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Development of Academic Skills from Preschool Through Second Grade: Family and Classroom Predictors of Developmental Trajectories

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Children's experiences with their parents and teachers were related to the acquisition of academic skills from preschool through second grade. Individual and group growth curves were estimated, and individual patterns of change were predicted from selected demographic, family, and classroom characteristics to identify multiple pathways to early academic competence. Standardized assessments of language and academic skills and parent and teacher surveys were collected on 511 children beginning in the second-to-last year of child care through the third year of elementary school. As expected, children tended to show better academic skills across time if their parents had more education and reported more progressive parenting beliefs and practices. Statistical interactions between family background and teacher–child relationships indicated that a closer relationship with the teacher was positively related to language skills for African-American children and to reading competence for children whose parents reported more authoritarian attitudes. These results provide further evidence that social processes in classrooms are important for academic competence for children considered at risk for academic problems. © 2002 Society for the Study of School Psychology. Published by Elsevier Science Ltd

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Identification of factors that promote competence for children at risk for academic problems is necessary for successful implementation of current state and federal policies that emphasize academic competence for all

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children. Whereas much is known about family and classroom factors that promote academic competence for all children, developmental theory suggests that classroom processes may be especially important for children who may enter school at higher risk for academic problems. It is well established that children's early acquisition of academic skills is promoted by stimulating and responsive parenting practices, early literacy and numeracy experiences, and positive experiences with adults in child care and in the classroom (Committee on Early Childhood Pedagogy, 2000). Ecological theories posit that interpersonal interactions, such as those between children and teachers, may differentially impact children's development depending on the child's personal characteristics and family context (Bronfenbrenner & Morris, 1998). In this study, we explored whether the interpersonal interactions between a child and his or her teachers may provide a possible pathway to competence for children who enter school at risk for academic problems due to family characteristics.

The influence of family characteristics on academic performance in the early school years is well established (e.g., Entwisle & Alexander, 1999; Pianta & McCoy, 1997). Children from more affluent families and children with more highly educated parents are likely to perform well on a range of cognitive and social tasks at school age and to show positive change over time (Duncan & Brooks-Gunn, 1997; Huston, McLoyd, & Garcia Coll, 1994; Neisser et al., 1996; Patterson, Kupersmidt, & Vaden, 1990). Aspects of parenting such as the emotional tone of parent-child interactions, parent discipline styles, or beliefs about child-rearing practices, as well as more global demographic characteristics, also are associated with performance in school (Bradley, Corwyn, Burchinal, McAdoo, & Garcia Coll, 2001; Pianta & Harbers, 1996).

Whether family characteristics predict school competence in the same manner for all children has been debated. For example, there is some evidence that the role of parents' beliefs about parenting practices in the development of social and cognitive competence may differ according to social class or ethnic background. Whereas more optimal child outcomes are associated with more authoritative beliefs for middle-class white children (Miller, 1988), these relations have not been consistently observed among African-American families, especially among families living in poverty (Dornbusch, Ritter, Liederman, Roberts, & Fraleigh, 1987; Lamborn, Dornbusch, & Steinberg, 1996).

It is widely believed that the child's development of early academic skills is also influenced by experiences in child care (Lamb, 1998a, 1998b; NICHD ECCRN, 2000) and the school classroom (Alexander & Entwisle, 1988; Graue, 1999). Child care and school experiences have been shown to predict language and academic skills independently from family experiences, although family experiences tend to be stronger

predictors (NICHD ECCRN, 2000). The relationships that an individual child forms with his or her teachers appear to be a particularly important aspect of classroom experiences. It is believed that young children are better able to attend to and learn from adults with whom they have close relationships than from adults with whom they have detached or have conflicted relationships (Pianta, 1999). Based on attachment theory, the model posits that if children feel emotionally secure and can communicate effectively with their teachers, children will be better able to devote their energies and attention to learning (Howes, 1999; Pianta, 1999). Empirical evidence from at least two studies supports this theory. In prior analyses of this sample from the Cost, Quality, and Outcomes Study, both the quality of classroom practices and the closeness of the teacher-child relationships independently predicted children's language, cognitive, and social skills in preschool (Peisner-Feinberg & Burchinal, 1997). Recent analysis of another large longitudinal data set indicates that teacher-reported negativity in child-teacher relationships predicts poorer academic performance on standardized tests, lower grades in academic subjects, poorer ratings of positive work habits, and more disciplinary infractions through early elementary school (Hamre & Pianta, 2000). These associations were obtained even after adjusting for child cognitive ability and teacher ratings of classroom misbehavior. These two studies suggest that child-teacher relationships are a salient aspect of experience in out-of-home settings, at least during the preschool to early elementary school period.

Developmental theory suggests that the relation between these two environmental contexts, the classroom and the family, is important in predicting developmental patterns and identifying multiple pathways to competence (Bronfenbrenner & Morris, 1998). An important policy question involves whether aspects of child care and school experiences can serve as protective factors for children from high-risk family contexts. In some prior research, higher quality child care buffered the negative impact of poverty on children's language and academic development (Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Lamb, 1998a, 1998b). Extant longitudinal analyses suggest that child-teacher relationships moderate child characteristics in relation to early school outcomes, and in turn, have mediated effects on outcomes through eighth grade (Hamre & Pianta, 2000). In their recent analysis of longitudinal data, Hamre & Pianta (2000) report that child-teacher relationship quality moderated the relation between several child characteristics and later school outcomes. For example, the extent to which child misbehavior in the kindergarten classroom predicted later disciplinary infractions was different for kindergarten teachers who reported negative versus positive relationships with the child. Child misbehavior was a strong predictor if the kindergarten teacher reported a negative

relationship and a weak predictor for misbehaving children with positive child–teacher relationships.

Most studies have not examined patterns of change over time in the acquisition of academic skills even though it is widely believed that the child's development is influenced by the cumulative impact of the child's experiences within the family and other contexts such as the classroom. In this study, we were interested in identifying family beliefs and practices and teacher–child relationships as predictors of pathways to academic competence for children from diverse social class and ethnic backgrounds. Specifically, the purpose of the study was to identify child, family, and classroom factors that predicted developmental levels or rates of change over time in academic skills from preschool to elementary school, in order to identify pathways to competence.

METHOD

Participants

The participants included 511 children who had at least 2 years of data in the Cost, Quality, and Outcomes Study (CQO). The CQO study involved two stages of sampling, both of which occurred in the first year of the study. First, child care centers were selected. The CQO study first identified four states representing varying levels of stringency in state child care regulations—California, Colorado, Connecticut, and North Carolina. Data were collected in the fall and winter of 1992 on a stratified random sample (half for-profit and half nonprofit per state) of 401 licensed full day, full year child care centers. If the center had only one or two classrooms, those classrooms were selected. Otherwise, two classrooms were randomly selected at each center. An infant or toddler classroom and a preschool classroom were selected if possible. Two preschool classrooms were selected if the center did not serve infants or toddlers, and two infant classrooms were selected if the center did not serve preschoolers.

Second, children were recruited at participating centers if the center included a classroom in which children were two years from entering kindergarten. Only the preschool classrooms serving children who planned to enter kindergarten in the Fall of 1994 were included in the outcomes portion of the study (see [Peisner-Feinberg & Burchinal, 1997](#) for details). Children were recruited if (1) they were of an age to enter kindergarten in the fall of 1994; (2) they had been enrolled in the target classroom during the classroom observation data collection phase; (3) they were expected to attend the same center the following year; and (4) they spoke English and the primary language spoken in the child's home was English. All eligible children in the classroom were invited to participate in the study, and up to

12 children could be randomly selected from those with parent permission to participate.

Five waves of longitudinal data were collected. Data were collected in the spring of the child's second-to-last year of child care, spring of the child's last year of child care, spring of kindergarten, and spring of the child's second grade year. Of the 511 children included in this sample, 487 children (271 girls) also had data in Year 2, 399 children (226 girls) had data in Year 3, and 367 children (201 girls) also had data in second grade. The mean age of the children at the first data collection year was 51.6 months (S.D.=4.32), at the second data collection year (last year of child care) 61.44 months (S.D.=4.06), at the third data collection year (kindergarten) 72.40 months (S.D.=4.11), and in the fifth year (second grade) 96.4 months (S.D.=4.11). In the first year of data collection approximately 66% of the children were white, 15% were African-American, 5% Latino, 4% Asian-American, and the remainder of mixed racial background. Approximately 79% of the children in the second grade sample were white, 8% were African-American, 6% Latino, 5% Asian-American, and the remainder of mixed racial background. The education level of the mothers of the children in the first year of the study averaged some college ($M=14.76$ years; S.D.=2.29; range 10–20).

Excluded from analyses were children without at least one measure of parental attitudes, one measure of parenting practices, teacher report of closeness, maternal report of education and ethnicity, and child assessments. Most of the excluded children could not be located after the first year, and therefore their parents were never asked to complete a measure of parenting practices. Comparisons of the 511 children included in these analyses and the 317 children excluded due to missing data indicated that included children tended to have mothers with slightly more education ($M=14.5$ and 13.6 years), were more likely to be white (75% and 54%), had slightly closer relationships with their teachers in the first year ($M=4.08$ and 4.22 years), and had parents with more progressive attitudes about parenting ($M=3.30$ and 3.55 years). No differences emerged when the two groups were compared on gender.

Procedures

Repeated assessments of the children's academic skills and of their relationships with the teachers were collected. In Years 1, 2, 3, and 5 of the study children were individually assessed using standardized measures of receptive language and academic skills. The first two standardized assessments were conducted in child care, the third assessment in kindergarten, and fourth assessment in the second grade classrooms.

Each standardized assessment took approximately 30 min to complete. In each data collection year, joint training in child assessments was provided for the data collectors from all sites. Site coordinators monitored individual data collectors throughout the data collection process. In addition, teachers completed the Student–Teacher Relationship Scale (Pianta, 1994) for each child in each year of data collection. Different aspects of the family were assessed in each year of data collection.

Demographic characteristics. Parents were asked in the first year of the study to list the child’s ethnicity and gender and the mother’s education.

Child characteristics. The child’s social skills were rated by the teacher in the first year of the study with the *Classroom Behavior Inventory* (CBI) (Schaefer, Edgerton, & Aaronson, 1978). Forty-two items were rated for how typical they are of the child, using a 5-point likert scale from not at all to very much like. This scale has been widely used to study classroom behaviors in studies of child care (e.g., Haksins, 1985) and learning disabilities (e.g., Osborne, Schulte, & McKinney, 1991), with these teacher ratings of behavior demonstrating good association with observed behavior in the classroom in both studies. Two scales based on eight items described the child in terms of happiness, friendliness, sociable, and shyness. For example, one item asks the teacher to rate how much the following describes the target child “laughs and smiles easily and spontaneously in class”, on a scale from “Not at all like” (1) to “Very much like” (5). An extroversion composite was formed from the extroversion and introversion (reversed) scales, with an α of .83.

Parenting beliefs, and practices. In every data collection year, parents completed family survey forms including information on demographics and parenting beliefs and practices. Parents completed the Rank Order of Parental Values (Schaffer & Edgerton, 1985) in Year 1, the Home Screening Questionnaire (Frankenburg & Coons, 1986) in Year 2, the Family Routines Questionnaire (Boyce, Jensen, James, & Peacock, 1983) in Year 3, the Parenting Stress Index (Abidin, 1990) in Year 4, and the Parent Beliefs Scale (Schaffer & Edgerton, 1985) in Year 5. The type of information collected in each year varied because we included a single parenting questionnaire in each annual contact to avoid burdening the parents.

In Year 1, parents computed the *Rank Order of Parental Values* (Schaffer & Edgerton, 1985), which asks parents to rank order statements concerning things children should learn, e.g., to think for him/herself; to keep things neat and in order. The measure distinguishes between authoritarian and authoritative parenting beliefs, and has been related to observations of

parenting and children's adjustment to school (Campbell, Goldstein, Schaefer, & Ramey, 1991). For example, one item asks the parent to rank order these five statements "How important is it for your child to: (a) think for him/herself, (b) keep him/herself and his/her clothes clean, (c) be curious about many things, (d) be polite to adults, (e) be kind to other children." Factor analysis with varimax rotation identified two of the original three subscales. The factor analysis resulted in four factors, two of which were used in these analyses. These were: nonconformity (combining items related to cleanliness, politeness, neatness, or good manners), $\alpha=.81$ and curiosity (combining items related to curiosity, imagination, interest in how and why), $\alpha=.79$, and scores computed as the mean of item ranks can range from 1 (very low) to 5 (very high).

In Year 2, parents completed the *Home Screening Questionnaire* (Frankenburg & Coons, 1986), which is a self-administered adaptation of the Home Observation for Measure of the Environment (HOME) scale. Frankenburg reported high correlations with observations of the family environment on the HOME. An example item asks "How often do you and your child get a chance to play together (like pretend games, dolls house, cars and trucks, or table games)?" with response options of "(a) hardly ever, (b) at least once a week, (c) at least three to four times a week, and (d) everyday." The Home Screening Questionnaire captures parental perceptions of the availability of social, emotional and cognitive support within the home. We used a single total score from this measure, $\alpha=.67$.

In Year 3, parents completed the *Family Routines Questionnaire* (Boyce et al., 1983). This instrument was designed to measure an individual family's enactment of positive routines that are considered supportive for family members: workday routines, weekend and leisure time, children's routines, bedtime, meals, extended family, leaving and homecoming, disciplinary routines, and chores. An example item asks how often the "Parent and child play together" with responses of "everyday, three to five times a week, one to two times a week, and almost never". This tool has been widely used in research on a diverse range of families. We used factor analysis to derive three subscales. One subscale was included in analyses, parent-child interactions (parents have time to talk to children, parents and children play together, children have regular bedtimes, parents read stories to children, parents have regular play times with children, and children do special things at bedtime), $\alpha=.67$.

In Year 4, parents were asked to complete the *Parenting Stress Index* (Abidin, 1990), a widely used measure of parent perceptions of their concerns about being parents and their relationship with their child. An example item asks the parent to rate the degree to which they agree with this statement "My child smiles at me much less than I expected." We used the short form of this instrument and included the parental distress scale ($\alpha=.93$) in analyses.

In Year 5, parents completed the *Parent Modernity Scale* (Schaffer & Edgerton, 1985), measuring the extent to which parents maintain parenting beliefs that are more “traditional” or authoritarian versus more “modern” or child-centered. Parents were asked to indicate how much they agree with statements like “Children will not do the right thing unless they must.” This measure has showed to be highly correlated with measures of parenting and child outcomes (NICHD ECCRN, 2000). The two scales, modernity ($\alpha=.66$) and traditional ($\alpha=.88$), had acceptable α levels and were used in this analysis.

Classroom experiences. Teacher perceptions of their relationship with each child were assessed with the Student–Teacher Relationship Scale (STRS, Pianta, 1994). The STRS is a 30-item, 5-point scale that yields two primary scale scores, closeness and conflict. A widely used assessment of a teacher’s view of their relationship with a particular student, the scale scores predict teachers’ ratings of children’s classroom behavior, academic outcomes, and with retention in school for school-age children (Hamre & Pianta, 2000; Pianta, Steinberg, & Rollins, 1995). An example item asks the teacher to indicate how much this statement described her relationship with the target child “I share an affectionate, warm relationship with this child”, with responses ranging from 1—“definitely does not apply” to 5—“definitely applies”. The closeness scale was used in the present study as a primary predictor of interest. This scale assesses the degree of warmth, positive emotions, and open communication between child and teacher ($\alpha=.82$) and can range from 1 (very low) to 5 (very high).

Children’s developmental outcomes. The *Peabody Picture Vocabulary Test-Revised* (PPVT-R) (Dunn & Dunn, 1981) provided a measure of receptive language comprehension. This instrument is designed for use from 2.5 years old to adulthood, and the format is appropriate for young preschool children, requiring them to point to the picture that matches the word spoken by the examiner. PPVT-R raw scores are converted into standard scores based on age with a mean of 100 and a standard deviation of 15, derived from a national standardization sample. The PPVT-R has acceptable split-half and test–retest reliability, is well correlated with other measures of vocabulary, and is moderately predictive of school achievement.

Reading and math subtests of the *Woodcock–Johnson Tests of Achievement-Revised*, WJ-R (Woodcock & Johnson, 1990) were used to measure children’s reading and mathematical achievement. The reading subtest was Letter–Word Identification and the math subtest was Applied Problems. Internal consistencies were reported in the manual as 0.92 and 0.91 for the two scales, respectively. Rasch scores were used in the analysis, which

allowed for calculation of individual growth over time in the longitudinal data.

RESULTS

Analyses identified child, family, and classroom characteristics related to the development of academic skills during the preschool to through the third year of elementary school.

Descriptive Analyses

Parenting beliefs and practices. Descriptive data for the measures of family demographic characteristics and parenting beliefs and practices are in [Tables 1 and 2](#). On average, parents reported that they were progressive in parenting beliefs, positive in parenting practices, and experienced relatively low levels of parental distress (see [Table 1](#)). However, the standard deviations and ranges indicate considerable variability. The family measures tended to be modestly to moderately correlated. Pearson product moment correlations among parenting beliefs and practices are in [Table 2](#). As expected, although these measures were collected over time, parental reports of beliefs and practices are associated in conceptually consistent ways.

Table 1
Descriptive Information

	Data Collection	<i>n</i>	Mean	S.D.	Range
<i>Demographic characteristics</i>					
Maternal education	Year 1	511	14.44	2.31	10–20
Ethnicity (% white/non-Hispanic)	Year 1	511	75%		
<i>Child characteristics</i>					
Gender (% male)	Year 1	511	51%		
CBI extroversion/introversion	Year 1	511	4.03	0.67	1.5–5
<i>Parenting beliefs and practices</i>					
Rank order of parental values	Year 1				
Nonconformity		505	3.55	0.87	1–4.5
Curiosity		505	3.65	1.06	1–5
Home screening questionnaire	Year 2	428	44.58	5.02	14–53
FRI parent–child interaction	Year 3	358	2.31	0.43	0.71–3.0
PSI parental distress	Year 4	360	67.95	17.80	36–136
Modernity scale	7Year 5				
Modernity		341	33.69	3.60	21–40
Traditional		341	56.18	14.43	25–103

Note. Year 1 is the second to last year of child care, Year 2 is the last year of child care, Year 3 is kindergarten, Year 4 is first grade, and Year 5 is second grade.

Table 2
Associations Among Parenting Beliefs and Practices

	Correlations							Factor Loadings	
	1	2	3	4	5	6	7	Factor 1	Factor 2
<i>Parenting beliefs</i>									
(1) ROPV nonconformity	1.0							.81	.10
(2) Curiosity	.27***	1.0						.58	.09
(3) Mod. progressive	.29***	.14*	1.0					.51	-.13
(4) Mod. traditional	-.50***	-.26***	-.20***	1.0				-.72	-.21
<i>Parenting practices</i>									
(5) HHSQ total	.38***	.29***	.08	-.30***	1.0			.34	.73
(6) FRI parent-child interaction	.08	.13*	.02	-.09	.40***	1.0		.00	.78
(7) PSI parental distress	-.07	-.04	-.04	.08	-.27***	-.25***	1.0	.10	-.70

Note. Reported are Pearson Product Moment correlations in the first seven columns and factor loadings in the final two columns.

* $p < .05$.

*** $p < .001$.

Composite family measures were created based on the assumption that parents' child-rearing beliefs and attitudes tend to be stable over time (Burchinal, Campbell, Bryant, Wasik, & Ramey, 1997; Sameroff, Seifer, Baldwin, & Baldwin, 1993). We used factor analysis to create two summary scores representing parenting beliefs and practices over time. The seven parenting beliefs and practices scores were entered into a factor analysis with varimax rotation. Two factors emerged: Progressive beliefs (high positive factor loadings on first year nonconformity and curiosity scores and negative loading on the fifth year traditional beliefs score) and Positive practices (high positive loadings for the Home Screening Questionnaire total and FRQ parent-child interaction and negative loading for the PSI parental distress). We created two scores, beliefs and practices, from the mean of the standardized scores that loaded on each factor after reversing the scores for measures with negative loadings.

Developmental outcomes. Descriptive data for the developmental outcomes are in Table 3. As shown in Table 3, though children were slightly below average in verbal intelligence, and pre-reading in Year 1 of the study, by second grade the average scores on the developmental assessments were slightly above average. On average, the children tended to be rated as socially outgoing.

Table 3
Associations Between Developmental Outcomes and Selected Family, Child, and Classroom Predictors

	Developmental Outcomes Standard Scores							
	Descriptive Statistics			Correlations				
	<i>n</i>	M	S.D.	M Ed	Child Extrov	Parenting		T-C Closeness
					Beliefs	Practice		
<i>PPVT vocabulary</i>								
Year 1 (preschool)	511	97.6	16.6	.41***	.16***	.38***	.30***	.12**
Year 2 (preschool)	427	102.0	17.5	.38***	.18***	.40***	.40***	.16**
Year 3 (kindergarten)	345	104.9	15.6	.41***	.09	.37***	.28***	.10
Year 5 (second grade)	281	106.5	14.3	.27***	.07	.31***	.20***	-.05
<i>WJ Letter-word identification</i>								
Year 1 (preschool)	510	101.3	13.0	.27***	.09	.21***	.15***	-.00
Year 2 (preschool)	428	101.5	13.2	.20***	.06	.26***	.18***	.08
Year 3 (kindergarten)	345	102.7	14.9	.14**	.12*	.17**	.17**	.13
Year 5 (second grade)	282	116.5	15.6	.14*	.11	.20***	.17**	.02
<i>WJ applied problems</i>								
Year 1 (preschool)	483	104.8	13.4	.27***	.13**	.22***	.22***	.06
Year 2 (preschool)	428	106.6	15.0	.26***	.07	.22***	.29***	.05
Year 3 (kindergarten)	345	108.0	14.7	.27***	.13*	.20***	.22***	.06
Year 5 (second grade)	282	120.8	15.9	.22***	.19***	.18**	.21***	.04

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Correlations among measures. We then examined associations of developmental outcomes over time with the continuous family background (maternal education), child (extroversion), parenting (parental reports of parenting beliefs and practices), and classroom variables (teacher reports of closeness with the child). These associations are in Table 3. Maternal education, not surprisingly, was moderately correlated with outcomes at all ages, but was less correlated with reading skills after children entered kindergarten than while they were in child care. Child extroversion was associated with higher language scores when in child care and slightly higher reading and math skills somewhat inconsistently over time. Parent

reports of parenting beliefs and practices were modestly to moderately associated with receptive language and academic achievement over time. As can also be seen in [Table 3](#), teacher–child closeness was modestly correlated with receptive language only during the preschool years.

Predicting Developmental Trajectories

Hierarchical longitudinal analyses examined the children's developmental outcomes from age 4 through second grade. Hierarchical linear models (HLM) (Bryk & Raudenbush, 1992; Singer, 1998; Willett, Singer, & Martin, 1998) were conducted because these methods can appropriately describe the association between measures collected within nested designs. There were two levels of nesting in this study; children were recruited from child care classrooms, and then, longitudinal assessments of the children were collected. These methods appropriately analyze nested data by specifying that the nested factors are random variables, thereby estimating the degree of systematic correlation among assessments within each nested factor. The HLM methods can be viewed as a generalization of the multivariate repeated measures analysis of variance methods. Individual and group growth curves estimated simultaneously describe patterns of change in the outcome variables and identify factors related to those patterns of change. For this study, HLM offers several desirable advantages. We can (1) appropriately model information from two nested levels of the study, such as child and classroom; (2) include children with some missing data in analyses; (3) include as predictors time-varying covariates, such as longitudinal measures of the teacher–child relationship in the longitudinal analyses; and (4) allow for flexible specification of the within-subject and between-subject variance.

A separate analysis was conducted for each of three developmental outcomes: assessments of children's receptive language ability (PPVT-R standard score), reading ability (WJ-R Letter–Word Identification Rasch score), and math ability (WJ-R Applied Problems Rasch score). Patterns of development over time on these outcomes were predicted hierarchically from four blocks of predictors, along with state and year of data collection. State was entered in all analyses to represent the sampling frame including four sites of data collection. The variables of year and year-squared of data collection described the patterns of change over time in the outcome measures. Models were fit hierarchically to the data. The initial model included state, year, year-squared and all main effects of background, child, family, and classroom measures and their interactions with year. A quadratic between-subjects model was selected because we wanted to test for nonlinear patterns of change based on the four repeated assessments. Inclusion of a cubic term in preliminary models indicated that the quadratic growth curve was adequate to describe patterns of change over time.

Subsequent models tested whether interactions among background, child, family, and classroom blocks added substantially to predicting patterns of change in academic achievement.

The first model included the background, family, and classroom measures, along with state and year. The background block consisted of between-subject factors and included mother's education and child ethnicity (white/non-Hispanic = 1, not white = 0). To describe patterns of change over time, this set of variables also included interactions of year with mother's education and child ethnicity. The child block included two between-subjects variables, the child's CBI extroversion score and gender (male = 1, female = 0), and interactions between those variables and time. The family beliefs and practices block consisted of between-subjects predictors, and included the two factor scores (progressive beliefs and positive practices) and interactions between each factor and year. The classroom block consisted of time-varying variables, including the STRS teacher-child closeness rating each year and the interaction between this rating and year.

The next models added blocks of interaction terms. In each case, if the block significantly added to the model, then the significant interaction terms were retained in subsequent analyses. If the interaction block did not substantially add, it was not included in subsequent models. The second model added interactions of the family variables with the variables in the background and child blocks to the first model. The third model added interactions of the classroom variables with the background and child variables. The final model added interactions between the family and classroom variables. Interactions were retained in the model in each step only if the interaction block was statistically significant and the specific interaction term was significant.

Results from the final analyses in [Table 4](#). We do not present results from models in which adding blocks of interactions did not significantly enhance the fit of the model, although those results were used to decide which interactions should be included in the final model.

Receptive vocabulary. As shown in [Table 4](#), analysis of the children's PPVT indicated that the children showed marked individual differences in both their mean level of vocabulary [$\chi^2_{(1, n=511)} = 137.4, p < .001$] and their rate of change over time [$\chi^2_{(1, n=511)} = 3.76, p = .026$]. The children showed increases over time relative to the PPVT-R norming population, displaying both linear [$F(1, 528) = 11.0, p < .001$] and quadratic patterns of change [$F(1, 528) = 28.1, p < .001$]. The children tended to score below the mean of the norming population when assessed in their second to last year in child care, but they tended to show rather marked gains in ranking relative to the norming population in the next 2 years and maintained those gains between kindergarten and second grade.

Table 4
HLM Analyses: Individual and Group Growth Curve Parameter Estimates^a

		PPVT	WJ-Applied Problems	WJ-Letter-Word Identification
<i>Individual curve</i>				
Intercept	σ^2 (S.E.)	102.31*** (8.73)	98.21*** (8.86)	254.76*** (21.18)
Slope	σ^2 (S.E.)	2.17 (1.12)	7.20*** (1.79)	9.74*** (2.60)
Intercept, slope	σ (S.E.)	-1.03 (2.13)	-6.91** (2.49)	6.44 (5.58)
<i>Group curve</i>				
State ^b		***	**	***
Year	<i>B</i> (S.E.)	1.59** (0.48)	16.64*** (0.55)	28.25*** (0.73)
Year-squared	<i>B</i> (S.E.)	-0.72*** (0.14)	0.94*** (0.14)	3.54*** (0.19)
Background ^b		***	***	**
M. Education	<i>B</i> (S.E.)	1.55*** (0.25)	1.07*** (0.25)	0.83* (0.39)
M. Ed × Year	<i>B</i> (S.E.)	-0.18 (0.09)	-0.09 (0.11)	-0.31* (0.14)
Ethnicity ^c	<i>B</i> (S.E.)	8.30*** (1.32)	2.94* (1.32)	2.15 (2.03)
Ethnic × Year	<i>B</i> (S.E.)	-0.21 (0.50)	0.01 (0.57)	1.62* (0.76)
Child			**	*
Gender ^d	<i>B</i> (S.E.)	-0.36 (1.05)	-0.52 (1.05)	-3.66* (1.62)
Gender × Year	<i>B</i> (S.E.)	0.72 (0.38)	0.43 (0.45)	-0.92 (0.59)
Sociability	<i>B</i> (S.E.)	0.49 (0.38)	1.42*** (0.40)	1.48** (0.56)
Sociab. × Year	<i>B</i> (S.E.)	-0.25 (0.23)	0.14 (0.26)	0.40 (0.34)
Family ^b		***	**	*
Practices	<i>B</i> (S.E.)	2.18** (0.68)	2.38*** (0.68)	3.01** (1.05)
Practice × Year	<i>B</i> (S.E.)	-0.04 (0.26)	-0.08 (0.30)	0.47 (0.40)
Beliefs	<i>B</i> (S.E.)	3.56*** (0.86)	0.23 (0.86)	1.52 (1.32)
Beliefs × Year	<i>B</i> (S.E.)	-0.14 (0.31)	-0.07 (0.36)	-0.11 (0.48)
Classroom ^b		*		
T-C Closeness	<i>B</i> (S.E.)	0.73 (0.67)	-0.67 (0.39)	-0.14 (0.54)
T-C Closeness × Year	<i>B</i> (S.E.)	-1.03* (0.41)	-0.08 (0.26)	-0.35 (0.36)
Background × Family ^b				
Ethnicity × Beliefs	<i>B</i> (S.E.)			
Ethnicity × Beliefs × Year	<i>B</i> (S.E.)			
Background × Classroom ^b		**		
Ethnicity × T-C Closeness	<i>B</i> (S.E.)	-0.71 (0.74)		
Ethnicity × T-C Closeness × Year	<i>B</i> (S.E.)	1.18** (0.45)		
Family × Classroom ^b				*
Beliefs × T-C Closeness	<i>B</i> (S.E.)			-1.42* (0.66)
Beliefs × T-C Closeness × Year	<i>B</i> (S.E.)			-1.13** (0.40)

^a Standard errors of parameters estimates are listed in parentheses.

^b Significance levels from block tests are indicated by asterisks.

^c For ethnicity, white = 1.

^d For gender, male = 1.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

The children's patterns of change over time were related to the background characteristics [$F(4,528) = 23.8, p < .001$], family measures [$F(4,528) = 9.46, p < .001$], the classroom variable [$F(2,528) = 4.56, p = .011$], and interactions between background and classroom variables [$F(2,528) = 4.66, p = .001$]. Overall, children tended to show more advanced receptive language if their mothers had more education and their parents reported more progressive parenting beliefs and positive parenting practices. A three-way interaction among ethnicity, time, and teacher-child closeness meant that the associations among PPVT scores with ethnicity and teacher-child closeness changed over time. Teacher-child closeness was more strongly related to PPVT scores for children of color than for white children, and this association changed over time. Teacher-child closeness was a substantially stronger predictor of children's language during the child care years than later for children of color, but was not strongly related for white children in any year. The regression coefficients for teacher report of closeness for children of color ranged from 2.80 (S.E. = 0.94, $p = .003$) when the children were 4 years of age, 1.99 (S.E. = 0.71, $p = .005$) when the children were 5 years of age, to being not reliably different from 0 when the children were in kindergarten and second grade. Using the 75th and 25th percentile scores to indicate a close and not close relationship, the predicted score in Year 1 for children of color who experienced a close relationship with their teacher was 92.2 whereas the predicted mean in Year 1 for children who did not experience a close relationship was 88.7. This is an effect size of $3.5/8.9 = 0.39$ when the residual standard deviation is used as the denominator for computing effect sizes. In contrast, the regression coefficient was not reliably different from zero at all ages for white children.

Math. Children's math skills increased dramatically, as expected, between 4 and 8 years of age. Children displayed systematic individual differences in their overall math level (intercept: $\chi^2_{(1, n = 511)} = 123.0, p < .001$) and rate of change over time (slope: $\chi^2_{(1, n = 511)} = 16.24, p < .001$). Children with lower scores initially were slightly more likely to show greater gains, resulting in a correlation between slope and intercept of $r = -.26$ ($p = .005$). Overall, children showed both linear [$F(1,513) = 921.8, p < .001$] and quadratic [$F(1,513) = 43.56, p < .001$] patterns of change. As shown in Table 3, the children, on average, scored close to the norming mean at the first three assessment points, and scored a full standard deviation above the norm in second grade.

Individual patterns of change in the Rasch scores on the Applied Problems subscale over time were significantly related to background characteristics [$F(6,513) = 6.34, p < .001$], child characteristics [$F(4,513) = 3.47, p < .01$], and family variables [$F(4,513) = 3.47, p < .01$]. Children who scored higher on this math test tended to have mothers with more education, be

white, be rated as more socially extroverted, and have parents who reported more positive parenting practices. Maternal education, extroversion, and the parent's report of parenting practices were the strongest predictors of math skills across time.

No significant interactions were found in subsequent models.

Reading. Children's basic reading skills also increased dramatically between preschool and second grade. Children showed marked individual differences in their mean level (intercept: $\chi^2_{(1, n=511)} = 144.5, p < .001$) and rate of change over time (slope: $\chi^2_{(1, n=511)} = 14.01, p < .001$). Children's initial reading levels were not significantly correlated with their rates of acquisition over time. Children tended to show both linear [$F(1, 527) = 1495.9, p < .001$] and quadratic [$F(1, 527) = 346.1, p < .001$] rates of change over time. As shown in Table 3, the children showed modest gains in their ranking relative to the norming population between child care and kindergarten and large gains between kindergarten and second grade.

Individual patterns of change were related to the background variables [$F(4, 527) = 4.50, p < .01$], child characteristics [$F(4, 527) = 3.14, p = .014$], family factors [$F(4, 527) = 2.91, p = .021$], and the interaction among the family and classroom variables [$F(2, 527) = 2.91, p = .021$]. On average, children tended to score higher if their mothers had more education, they were female, they were more extroverted, and their parents reported more positive parenting practices. The rate of change over time was more positive if the child was white, and slightly less positive if the child's mother had more education. For example, the anticipated difference between children whose mothers had 16 and 12 years of education was 2.54 points in kindergarten, but this difference declined over time. Children whose mothers had 12 years of education were expected to gain 28.1 points per year, whereas the children whose mothers had 16 years of education were expected to gain 27.4 points per year.

The significant interaction among the family and classroom variables indicated that teacher-reported closeness with the child was more positively related to gains over time in reading scores when the child's parents reported less progressive parenting attitudes. For children whose parents reported more progressive parenting attitudes, teacher-child closeness was a positive predictor of reading scores during the preschool year, but not during kindergarten or second grade. In contrast, for children whose parents reported less progressive attitudes, teacher-child closeness was a positive predictor of reading scores during kindergarten and especially second grade, but not during the preschool years. Indeed, among children whose parents reported more traditional attitudes, gains in reading over time were predicted by teacher-child closeness. For example, among children whose parents' beliefs score was at the 25th percentile, children

experiencing higher levels of teacher–child closeness (75th percentile) gained 2.1 more points over time than children experiencing lower levels of closeness (25th percentile). This is an effect size of about 0.17 (residual standard deviation = 12.23).

DISCUSSION

The results from this study provide further evidence that there are multiple pathways to academic competence in the early school years. Overall, in the present study as in many others (e.g., [NICHD ECCRN, 2000](#)), family characteristics were the best predictors of children’s outcomes. However, this study also provides further evidence that teachers’ perceptions of the closeness of their relationship with the individual child serves as an alternative pathway competence for children who may be at risk for lower achievement due to family characteristics ([Entwisle & Alexander, 1999](#); [Hamre & Pianta, 2000](#)). A close relationship with the teacher predicted better language skills for children of color and reading skills for children whose parents held more authoritarian parenting views.

Family characteristics such as maternal education and parents’ caregiving practices and parenting attitudes were the strongest predictors of child outcomes, even among these children who experienced full-time nonparental child care. Although several studies of children in child care suggest that characteristics of the child care setting, especially qualities of the teacher–child relationship, may provide better prediction of outcomes for children who experience extensive child care ([Egeland & Heister, 1995](#); [Howes, Hamilton, & Phillipsen, 1998](#); [Howes, Matheson, & Hamilton, 1994](#); [Pierrehumbert, Ramstein, Karmaniola, & Halfon, 1994](#)), a report from the NICHD Study of Early Child Care ([ECCRN, 1998](#)) indicated that family demographics, parenting beliefs, and parenting styles provided equally good prediction of early childhood outcomes for children reared exclusively by their parents compared to children experiencing early and extensive child care. The results from the present study provide further evidence that family characteristics provide good prediction of outcomes from early to middle childhood among children in extensive child care, even when those family characteristics are measured cross-sectionally using parental report rather than longitudinal direct observations.

Further, as with other research, we found that attributes of the child predicted academic achievement through elementary school. That children viewed as more outgoing acquired reading and math skills more rapidly in elementary school is consistent with reports that social competencies and academic skills are not functionally independent in the early elementary years ([Campbell et al., 2001](#); [Hamre & Pianta, 2000](#)). Children

rated as more out-going and friendly in preschool tended to have higher scores on both academic achievement tests, but not higher language scores. As has been reported in a number of studies (e.g., Alexander & Entwisle, 1988; Patterson et al., 1990), girls tended to have better reading skills than boys.

In addition to confirming the role of family background, beliefs, and practices as fundamental to children's success in the early school years, this study's results support a growing body of evidence suggesting that experiences with adults in child care settings and the early school years also can enhance children's success in school (e.g., Hamre & Pianta, 2000; Pianta et al., 1995). Like those studies, this study suggests that social and emotional processes involved in relationships between children and teachers, particularly when reported on by teachers, are an important aspect of classroom experiences related to the children's acquisition of academic skills. In the present study, a close relationship with one's teachers appeared to enhance the acquisition of reading skills for children whose parents espouse more authoritarian beliefs and of language skills for children of color. Whereas previous research has indicated that children whose parents have more authoritarian beliefs and children of color are at greater risk for experiencing difficulties acquiring reading and math skills (Entwisle & Alexander, 1999), our research extends those findings by suggesting that a close relationship with the teacher may serve as a protective factor for these children.

Whereas the observed effect sizes were small to moderate, and tended to be larger when children were younger, suggesting that close relationships between teacher and children is especially important for these children because they are especially at risk for experiencing academic problems and becoming unengaged with school (Dickinson & Sprague, 2002). The finding that teacher-report of close relationships predicts receptive language scores for children of color during the preschool years is important because receptive language is one of the best preschool predictors of academic competence during early elementary years (Committee on Early Childhood Pedagogy, 2000). The association between teacher-child closeness and reading skills for children whose parents have more authoritarian beliefs is consistent with views of Alexander and Entwisle's (1988, 1999), later extended by Pianta (1999). They believe that children, especially those who otherwise may be less able to access instructional resources in the classroom, must be engaged socially with classroom teachers to acquire the prerequisite knowledge and skills for learning within the classroom environment. These findings are consistent with findings from prior studies demonstrating that positive child-teacher relationships served as a protective factor in the acquisition of academic skills for children at risk for early school problems because of misbehavior or gender (Hamre & Pianta, 2000) or personality characteristics, such as an active, demanding interac-

tional style (Rimm-Kaufman & Pianta, 1999). Our finding is also somewhat similar to that reported by Dickinson et al. in longitudinal studies of Head Start children. They found that quality of teacher–child conversations predicted both the level and rate of change in vocabulary and word decoding of children as they entered into elementary school (Dickinson & Sprague, 2002). Future research might examine the role of teacher–child relationships in conjunction with specific conversational styles, teaching styles, and curricula to replicate these findings and further delineate classroom experiences that enhance academic skills for children at risk for academic problems.

The study has its limitations. First, our assessments of language, reading, and math skills, although objective and standardized, may not be as sensitive to classroom effects or growth as are observational measures or individualized criterion- or curriculum-referenced assessments (see Meisels, 1999). Second, we used the PPVT-R to measure language because it was the most widely used measure at the time the study was conducted. This measure has been criticized for being biased against African-American children and other children of color (Neisser et al., 1996). However, we adjusted for bias to some degree by including ethnicity as a main effect and therefore controlling for mean differences in total scores related to ethnicity when testing whether family or classroom variables predict developmental outcomes differently by ethnicity. Results suggest that associations between a predictor (teacher–child closeness) and the PPVT-R were stronger, not weaker, for children of color, providing a result in the opposite direction than one would expect if estimating that association was effected by biased measurement. Third, we relied on teachers' perceptions as indicators of the quality of their relationships with the children, and did not use observational or child-report indices (although child-report measures are problematic at these young ages, see Pianta, 1999). However, teacher report of relationships correlates with observations of teacher sensitivity in child care and classroom settings (Peisner-Feinberg & Burchinal, 1997) as well as child reports of relationship quality (Birch & Ladd, 1998; Cicchetti & Lynch, 1993).

In the main, these findings provide evidence that experiences in classrooms interact with aspects of developmental history to affect trajectories in language, reading, and math skills. As such, they support Bronfenbrenner's contention that developmental growth occurs through interactions between persons and contexts over time (Bronfenbrenner & Morris, 1998). Significant statistical interactions between and among family background and experiences in classroom settings sheds new light on the ways in which experiences in child care and formal educational settings contribute to alternative pathways toward competent outcomes, and reflects an important integration of developmental and educational perspectives. These findings provide further evidence that affective relationships

between teachers and children play an important role in the early acquisition of academic skills for at risk children, and should be considered along with issues such as curriculum in current policy initiatives designed to ensure no child is left behind.

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REFERENCES

- Abidin, R. R. (1990). *Parenting stress index* (3rd ed.). Charlottesville, VA: Pediatric Psychology Press.
- Alexander, K. L., & Entwisle, D. R. (1988). Achievement in the first 2 years of school: patterns and processes. *Monographs of the Society for Research in Child Development*, 53(2), 157.
- Birch, S. H., & Ladd, G. W. (1998). Children's interpersonal behaviors and the teacher-child relationship. *Developmental Psychology*, 34, 934-946.
- Boyce, W. T., Jensen, E. W., James, S. A., & Peacock, J. L. (1983). The family routines inventory: theoretical origins. *Social Science and Medicine*, 17, 193-200.
- Bradley, R. H., Corwyn, R. F., Burchinal, M., McAdoo, H. P., & Garcia Coll, C. (2001). The home environments of children in the United States: Part 2. Relations with behavioral development from birth through age 13. *Child Development*, 72, 1868-1886.
- Bronfenbrenner, U., & Morris, P. A. (1998). The ecology of developmental processes. In W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Vol. 1. Theoretical models of human development* (5th ed.) (pp. 993-1028). New York: Wiley.
- Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models*. Newbury Park, CA: Sage Publications.
- Burchinal, M. R., Campbell, F. A., Bryant, D. M., Wasik, B., & Ramey, C. T. (1997). Early intervention and mediating processes in cognitive performance of children of low-income African American families. *Child Development*, 68, 935-954.
- Campbell, F. A., Goldstein, S., Schaefer, E. S., & Ramey, C. T. (1991). Parental beliefs and values related to family risk indicators, educational intervention, and child academic competence. *Early Childhood Research Quarterly*, 6, 167-182.
- Campbell, F. A., Pungello, E. P., Miller-Johnson, S., Burchinal, M. R., & Ramey, C. (2001). The development of cognitive and academic abilities: growth curves from an early intervention educational experiment. *Developmental Psychology*, 37, 231-242.
- Cicchetti, D., & Lynch, M. (1993). Toward an ecological/transactional model of community violence and child maltreatment: consequences for children's development part of a symposium on: Children and violence. *Psychiatry*, 56, 96-118.

- Committee on Early Childhood Pedagogy (2000). Executive summary. In B. Bowman, M. S. Donovan, & M. S. Burns (Eds.), *Eager to learn: educating our preschoolers* (pp. 1–22). Washington, DC: National Academy Press.
- Dickinson, D. K., & Sprague, K. E. (2002). The nature and impact of early childhood care environments on the language and early literacy development of children from low-income families. In D. Dickinson, & S. Neuman (Eds.), *Handbook of early literacy research*. New York: Guilford Press.
- Dornbusch, S. M., Ritter, P. L., Leiderman, P. H., Roberts, D., & Fraleigh, W. (1987). The relation of parenting style to adolescent school performance. *Child Development, 58*(5), 1244–1257.
- Duncan, G. J., Brooks-Gunn, J. (Eds.) (1997). *Consequences of growing up poor*. New York: Russell Sage Foundation.
- Dunn, L. M., & Dunn, L. M. (1981). *Peabody picture vocabulary test-revised*. Circle Pines, MN: American Guidance Service.
- Egeland, B., & Hiester, M. (1995). The long-term consequences of infant day-care and mother–infant attachment. *Child Development, 66*, 474–485.
- Entwisle, D. R., & Alexander, K. L. (1999). Early schooling and social stratification. In R. C. Pianta, S. Rimm-Kaufmann, & M. Cox (Eds.), *The transition to kindergarten* (pp. 13–38). Baltimore, MD: Brookes Publishing.
- Frankenburg, W. K., & Coons, C. E. (1986). Home screening questionnaire: its validity in assessing home environment. *Journal of Pediatrics, 108*, 624–626.
- Graue, E. (1999). Diverse perspectives on kindergarten contexts and practices. In R. C. Pianta, S. Rimm-Kaufmann, & M. Cox (Eds.), *The transition to kindergarten* (pp. 109–142). Baltimore, MD: Brookes Publishing.
- Hamre, B., & Pianta, R. C. (2000). Early teacher–child relationships and children’s social and academic outcomes through eighth grade. *Child Development, 72*(2), 625–638.
- Haksins, R. (1985). Public school aggression among children with varying day care experience. *Child Development, 56*, 689–703.
- Howes, C. (1999). Attachment relationships in the context of multiple caregivers. In J. Cassidy, & P. R. Shaver (Eds.), *Handbook of attachment theory and research* (pp. 671–687). New York, NY: Guilford Publications.
- Howes, C., Hamilton, C. E., & Phillipsen, L. C. (1998). Stability and continuity of child–caregiver and child–peer relationships. *Child Development, 69*(2), 418–426.
- Howes, C., Matheson, C., & Hamilton, C. E. (1994). Maternal, teacher and child care history correlates of children’s relationships with peers. *Child Development, 65*, 264–273.
- Huston, A. C., McLoyd, V., & Garcia Coll, C. (1994). Children and poverty: Issues in contemporary research. *Child Development, 65*, 275–282.
- Lamb, M. E. (1998a). Assessments of children’s credibility in forensic contexts. *Current Directions in Psychological Science, 7*(2), 43–46.
- Lamb, M. E. (1998b). Fatherhood then and now. In A. Booth, A. C. Crouter, et al. (Eds.), *Men in families: when do they get involved? What difference does it make?* (pp. 47–52). Mahwah, NJ, USA: Lawrence Erlbaum Associates, Publishers.
- Lamborn, S. D., Dornbusch, S. M., & Steinberg, L. (1996). Ethnicity and community context as moderators of the relations between family decision making and adolescent adjustment. *Child Development, 67*, 283–301.
- Meisels, S. (1999). Assessing readiness. In R. C. Pianta, S. Rimm-Kaufmann, & M. Cox (Eds.), *The transition to kindergarten* (pp. 109–142). Baltimore, MD: Brookes Publishing.
- Miller, S. A. (1988). Parents’ beliefs about children’s cognitive performance over time. *Child Development, 59*, 259–285.
- Neisser, U., Boodoo, G., Bouchard, T. J., Boykin, A. W., Brody, N., Ceci, S. J., Halpern, D. F., Loehlin, J. C., Perloff, R., Steinberg, R., & Urbina, S. (1996). Intelligence: knowns and unknowns. *American Psychologist, 51*, 77–101.

- NICHD Early Child Care Research Network (1998). Relations between family predictors and child outcomes: are they weaker for children in child care? *Developmental Psychology*, *5*, 1119–1128.
- NICHD Early Child Care Research Network (2000). The relation of child care to cognitive and language development. *Child Development*, *71*, 958–978.
- Osborne, S. S., Schulte, A. C., & McKinney, J. D. (1991). A longitudinal study of students with learning disabilities in mainstream and resource programs. *Exceptionality*, *2*, 81–96.
- Patterson, C. J., Kupersmidt, J. B., & Vaden, N. A. (1990). Income level, gender, ethnicity, and household composition as predictors of children's school-based competence. *Child Development*, *61*, 485–494.
- Peisner-Feinberg, E. S., & Burchinal, M. R. (1997). Relations between preschool children's child-care experiences and concurrent development: the cost quality, and outcomes study. *Merrill-Palmer-Quarterly*, *43*(3), 451–477.
- Pianta, R. C. (1994). Patterns of relationships between children and kindergarten teachers. *Journal of School Psychology*, *32*(1), 15–31.
- Pianta, R. C. (1999). Enhancing relationships between children and teachers. Washington, DC, USA: American Psychological Association.
- Pianta, R. C., & Harbers, K. L. (1996). Observing mother and child behavior in a problem-solving situation at school entry: relations with academic achievement. *Journal of School Psychology* *34*(3), 307–322.
- Pianta, R. C., & McCoy, S. J. (1997). The first day of school: the predictive validity of early school screening. *Journal of Applied Developmental Psychology*, *18*(1), 1–22.
- Pianta, R. C., Steinberg, M. S., & Rollins, K. B. (1995). The first two years of school: teacher-child relationships and deflections in children's classroom adjustment. *Development and Psychopathology*, *7*(2), 295–312.
- Pierrehumbert, B., Ramstein, T., Karmaniola, A., & Halfon, O. (1994). Child care in the preschool years, behavior problems and cognitive development. Unpublished paper, Service Universitaire de Psychiatrie l'Enfant et del'Adolescent, Lausanne, Switzerland.
- Rimm-Kaufman, S. E., & Pianta, R. C. (1999). Patterns of family-school contact in preschool and kindergarten. *School Psychology Review*, *28*(3), 426–438.
- Sameroff, A., Seifer, R., Baldwin, A., & Baldwin, C. (1993). Stability of intelligence from preschool to adolescence: the influence of social and family risk factors. *Child Development*, *64*, 80–97.
- Schaffer, E., & Edgerton, M. (1985). Parental and child correlates of parental modernity. In I. E. Siegel (Ed.), *Parental belief systems*. Hillsdale, NJ: Erlbaum.
- Schaefer, E. S., Edgerton, M., & Aaronson, M. (1978). Classroom Behavior Inventory. Unpublished rating scale.
- Singer, J. (1998). Using Proc Mixed to fit multilevel models, hierarchical models, and individual growth curves. *Journal of Educational and Behavioral Statistics*, *24*, 323–355.
- Willett, J., Singer, J., & Martin, N. (1998). The design and analysis of longitudinal studies of development and psychopathy in context: statistical models and methodological considerations. *Development and Psychopathy*, *10*, 395–426.
- Woodcock, R. W., & Johnson, M. B. (1990). *Woodcock-Johnson psycho-educational battery revised*. Allen, TX: DLM Teaching Resources.