conducted following a multi-step process. An unconditional model containing no predictor variables was fit first, to compute the intraclass correlation coefficients (ICCs) or proportion of between-classroom variance in language gains. Next, a full model was fit, and is presented in Appendix A. This model controlled for age and two indicators of SES (maternal education, household income) and predicted language gains from children's attendance, classroom quality, and

the attendance X classroom quality interaction. The attendance X classroom quality interaction was of particular interest in the present study, as this term corresponded to our hypothesis that quality would moderate the relation between attendance and language gains. Main effects of the attendance and instructional quality variables were examined only when the interaction term was non-significant (Cohen et al. 2003).

Results

Descriptive statistics of Study 1 child measures are presented in Table 1, and correlations are reported above the diagonal in Table 2. Note that children's gains on the measure of syntactic complexity (i.e., MUBI) were significantly correlated with all covariates included in the analysis except for age. Note also that syntactic complexity gains were significantly and negatively related with beginning-of-year language scores, indicating that children with high initial language scores made smaller gains than children with lower beginning-of-year language scores.

Though the unconditional model predicting language gains yielded a small ICC (.003), the final model suggested significant within-classroom variance in the magnitude of language gains (7%, $p = .05$). The coefficients representing the main effects of each variable, as well as the attendance X instructional quality interaction, are presented in Table 3. Full model results showed that attendance and instructional quality interacted in predicting children's expressive language gains (see Table 3). This interaction is graphed in Fig. 1. As hypothesized, daily attendance rates and children's language gains were positively related for children enrolled in higher quality classrooms. Conversely, daily attendance rates and language gains were negatively related for children enrolled in lower quality classrooms. Model results for children with below-average rates of attendance, however, showed an unexpected finding: for these children, gains in syntactic complexity were greater for those enrolled in lower rather than higher quality classrooms.

Discussion

Results of Study 1 confirmed our hypothesis, showing that children enrolled in higher quality classrooms with higher levels of daily attendance exhibited significantly larger gains in expressive language than those who attended fewer days in the same classrooms. Also consistent with our hypothesis, those children who attended increased days in lower quality classrooms showed smaller gains in expressive language than those with the same levels of attendance in higher quality classrooms. The unexpected finding was a continuation of this interaction, which showed that children with lower attendance in lower

Table 2 Correlations of primary study variables for Study 1 (above diagonal) and Study 2 (below diagonal)

Variable	1	2	3	4	5	6
1. Age	–	.04	.00	.16	.07	.00
2. Maternal education	−.11	–	.37*	.09	−.05	.20**
3. Household income	.16*	.36**	–	.26**	.09	.18**
4. Attendance	.25**	−.01	.17*	–	.06	.11**
5. Fall language score	.26**	.24**	.15	−.01	–	−.53**
6. Language gain	−.16*	.01	−.02	.02	−.55**	–

* $p < .05$, ** $p < .01$

Table 3 Hierarchical linear modeling results predicting language gains from the interaction of instructional quality and attendance

	Study 1				Study 2			
Variable	Coefficient	SE	*df*	*p*-value	Coefficient	SE	*df*	*p*-value
Language gain intercept (γ_{00})[a]	.841	.232	12	.004	3.212	.695	44	<.001
Child level variables								
Age (γ_{10})	−.005	.062	122	.938	−.269	.119	153	.026
Attendance (γ_{20})	.022	.019	122	.250	.043	.034	153	.200
Maternal education (γ_{30})	.304	.261	122	.246	−.386	.606	153	.525
Household income (γ_{40})	.014	.015	122	.338	.035	.183	153	.850
Classroom level variable								
Instructional quality (γ_{01})	.023	.235	12	.923	−1.607	.577	44	.008
Cross-level interaction								
Attendance x instructional quality (γ_{21})	.049	.018	122	.008	.065	.032	153	.046

Random effects	Variance	χ^2	df	*p*-value	Variance	χ^2	df	*p*-value
Classroom level (U_0)	.048	10.61	12	>.500	2.720	55.910	44	.108
Child level (R)	2.614				58.228			

[a] MUBI served as the language outcome in Study 1; NAP score served as the outcome in Study 2

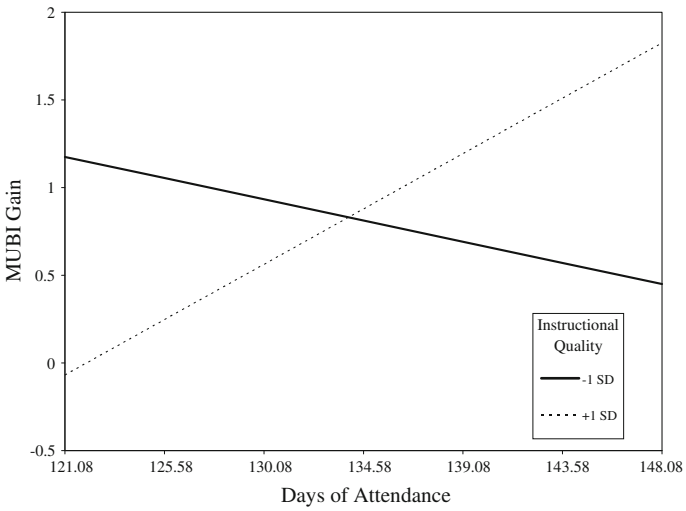

Fig. 1 Relation of attendance and MUBI gain for children enrolled in lower and higher quality classrooms

quality classrooms showed larger gains than those attending at similar rates in higher quality classrooms. Although perplexing, this finding might potentially be explained by systematic differences between children who attend and do not attend school regularly or between children who attend lower versus higher quality classrooms.

SES may constitute one such difference. The SES of children's families has been linked to both time spent in childcare/preschool (Christian et al. 1998) and the quality of

childcare/preschool in which children are enrolled (Kontos 1991). Evidence from the Hubbs-Tait et al. (2002) study discussed previously suggested that SES may further moderate the interaction between attendance and classroom quality. Theoretically, the difference in the language quality between home and school should be largest for those children with lowest SES; these children stand the most to gain from experiencing the presumably higher quality language-learning environment of the preschool classroom (relative to the home environment). Thus, the interrelations among attendance, classroom quality, and SES deserved further attention, including testing of a 3-way interaction among these variables. With only 14 teachers, the sample size and power of Study 1 was insufficient to test such effects. A second study was used to not only replicate the findings from Study 1 (providing an independent test of the interplay among daily attendance, language gains, and classroom quality), but also to examine potential 3-way interactions in which child-level SES was included as a variable of interest.

Study 2

The sample for Study 2 was drawn from a large-scale study of preschool classroom practices and their relation to children's language growth; the study involved 352 preschool children enrolled in 46 different classrooms. Similar to Study 1, all programs were publicly-funded (34 classrooms were affiliated with Head Start, 11 classrooms were affiliated with the state-support pre-kindergarten initiative, 1 independent classroom) and mainly served children from low-income families.

Method

Participants

Inclusion criteria were consistent with that of Study 1; children were included if they attended at least 50 days of preschool (1 child excluded), and if they had complete data on the key set of variables utilized (final $n = 160$). Comparisons showed similar ages, attendance rates, language gains, gender, ethnicity, language spoken in the home, household incomes, and maternal educations for children included and excluded in the present analyses, ($ts < 2$, $ps > .253$). Although initial language abilities were slightly higher for included ($M = 14.77$) as opposed to excluded ($M = 12.94$) children, this difference was not statistically significant, $p = .078$. Descriptive data for the final sample included in Study 2 is provided in Table 1 alongside data from Study 1. All children were between 3:5- and 5:6-years of age, and 46% were female. The majority of children were White (40%); 39% were Black, 9% were Hispanic/Latino, and 12% were of mixed or unspecified races or ethnicities. Most children spoke English as their primary language at home (98%); 8% also spoke a second language (mainly Spanish).

The preschool teachers serving these children were mainly female ($n = 1$ male). The majority of teachers were White (68%); 25% were Black and 7% were of other or mixed races/ethnicities. Most teachers held college degrees at the Associates (41%), Bachelors (30%), or Masters (25%) levels. Teachers reported 0 to 25 years of experience in education ($M = 11.68$, SD = 7.17).

All teachers reported using child-centered approaches in their classrooms (*Creative Curriculum* or *High/Scope*). Similar to Study 1, these approaches emphasize the importance of engaging children in high-quality interactions to support language,

social/emotional, and cognitive development. Some of the teachers were also trained in use of Hanen techniques (www.Hanen.org) to facilitate social and language development in their classrooms. This approach encourages teachers to be conversationally-responsive to children through use of three sets of strategies (child-oriented techniques to increase joint child-teacher engagement, interaction-promoting techniques to increase child-teacher conversations, and language modeling techniques to scaffold children's language development).

Measures

Children and teachers participated in a variety of project activities during their involvement, many of which were highly similar to those in Study 1. Like Study 1, measures included maternal education and household income as indicated on parent surveys, child language assessments, classroom quality observations, and attendance records.

Parent Surveys Parent surveys were administered in the beginning-of-year of the year. Maternal education was coded on a scale of 0 (eighth grade or less) to 8 (doctoral degree). Five percent of children's mothers had eighth grade educations or less, 21% had begun but not completed high school, 27% had high school diplomas, 38% had some vocational or college training but no college degree, 7% had earned Associates degrees, 1% had completed Bachelors degrees, and 1% had completed Masters degrees. Household income was coded on a scale of 0 ($5,000 or less) to 17 ($85,000 or more) in $5,000 increments. Parents reported incomes covering the complete range of the scale, with an average in the $15,001 to $25,000 range (see Table 1).

Child Language Assessments In the beginning and end of the year, a spoken fictional narrative was collected from each child as part of a larger assessment battery. The present study elicited fictional narratives using the wordless storybook *Frog Where Are You?* (Mayer 1969). Frequently used in this capacity (e.g., Botting 2002; Bordreau and Hedberg 1999; Eriksson 2001; Greenhalgh and Strong 2001; Miles and Chapman 2002; Norbury and Bishop 2003; Pearce et al. 2003; Restrepo 1998), the picture book is well-suited for collecting narrative samples as it illustrates a typical story sequence (i.e., initiating event, plan, goal attempts, and consequences) and traditional story components (e.g., characters, setting). Using a standardized protocol through which to elicit narratives, trained examiners helped each child preview the book and then asked him or her to tell a make-believe story. Narratives were videotaped for later analysis in a lab setting.

Narratives were coded directly from video using an 18-point protocol developed for research purposes (the full protocol is available online http://preschoollab.osu.edu/nap/). Prior to completing coding, research staff was trained to at least 80% accuracy in scoring against three master-coded narrative samples. Staff coded the presence and frequency of 18 items concerning the narrative's syntactic complexity on a scale of 0 (no occurrence) to 3 (three or more occurrences). Specific aspects of children's narratives coded included sentence structure (4 items), phrase structure (three items), modifiers (two items), nouns (three items), and verbs (six items). All items were summed to create a composite narrative score, a Narrative Assessment Protocol (NAP). Double-coding of 12% of the narratives by two trained coders working independently of one another showed high reliability (93% agreement within one value). Internal consistency (Cronbach's alpha) as based on the beginning-of-year NAP assessment ($n = 261$) was .83 for all items, indicating adequate

reliability among the individual items. Prior research (Justice et al. 2008a, b) has demonstrated the concurrent and predictive validity of NAP composite scores to standardized measures of language scores.

Classroom Observations As occurred in Study 1, classroom quality was coded using the CLASS (Pianta et al. 2006). Classrooms were observed at the beginning of the year and the end of the year by research staff following CLASS manualized procedures. All CLASS scoring was conducted by persons who had achieved a 90% reliability criterion in a training protocol conducted by reliable CLASS trainers. Analogous to Study 1, instructional quality composites were computed, averaging across the two classroom observations. Teachers exhibited, on average, slightly lower levels of instructional quality ($M = 3.07$, SD $= 1.07$) than seen in Study 1; nonetheless, average scores are about 1.5 standard deviation units higher than ratings provided in large-scale studies of preschool quality that utilize the CLASS assessment (Mashburn et al. 2008).

Attendance Records Attendance records were maintained by preschool teachers and collected by research staff. The total number of days attended was computed for each child.

Analysis

Two sets of analyses were conducted for Study 2. The first set paralleled the analysis of Study 1 and attempted to replicate our initial finding concerning classroom quality as a moderator of the relation between children's daily attendance rates and expressive language gains (this model is presented in Appendix A). Following the replication, post-hoc analyses further examined the role that SES may have played in the pattern of results. SES was measured by maternal education for these analyses because of its strong relations to other SES indicators, including family income, employment status, and free-lunch eligibility (Christian et al. 1998), as well as a direct relation to quality of the childcare center selected (Kontos 1991).

Three post-hoc HLM analyses explored the relations among SES, attendance, classroom quality, and language gains. First, relations between maternal education and children's language scores in the beginning-of-year were examined, accounting for shared classroom variance. A second model indicated the same relation when instructional quality was entered as a predictor. Finally, the original HLM model predicting language gains from attendance, classroom quality, and control variables was modified to also include a three-way interaction with SES (maternal education x attendance x classroom quality). This final model allowed for direct exploration of maternal education as a moderator of the original finding.

Results

Prior to conducting analyses, we examined the extent to which the Study 1 and Study 2 samples were similar, as presented in Table 1. These data show that children in both samples were remarkably alike in both age and SES. With respect to the latter, parental reports indicated (a) a majority of mothers with the equivalence of high school diplomas and/or some college or technical training but no degree and (b) household incomes in the low- to mid-$20,000 s. Children in Sample 2 had slightly lower attendance rates than those in Sample 1. These children also attended preschool classrooms exhibiting a wider range of

instructional quality than those in Study 1, although average levels were higher than those seen in large-scale reports of classroom quality (e.g., Mashburn et al. 2008). Correlations among the primary study variables are presented below the diagonal in Table 2. Similar to Study 1, language gain was negatively correlated with initial language skills and positively related to household income. Income and attendance were also positively related. Unlike Study 1, maternal education was positively related to initial language skills, and attendance and language gain were unrelated.

Replication Analyses The unconditional model with children's language gains as the dependent variable yielded an ICC of .0608. Thus, between-classroom differences were minimal as compared to differences among children within the same classroom. However, the ICC of the final model suggested a significant proportion of variance was attributable to classroom level effects ($p = .008$). The coefficients representing the main and interaction effects in the final model are presented in Table 3. As hypothesized, attendance and instructional quality interacted in predicting children's language gains. Moreover, the relations among attendance, instructional quality, and language gains were consistent with those seen in Study 1. As depicted in Fig. 2, higher attendance in higher quality preschool classrooms was related to greater language gains, whereas higher attendance in lower quality preschool classrooms was associated with lesser gains. However, consistent with Sample 1, the contradictory finding was again present: of those children with the lowest rates of attendance, gains were larger for those who were enrolled in lower quality classrooms.

Post-Hoc Analyses Maternal education and beginning-of-year narrative scores were significantly and positively related, ($\gamma = .032$, $t[158] = 2.807$, $p = .006$) indicating that children of more highly educated mothers tended to begin their preschool year with higher language abilities. Unexpectedly, maternal education and classroom quality were significantly and negatively related, $\gamma = -.151$, $t(44) = -2.121$, $p = .039$. In this sample, children of less educated mothers were more likely to attend higher quality preschool

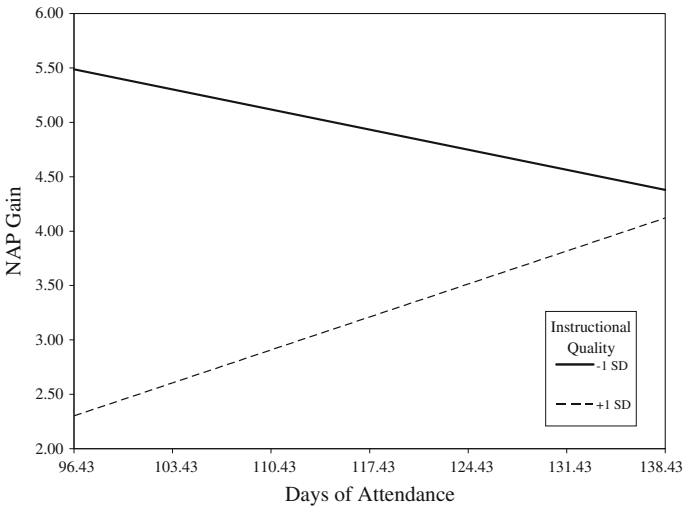

Fig. 2 Relation of attendance and NAP gain for children enrolled in lower and higher quality classrooms

classrooms and children of more highly educated mothers were more likely to attend lesser quality preschool classrooms. These findings may partially explain the gap in language gains between low-attending children enrolled in lower versus higher quality classrooms (e.g., left sides of Figs. 1, 2). Because children in these lower quality classrooms tended to come from higher SES backgrounds (represented by maternal education), gains may have been due to home rather than school language experiences, particularly for children who did not regularly attend preschool.

These results suggest maternal education may function as a moderator of the daily attendance x instructional quality interaction seen in both Study 1 and Study 2. Indeed, the three-way interaction among maternal education, daily attendance, and instructional quality significantly predicted children's language gains, $t(150) = -2.113$, $p = .036$; the relation of attendance to children's language gains was dependent upon both classroom quality and SES. This interaction is depicted in Fig. 3. Children of lower SES backgrounds enrolled in higher quality preschools showed a positive relation between language gains and daily attendance. These children made greater gains with higher rates of attendance. Regardless of classroom quality, children of higher SES backgrounds showed a similar positive relation between attendance and language gains. Also, these relations were considerably less strong (i.e., smaller slope) than for children of lower SES in higher quality classrooms. In contrast, children of lower SES backgrounds enrolled in lower quality classrooms showed a negative relation between language gains and attendance. With higher rates of attendance, these children made lesser gains.

It is important to note that, while the fit lines indicate a differential gain that benefits children of lowest SES backgrounds in poor quality classrooms when attendance rates are low, there are relatively few children at these points in the distribution. As discussed above, children in the lowest quality classes tended to come from homes of higher SES. The gap favoring children of higher SES backgrounds in lower quality classrooms is similarly explained by the negative relation between maternal education and classroom

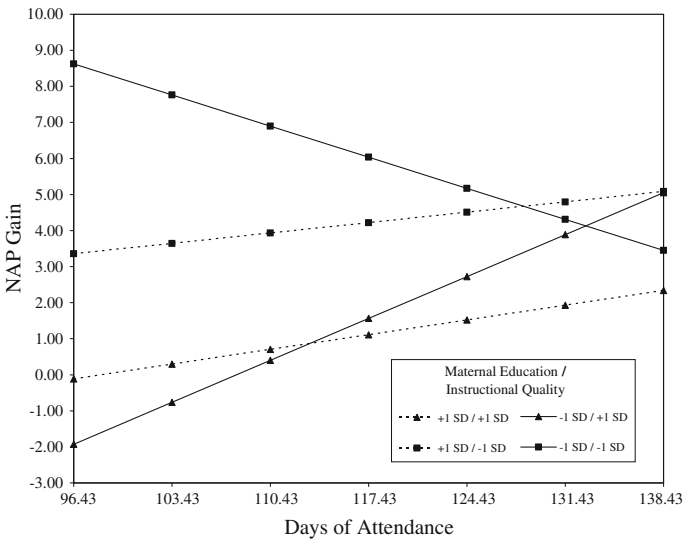

Fig. 3 Relation of attendance and NAP gain for children of lower and higher socioeconomic backgrounds enrolled in lower and higher quality classrooms

quality; children with higher SES backgrounds were disproportionately represented in lower quality classrooms. Finally, the general differences observed between children of lower and higher SES groups are reflective of the typical achievement gap described in the extant literature.

General Discussion

In the present study, we tested the hypothesis that children's language gains would be significantly related to the quality of the preschool learning environment and that this relation would vary depending upon the amount of time spent in that environment as measured by children's daily attendance rates. Expanding upon prior research (Hubbs-Tait et al. 2002), the present study found positive relations between children's daily attendance rates and language gains within the context of high-quality classrooms in two independent samples of children attending targeted enrollment preschool programs. These results further expand the previous literature by using measures of syntactic complexity as the language measure of interest, demonstrating that the positive association for attendance and language gains extends to expressive as well as receptive language skills. Moreover, in finding that the attendance-language gain associations were moderated by classroom quality, the present results lend further support to the social-interactionist theory of language development (Bohannon and Warren-Leubecker 1985). It is important to note that the positive relations between attendance and language gains were strongest for higher quality preschool classrooms, suggesting that increased exposure to the enriched language-learning environments of such classrooms, even given the differences between the two samples of teachers (e.g. differences in educational level of teachers), is an important mechanism for promoting the language achievements of children.

A particular strength of the current study was in its measurement and consideration of classroom quality. While the extant literature provides some evidence of the relation between variable attendance and academic outcomes (i.e. Christian et al. 1998; Hubbs-Tait et al. 2002), and significant evidence of the relation between preschool classroom quality and children's language outcomes (i.e. Pianta et al. 2006), the present study combined these two ideas, testing how the two constructs interact. We found that preschool teachers' instructional quality moderated the relations between attendance and children's language gains. These results suggest that attendance in preschool is important but must be considered in light of the learning opportunities that preschool attendance affords; classroom quality matters as well. Results of the present study showed that greater attendance was associated with larger language gains for children enrolled in higher quality classrooms, an unsurprising finding given the large extant literature supporting positive relations among (a) quality of early childcare/preschool and a variety of child outcomes (Tabors et al. 2001) and (b) quality of adult-child interactions and language input and child language achievement (Huttenlocher et al. 2002; Pianta et al. 2006).

Notably, the present results do not support general associations between children's daily attendance rates and language gains. Although a main effect of attendance may be logical based on the literature, this finding is similar to those of Hubbs-Tait et al. (2002). In the present study, when the interaction of instructional quality and attendance was not included in the equations, no significant relations between language gains and attendance rates were found. Had assessments of classroom quality not been included in the present analyses, relations between attendance and language gains may not have been detected.

The relations between attendance and quality in predicting children's language gains are particularly noteworthy when considering children from lower SES backgrounds. Although

the most disadvantaged children showed the greatest language gains as a result of preschool attendance, these benefits were apparent only within the context of higher quality classrooms. In lower quality classrooms, these children showed negative relations between attendance and language gain, meaning that greater attendance in these classrooms was associated with lesser language growth. This finding is in stark contrast to results for relatively more advantaged children, who showed smaller but still positive relations between attendance and language gains regardless of classroom quality.

Although such results are generally consistent with notions of preschool as a means of mediating risk due to socioeconomic background or poverty (Campbell et al. 2001; Hubbs-Tait et al. 2002; Loeb et al. 2004, Votruba-Drzal et al. 2004), they also have acute implications concerning the availability and accessibility of high quality programs serving disadvantaged children. With respect to availability, greater attention must be paid to ensuring that offered programs meet not only structurally-based but also process-oriented standards of quality (Mashburn et al. 2008). Although federally- and state-funded programs are generally required to meet minimal structural requirements, assessments of the extent to which these programs support children's language and learning remains highly variable (Justice et al. Justice et al. 2008a, b; LoCasale-Crouch et al. 2007). In our samples of publicly-funded preschool classrooms, the levels of instructional quality provided were insufficient to promote the language achievement of all enrolled children, despite the fact that the classrooms within this study exhibited relatively high levels of instructional quality (Mashburn et al. 2008). Additional research should be conducted to more specifically determine what is presently occurring in these types of preschool classrooms, and what can be done to improve the quality such that all children are able to benefit from instruction. Studies that seek to link children's exposure to specific types of linguistic input to their growth in language would offer a level of precision regarding preschool classroom quality that has seldom appeared in the literature (but see Huttenlocher et al. 2002). However, the results of the present study suggest that the "unpacking" of classroom quality measures to identify those features most influential to children's language growth will be an important avenue for future research.

The present results further argue that attention should be paid to the access afforded children from more disadvantaged backgrounds, as the potential of high quality preschool programs to mediate risk may be tied to the regularity with which children attend these programs. Put simply, children who are not present in the classroom cannot reap the benefits of the learning opportunities provided to them by teachers and other specialists in these settings. Given that disadvantaged children may be more likely to miss more school due to the effects of poverty on their own physical health and well-being (see Shonkoff and Phillips 2000) or their family's access to resources needed to regularly participate in preschool programs, such as transportation and flexible work schedules (Corcoran and Chaudry 1997), perhaps the availability of publicly-funded programs would benefit from being coupled with efforts to ensure regular participation (i.e., attendance) in the high quality learning opportunities they provide.

Limitations and Future Directions

Despite the fact that the results of both present studies supported our main hypothesis, namely that attendance and classroom quality would be positively related in predicting children's expressive language gains, findings concerning the magnitude of gains for children enrolled in higher and lower quality classrooms remain perplexing. In initial analyses, we found that children in lower quality classrooms made larger gains than those

in higher quality classrooms when daily attendance rates were low. Post hoc analyses suggested that these differences may be largely attributable to the socio-economic characteristics of our particular samples.

First, SES and classroom quality were inversely related for participants in our studies, such that children from the most disadvantaged backgrounds largely attended higher quality classrooms. Second, given our sample of state- and federally-funded programs with targeted enrollment, the majority of children who participated in our studies were relatively disadvantaged; due to the restricted range of this sample, examining SES variations within this population effectively compares the "lowest of the low" and "highest of the low". These features of this study may represent important limitations, in that modeled results for lower quality classrooms and children of lower SES backgrounds may thus denote (a) relatively few children in our particular samples exhibiting these paired characteristics, and (b) children who were not representative of the general patterns in our data or the population from which we sampled. Essentially, these relations indicate a sort of selection bias that may affect the validity and generalizability of results when comparing children from lower and higher socioeconomic backgrounds. Unfortunately, the samples and correlational design of the present studies restrict our ability to fully disentangle these unexpected findings. Further work utilizing larger samples with less collinearity between classroom quality and SES will be required to better understand these results.

An additional limitation concerns the overall design of this study; specifically, the correlational design and therefore the interpretations we might draw from the present work deserve further attention. Although an increasing pool of evidence now lends support to the notion that preschool attendance leads to greater cognitive, social, and academic gains (Christian et al. 1998; Hubbs-Tait et al. 2002), the correlational nature of the study disallows true causal interpretation. In other words, although attendance may logically lead to greater language gains, this relation may exist in the other direction: children who are likely to experience greater language gains tend to have higher daily attendance rates. Greater support for the directionality of these relations will require further study using different research methodology.

Relatedly, one of the major limitations of correlational designs is the third variable problem (Shadish et al. 2002). Specifically, although we have extended previous work by including both classroom quality and SES in studying relations of attendance and language gain, additional factors may moderate or mediate these relations and deserve attention in future research. In addition, though we consider attendance to be a proxy measure of exposure, it is possible that attendance could be an index of several other constructs, such as the child's health, the parent's job stability, or the parent's ability to bring the child to school. Finally, the impacts of attendance on other aspects of children's development are important to consider. For example, results of the NICHD study of Early Childhood and Youth Development showed that an increased number of hours in non-parental care of any type was associated with an increase in problem behaviors (2006). This finding highlights that more research into the quantity questions of early school experiences is needed.

Conclusion

The results of the present study suggest that preschool attendance is an important factor for early childhood researchers, professionals, and policymakers to consider. Surprisingly few studies have examined daily attendance rates as potentially influential to moderating the gains that children experience from preschool participation, with work by Hubbs-Tait et al. (2002) offering one exception. As previously discussed, this study demonstrated that daily

preschool attendance may compensate for high family risk in promoting children's language skills and social competence. The present study expands upon this work by considering the importance of classroom quality within this relation. The present work provides additional support to this extant body of research suggesting that classroom attendance is important within the context of high-quality classrooms, particularly when language facilitation is a primary goal. Future applied studies that consider approaches to heightening classroom quality within targeted enrollment preschool programs and means for increasing children's daily attendance rates within such programs will be influential for translating the present findings to public policy initiatives.

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