

Academic and Cognitive Functioning in First Grade: Associations with Earlier Home and Child Care Predictors and with Concurrent Home and Classroom Experiences

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Abstract. Family and child care experiences from birth to 54 months, achievement and social competence at entry to school, maternal sensitivity at first grade, and qualities of first-grade classrooms were used to predict academic and cognitive functioning at first grade for 832 children enrolled in the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care. Repeated assessments of functioning from preschool to first grade indicated that individual differences in academic and cognitive functioning over the course of two years were relatively stable. In regression models that predicted relative change in cognitive ability from 54 months to first grade, child gender and race, family income-to-needs ratio, maternal education and sensitivity, and home learning environment were significant predictors. Preschool academic cognitive functioning served as a significant mediator between child characteristics, early family factors, child care quality, and first-grade child outcomes. Children's social competence prior to school entry served a secondary yet significant mediating role between early experience and elementary school academic functioning. Upon controlling for early home and child care factors, classrooms that spent more time on literacy, language, and math instruction were associated with higher scores on tests of reading achievement, phoneme knowledge, and long-term retrieval.

Children's early school experiences are a matter of national concern as evidence consistently points to the significance of early achievement in predicting future educational accomplishments (Chen, Lee, & Stevenson, 1996). Although two-thirds of America's first-

time kindergartners appear to enter school proficient in the recognition of letters and even more can recognize numbers and shapes (West, Denton, & Germino-Hausken, 2000), this is perhaps a deceptively bright picture of current affairs. In contrast, children's preaca-

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For a further description of implications for policy and practice, the reader is referred to: www.nasponline.org/publications/sprsupplemental.html

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ademic skills upon entry into school vary consistently as a function of multiple risk factors (e.g., family poverty, race or ethnicity; Denton & West, 2002), and kindergarten teachers' views suggest widespread concern. A national sample of kindergarten teachers reported that they believed 30% of their current class showed moderate difficulty in adjusting to school and another 16% had more serious problems (Rimm-Kaufman, Pianta, & Cox, 2000).

Increasingly, early childhood is viewed as a sensitive period for the development of key cognitive, literacy, and language skills; in turn, these skills appear to be shaped by child characteristics and family, child care, and early classroom experiences (Morrison & Cooney, 2002; National Institute of Child Health and Human Development [NICHD] Early Child Care Research Network [ECCRN], 2002a). Identifying the relative contributions of early experiences at home and in child care to academic readiness prior to school entry is one goal of the current study. A second, perhaps more important goal, however, is to establish the persistence of these early influences relative to concurrent experiences in family and classroom contexts for the prediction of children's first-grade academic and cognitive functioning. Together, these closely linked goals can help to clarify the scope and foci of educational policy and practice related to the transition to school (Barbarin et al., 2004; Pianta & Cox, 1999).

It has been argued that pathways for later educational success or difficulty are formed during young children's early adjustment to school (Entwisle & Hayduk, 1988; Hamre & Pianta, 2001). Prekindergarten cognitive skills and math and reading achievement during first through third grade tend to be maintained into early and late adolescence (Reynolds, 1994; Stevenson & Newman, 1986), although there is clear evidence that stability is only moderate in the early grades (LaParo & Pianta, 2001). In addition, early academic problems place children at risk for grade retention and school dropout (Alexander, Entwisle, & Kabbani, 2002; Consortium of Longitudinal Studies, 1983). Because

apparently few opportunities occur after third grade to alter an academic development trajectory, understanding the factors that shape the early phases of achievement trajectory, during the preschool to primary-grade period, has implications for early mobilization of educational resources. These resources could then be targeted based on findings about the relative influence of child, family, child care, and classroom factors on children's cognitive skills and academic achievement. Weighing the relative contribution of early and concurrent experiences also provides a context for interpreting the effectiveness of school-based programs that seek to raise achievement.

Children's early experience within their family and aspects of family structure are consistently strong predictors of preacademic skills, as well as later academic achievement and cognitive functioning (Bornstein & Tamis-LeMonda, 1989; Estrada, Arsenio, Hess, & Holloway, 1987; McWayne, Hampton, Fantuzzo, Cohen, & Sekino, 2004; Morrison & Cooney, 2002). Maternal education and family income are key elements of family structure that have been associated with young children's academic outcomes, language development, and cognitive abilities (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Duncan & Brooks-Gunn, 1997; NICHD ECCRN, 2000). In addition, aspects of the parent-child relationship, in particular maternal sensitivity during parent-child play interactions, are especially robust predictors of children's academic competence in kindergarten and first grade, even after accounting for factors such as maternal education (NICHD ECCRN, 2002a; Pianta & Harbers, 1996; Sameroff, Seifer, Baldwin, & Baldwin, 1993). Relatedly, a stimulating home environment is another well-established element of the family associated with young children's academic and cognitive development (Bradley, Corwyn, Burchinal, Pipes McAdoo, & Garcia Coll, 2001). There is general consensus that early family context, and in particular parenting quality and the stimulation of language skills, tends to make a stronger contribution to children's development than other early childhood contexts (NICHD ECCRN & Duncan, 2003).

Early child care experiences, particularly high-quality care, also appear to enhance children's development of language and academic skills prior to school entry (Burchinal et al., 2002; NICHD ECCRN, 2000), even above and beyond the effects of the family environment as a "value-added" factor (NICHD ECCRN & Duncan, 2003). Across several naturalistic, longitudinal projects, including the Cost, Quality, and Outcomes Study, NICHD Study of Early Child Care, and the Multi-State Study of Prekindergarten, findings consistently demonstrate that quality experiences in a child care context predict language, cognitive, and achievement outcomes, after controlling for family selection factors such as socioeconomic status and parental sensitivity (Barbarin, Bryant, Burchinal, Clifford, Early, & Pianta, 2004; NICHD ECCRN, 2000; Peisner-Feinberg et al., 2001). Definitive evidence from quasi-experimental and experimental studies with samples of children who experience social and economic risks further indicates a positive effect of comprehensive, high-quality early child care and children's cognitive ability and academic success in elementary school through adolescence (Barnett, 1995; Burchinal, Campbell, Bryant, Wasik, & Ramey, 1997; Ramey & Ramey, 1998; Reynolds, 1999). Effects of the most thorough and concentrated of these early child care interventions are reported to have sustained into early adulthood, leading to positive academic achievement and increased rates of employment (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002; Yoshikawa, 1995). Further longitudinal examination of the effect that early family and child care experiences have on cognitive development and academic achievement is required to determine whether early effects on toddler and preschool development are maintained into the school years.

We expected that children's academic and cognitive functioning in first grade would be predicted by cumulative prior early experiences within their family and child care environments. And yet there is the distinct possibility that early family and child care experiences influence children's academic functioning in the early grades

mainly as a function of explained variance in achievement and social competence prior to school entry, which simply carries over into first grade. Early childhood context would then provide little unique prediction of children's academic achievement beyond kindergarten and into later grades. It is thus important to follow up original findings that early child care and family factors predict language development and preacademic skills in preschool and kindergarten (Belsky, 2001; NICHD ECCRN, 2002a) with additional inquiry into unique prediction at first grade, controlling for those associations with prior functioning.

Social and academic competence are fairly interrelated in the preschool and kindergarten years (Cooper & Farran, 1988; Ladd, Birch, & Buhs, 1999; McClelland, Morrison, & Holmes, 2000), so the present study examined both domains as mediators of the effects of early experience on first-grade cognitive and achievement outcomes. As an illustration, the National Center for Early Development and Learning Multi-State Study of Pre-Kindergarten indicated a positive contribution of teacher-child closeness (a social factor) to the growth of skill in naming letters (an academic outcome) across the prekindergarten year (Howes et al., 2005). We therefore tested two paths by which early family and child care experiences may indirectly influence first-grade functioning: by way of relations with preacademic skills that children sustain into school and through early social competence that provides a foundation for academic success following the transition into school.

The prediction of academic and cognitive functioning at the end of first grade necessitates additional attention to relevant contemporaneous factors, such as first-grade family experience and classroom context. Operating within a value-added perspective (Hanushek, 1999), it is important to account for previously measured functioning to understand whether first-grade classroom and family factors are associated with relative changes in academic and cognitive outcomes over the school transition period. The most recent *Conditions of Education* report from the Department of Education (Wirt, Choy, Provasnik, Rooney, Sen, & Tobin, 2003) indicated

that on average children's reading and mathematics skills increase steadily across the kindergarten to first-grade transition. However, on an individual basis academic and cognitive outcomes are marked by instability during this developmental period and therefore appear quite amenable to influence by concurrent change agents (LaParo & Pianta, 2001). For example, in one of the few prospective investigations of this issue, Bradley, Caldwell and Rock (1988) found that concurrent home context had stronger relations with the educational achievement of 10- and 11-year-olds than early childhood or cumulative experience of the home environment. These findings suggest that concurrent family processes need to be included in a predictive model of children's academic achievement. Also, the amount and type of direct instruction in elementary school has been linked to children's development of academic skills (Frazier & Morrison, 1998; Juel & Minden-Cupp, 2000). Global classroom factors of emotional and instructional support have been concurrently related to children's academic skills in kindergarten (Howes et al., 2005; Pianta, LaParo, Payne, Cox, & Bradley, 2002), whereas parallel first-grade classroom elements, such as teacher-child instructional conversations and evaluative feedback to students, are similarly related to academic performance (NICHD ECCRN, 2002b).

Using data from the NICHD Study of Early Child Care (SECC), the current study applied an ecological, developmental framework to the transition period between preschool and first grade. Initially, child characteristics and familial and child care factors—family demographics, maternal characteristics (depression, sensitivity), home learning environment, and two aspects of child care experience (quantity, quality)—were accumulated across the birth to kindergarten period and then examined in association with children's academic and cognitive functioning at the end of first grade (reading, math, phoneme knowledge, long-term retrieval, short-term memory, auditory processing, verbal comprehension). These predictions were then adjusted for academic and social competence measured prior to school entry. Finally, the same prediction model was supplemented with maternal sensi-

tivity at first grade and four elements of the first-grade classroom environment (instructional support, emotional support, mathematics instruction, and language and literacy instruction) to examine the value added of school experience for predicting individual differences in child academic and cognitive outcomes.

Method

Participants

Families were recruited through hospital visits to mothers shortly after the birth of a child in 1991 at 10 locations in the United States (Little Rock, AR; Irvine, CA; Lawrence, KS; Boston, MA; Philadelphia, PA; Pittsburgh, PA; Charlottesville, VA; Morganton, NC; Seattle, WA; Madison, WI). Recruitment and selection procedures have been described in several publications (see NICHD ECCRN, 2002a,b). Of the initial pool of eligible mothers contacted for participation, 1,364 completed a home interview when the infant was 1 month old and became study participants.

In the children's second year of school (which for most was first grade), 966 of the original participants were observed in their classrooms, and 832 of these 966 had complete or nearly complete information on all assessments included in this investigation. Descriptive statistics on this sample for all predictor variables used in this study are presented in Table 1, and bivariate correlations among outcomes are presented in Table 2. Mothers of these 832 children had an average of 14.58 years of education ($SD = 2.43$); 86% were partnered on at least one occasion between 6 months and first grade ($SD = 0.29$); and average family income across the 6 month to first-grade period was 3.87 times the poverty threshold ($SD = 2.75$). There were 419 males (50.4%) in the sample used in the present analyses and 139 of the children (16.7%) were non-White.

The sample used in analyses reported in this article was compared with children from the original group of 1,364 who were not included in these analyses because they either

Table 1
Descriptive Statistics for Predictors
in Analysis Models ($N = 832$)

Predictor	<i>M</i>	<i>SD</i>
Percentage partnered, 6–54 months	0.86	0.29
Maternal education at 1 month	14.58	2.43
Income-to-needs ratio, 6–54 months	3.87	2.75
Maternal depression, 6–54 months	9.20	5.45
Maternal sensitivity, 6–54 months*	0.07	0.70
Home environment, 6–54 months*	0.09	0.78
Average hours/week in care, 3–54 months	28.06	16.30
Quality of care, 6–54 months	2.82	0.24
Academic competence, 54 months*	0.05	0.67
Social competence, 54 months–kindergarten*	0.00	0.54
Instructional support, first grade	15.76	4.13
Emotional support, first grade	40.55	6.33
Literacy instruction, first grade	35.73	14.85
Mathematics instruction, first grade	8.44	10.93
Maternal sensitivity, first grade	16.93	3.07

*z score.

dropped from the study or had incomplete data. In the sample lost to attrition or incomplete data: mothers had fewer years of education at one month ($F = 42.01$, $p < .001$), children were more likely to be non-White ($F = 11.81$, $p < .001$), and the family's income-to-needs ratio was lower ($F = 22.71$, $p < .001$) than for the sample used in the analyses reported herein. Finally, because the NICHD SECC sample excluded children of adolescent mothers, mothers who did not speak English, and children who were hospitalized at birth or who had a diagnosed disability, it is somewhat less inclusive of children experiencing a range of potential risk conditions. As a consequence of these initial selection criteria and differences between re-

tained and dropped children, the current sample was less inclusive of children experiencing a range of potential risk conditions and limited generalizability of findings to more advantaged families. Constraints on this range also reduced the probability of finding significant associations among variables.

The observed classrooms were distributed across 747 different schools (including 295 classrooms in more than 150 private schools) in 32 states. Most of the classrooms visited were located in and around the cities in which the 10 data collection sites were also located, although the sample was fairly dispersed by the time the children reached first grade. Teachers in these first-grade classrooms were identified as the primary teacher of that child; 95% were credentialed in elementary education. Characteristics of these teachers and classrooms were consistent with reports from national samples of elementary school staffing and schools (National Center for Educational Statistics, 1994).

Overview of Data Collection

Children were followed from birth to first grade. Mothers were interviewed in person when infants were 1 month old. Measures of home and family environments were obtained via interviews and observations when children were 6, 15, 24, 36, and 54 months old. Child care settings were observed at those same ages, for all children who were in nonmaternal care on a regular basis for 10 or more hours per week. Mothers were telephoned regularly to update reports on child care use. Children's cognitive skills and academic achievement were assessed at 54 months and again at first grade; early social behavior was assessed at 54 months and kindergarten. The following sections describe the specific variables used and how they functioned in the analytic approach. Additional details about all data collection procedures, psychometric properties of the instruments, and descriptions of how composites were derived and constructed are documented in the manuals of operation of the study (<http://public.rti.org/secc/>).

Table 2
Correlations Among First Grade Achievement and Cognitive Outcomes

Outcome	1	2	3	4	5	6
Achievement						
1. Reading						
2. Phoneme knowledge	.85					
3. Mathematics	.57	.54				
Cognitive						
4. Long-term retrieval	.36	.35	.32			
5. Short-term memory	.44	.43	.52	.29		
6. Auditory processing	.34	.37	.37	.20	.33	
7. Verbal comprehension	.34	.35	.45	.28	.52	.35

Note: All r values significant at $p < .001$.

Child, Maternal, and Family Predictors

Measures of child, maternal, and family characteristics were collected from birth to first grade. Given primary interest in the value added of contemporaneous schooling experiences, early family data were composited across time and used as estimates of cumulative experience at home prior to school entry. During home interviews at 1 month, mothers reported their own *education* (in years) and the study children's *race or ethnicity* (e.g., White) and *sex* (e.g., female). The presence of a husband or partner in the home was assessed during telephone and in-person interviews at regular intervals between 1 and 54 months. *Partner status* was the proportion of three- to four-month intervals during which the mother reported that a husband or partner was present. Mothers reported family income at 6, 15, 24, 36, and 54 months. *Income-to-needs ratios* were calculated from U.S. Census Bureau tables as the ratio of family income to the appropriate poverty threshold for each household size and number of children under 18. These ratios were averaged in the current analyses.

Maternal depressive symptoms were assessed at 6, 15, 24, 36, and 54 months using the Center for Epidemiologic Studies Depression Scale (Radloff, 1977), a self-report measure that assesses depressive symptomatology in the general population. Cronbach's alpha

coefficients ranged from 0.88 to 0.91. The intercept derived from hierarchical linear model (HLM) analyses of individual growth curves was included in the current analyses as an indicator of the average level of depressive symptoms across this period.

Mother-child interactions were videotaped in semistructured 15-minute observations at 6, 15, 24, 36, and 54 months. The tasks are described in the manuals of operation (<http://public.rti.org/secc/>) and involved a free play session at 6 months and developmentally appropriate play and problem-solving tasks at 15, 24, 36, and 54 months. Videotapes of the mother-child interactions were sent to a central nondata collection site for coding. Inter-coder reliability was determined by assigning two coders to 19–20% of the tapes. Inter-coder reliability was calculated as the intra-class correlation coefficient. Reliability for the composite scores used in the current report exceeded 0.83 at every age. At 6, 15, and 24 months, composite maternal sensitivity scores were created from the sums of three 4-point ratings (maternal sensitivity to child nondistress, intrusiveness [reversed], and positive regard). At 36 and 54 months and first grade, the maternal sensitivity composite was the sum of the three 7-point ratings of supportive presence, hostility (reversed), and respect for autonomy. Cronbach alphas exceeded 0.70 at

every age. The first five sensitivity indicators were standardized and averaged across occasions to provide an estimate of average level of early *maternal sensitivity*.

The HOME Inventory (Caldwell & Bradley, 1984) is a measure of the stimulation and support available to a child in the home environment. The HOME integrates direct observation and a semistructured interview with a parent. At 6, 15, 36, and 54 months, composite home environment scores were created; Cronbach alphas exceeded 0.75 at every age. These four home environment indicators were standardized and averaged across occasions to provide an estimate of average level of the *home learning environment*.

Child Care Experiences Prior to School

During telephone interviews conducted at three-month intervals through 36 months and at four-month intervals thereafter, mothers reported hours of nonmaternal care that were being used. At 6, 15, 24, 36, and 54 months, child care settings were observed to evaluate child care quality.

Child care quantity. The estimate of quantity of child care was created from maternal telephone reports of hours per week in all nonmaternal care arrangements. HLM analyses computed the intercept (general tendency) of hours per week that nonmaternal care was used during the 16 intervals from 3 to 54 months, and this *quantity of child care* intercept score was used in subsequent analyses as an estimate of the average number of hours in nonmaternal child care across the period.

Child care quality. Observational assessments of quality were obtained for primary nonmaternal arrangements used for 10 or more hours per week at 6, 15, 24, 36, and 54 months. Observations were conducted during two half-day visits scheduled within a two-week interval at 6–36 months and one half-day visit at 54 months. At 6, 15, and 24 months, positive caregiving composite scores were the mean of five 4-point subscales (sensitivity to child’s nondistress signals, stimulation of cognitive development, positive regard

for child, emotional detachment [reversed], flatness of affect [reversed]). Cronbach’s alphas for the composite were 0.89 at 6 months, 0.88 at 15 months, and 0.87 at 24 months. At 36 months, these five scales plus two additional subscales, foster child’s exploration and intrusive (reversed), were included in the composite (Cronbach’s alpha = 0.83). At 54 months, the positive caregiving composite was the mean of 4-point ratings of caregivers’ sensitivity and responsivity, stimulation of cognitive development, intrusiveness (reversed), and detachment (reversed; Cronbach’s alpha = 0.72). Interobserver agreement for the positive caregiving composite scores exceeded 0.80 at all time points. For this report, an index of *child care quality* was formed using positive caregiving composite scores for all available time periods. The intercept derived from HLM analyses of individual growth curves was used in subsequent analyses as an estimate of the average level of child care quality. All observers were trained centrally and passed reliability tests using a threshold of 80% agreement prior to data collection, and paired observations were conducted on 20% of the sample with the obtained intraclass correlation averaging 0.87 across all ages.

Qualities of the First-Grade Classroom Environment

Classroom observations took place in the winter to early spring period of first grade using the Classroom Observation System for First Grade ([COS-1]; NICHD ECCRN, 2002b). All observations occurred during the morning and began with the official start of the school day. The entire observation took approximately 3 hr.

For the COS-1 observation, two 44-min cycles were completed. In each cycle, observers made time-sampled recordings for three 10-min periods of 30-s “observe” and 30-s “record” intervals. Thus, there were 30 different minutes in which discrete behaviors were sampled across each of the two observation cycles for a total of 60 different minutes (i.e., 60 intervals) in which these codes were sampled. For the purposes of the present in-

vestigation, only two of the time-sampled codes were used—teachers' use of *mathematics* and *language and literacy* instruction.

In addition, observers made global ratings of classroom quality and teacher behavior using a set of 7-point rating scales. Classroom- and teacher-level scales were factor analyzed and averaged into two composite indicators of the classroom environment: *Instructional Support for Student Learning* and *Emotional Support*. The Instructional Support composite included ratings of literacy instruction, evaluative feedback, instructional conversation, and encouragement of child responsibility. The Emotional Support composite included ratings of overcontrol (reversed), positive emotional climate, negative emotional climate (reversed), effective classroom management, teacher sensitivity, intrusiveness (reversed), and detachment (reversed).

All observers had to pass a videotaped reliability test involving six 44-min cycles for both behavioral coding and qualitative ratings. Criteria for passing were at least a 60% match with a master-coder on time-sampled codes and an 80% match (within one scale point) on the global rating scales. All coders passed at these levels on a reliability test before being certified to conduct observations in the field. Average exact agreement with the gold-standard videotape test for the time-sampled codes was 0.70. Average reliability for the teacher and classroom global ratings on the videotaped test was estimated at 0.63 (correlation method). Observers also conducted paired visits for the purposes of estimating live reliability. Correlations between observers exceeded 0.60 for all but 7 of the 44 time-sampled codes, with lower estimates owing to the infrequency of the observed behaviors. For estimates of live reliability on the global ratings of teachers and classrooms, correlations exceeded 0.70 for all but 3 of the 11 ratings.

Assessment of Child Functioning at Entry to School and First Grade

Two sets of child measures were used: one set reflecting preacademic and social functioning in the entry to school period and one

set reflecting the outcomes of interest—cognitive and academic functioning in the spring of first grade. Measures of child functioning were obtained from mothers' and teachers' reports at 54 months during a laboratory visit, a home visit, and a child care visit. Measures obtained in kindergarten were collected in the fall of the academic year, whereas first-grade outcomes were all assessed in the spring. Indicators of child social and academic functioning at entry to school (covariates in the model) reflected functioning assessed at 54 months, fall of kindergarten, or both. When indicators were available for both 54 months and kindergarten, they were averaged. Though compositing the competence indicators lessened the specificity of results, these composites were created to reduce the possible occurrence of Type II error and to establish more robust indicators of the constructs of interest.

School-entry academic competence is a composite score derived at 54 months from the Letter-Word Identification, Applied Problems, Memory for Sentences, Incomplete Words, and Picture Vocabulary subtests of the Woodcock-Johnson Psycho-Educational Battery—Revised (WJ-R; Woodcock & Johnson, 1989; Woodcock & Johnson, 1990), the Expressive and Auditory Comprehension subtests of the Preschool Language Scale (Zimmerman, Steiner, & Pond, 1992), and scores (reversed) for Omissions and Incorrect Responses from the Continuous Performance Test (Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991). Psychometric properties of these instruments are well documented and support their use as well-established measures. Scores on all these indices were standardized and averaged to yield the Preschool Achievement composite. Coefficient alpha for this composite was 0.85.

School-entry social competence is a composite score derived at 54 months and kindergarten from the respective home and school versions of the Social Skills Questionnaire from the Social Skills Rating System (Gresham & Elliott, 1990), the Internalizing Problems and Externalizing Problems subscales (reversed) of the Child Behavior Checklist (Achenbach, 1991) or Teacher Report Form (Achenbach, 1991), and the Conflict (re-

Table 3
Descriptive Statistics and Stability for Achievement and Cognitive Outcomes

Outcome	Entry to School		First Grade		F^a	R^b
	X	SD	X	SD		
Achievement						
Reading	99.68	13.58	112.40	15.89	674.99	.55
Mathematics	104.28	15.69	112.59	17.49	283.53	.64
Phoneme knowledge	—	—	108.35	14.45	—	—
Cognitive						
Short-term memory	93.84	18.05	99.46	14.79	109.61	.60
Auditory processing	97.23	13.41	96.10	10.98	5.60*	.38
Verbal comprehension	101.93	14.12	106.78	15.96	124.35	.68
Long-term retrieval	—	—	101.79	14.15	—	—

Note: Values of N range from 821 to 832.

^aAll F values significant at $p < .001$ except as noted. ^bAll r values significant at $p < .001$.

* $p < .05$.

versed) and Closeness composite indices from the teacher-report Student-Teacher Relationship Scale (Pianta, 2001). Mothers, caregivers, and teachers completed appropriate versions of these measures. Psychometric properties of these instruments are well established and substantiate their use with the current sample. Scores on all of these indices were standardized and averaged to yield the Preschool Social Competence composite. Coefficient alpha for this composite was 0.82.

Cognitive and academic competence in first grade was assessed using the two major portions of the WJ-R: the Tests of Achievement and Tests of Cognitive Ability (Woodcock & Johnson, 1989; Woodcock & Johnson, 1990). The achievement battery included assessments of *reading* (Letter-Word Identification), *mathematics* (Applied Problems), and *phoneme knowledge* (Word Attack). The cognitive battery encompassed measures of *long-term retrieval* (Memory for Names), *short-term memory* (Memory for Sentences), *auditory processing* (Incomplete Words), and *verbal comprehension* (Picture Vocabulary). For all subtests, raw scores were converted into standard scores with a mean of 100 and a standard deviation of 15, based on normative data for children of the same age.

Results

Descriptive results pertaining to changes in academic functioning between school entry (54 months/fall of kindergarten) and first grade and the stability of individual differences over the same period are summarized in Table 3 for subtests of the WJ-R that were administered at both time points. Mean differences across time for reading and math achievement were significant, indicating a moderate increase from prekindergarten to first grade. Cognitive outcomes also demonstrated significant mean differences across time, though relatively small. Short-term memory and verbal comprehension scores increased, whereas auditory processing scores slightly declined. As shown in the right-hand column of Table 3, stability of achievement and cognitive outcomes was relatively high.

Hierarchical Regression Analyses

Hierarchical regression analyses were conducted using two prediction models. The family and child care predictors that cumulated from birth through 54 months were evaluated in the first, *Early Family/Child Care* model. In the second, *Child/Current Family/School* model, the child's achievement at 54

months and averaged social functioning across 54 months and kindergarten were added, along with measures of observed maternal sensitivity and classroom context during the first-grade year.

The results for analysis of these models are presented in Tables 4 and 5 for achievement and cognitive outcomes, respectively. These results are displayed in columns labeled “Early Family/Child Care” and “Child/Current Family/School” under each dependent measure. Block-level statistics are underlined and estimated when the block was entered; they are identical for site, family, and child care blocks for both models and so are listed only once. The accompanying standardized betas are from the final model with all predictors for the respective model entered. Results are presented separately for achievement and cognitive outcomes, first focusing on whether early family and child care predictors account for significant increments in explained variance (the Early Family/Child Care model). Then, the extent to which initial prediction is attributable to child academic or social competence at school entry is reported, and whether current family context and classroom attributes add to the explained variance beyond initial predictors and prior competence (the Child/Current Family/School model).

First-grade achievement outcomes.

Results for children’s achievement in first grade (reading, math, and phoneme knowledge) are presented in Table 4. Of the early family and child care predictors, significant results were obtained for the family block, particularly for child gender and race or ethnicity, maternal education, maternal sensitivity, and home learning environment. Children with mothers who had lower levels of education scored lower on reading, math, and phoneme knowledge in first grade. Children who had a history of more sensitive interactions with their mothers scored higher on measures of math achievement and phoneme knowledge. White children scored higher on tests of phoneme knowledge and math, whereas boys performed better only on math. In addition, children who experienced a rich home learn-

ing environment performed better on reading and math in first grade. There were no significant findings for the child care block for first-grade achievement outcomes.

Child competence at 54 months and kindergarten was highly significant when added as a block to the model, which was mostly attributable to stability of the dependent measure being predicted. However, children’s social competence was also a significant predictor for all three areas of achievement, suggesting that social skills contribute to relative increases in achievement from kindergarten to first grade. After adding prior child functioning, math achievement in first grade was no longer related to maternal sensitivity, maternal education, home learning environment, or child race or ethnicity. Also, child race or ethnicity and maternal sensitivity no longer predicted phoneme knowledge, nor did home learning environment or maternal education any longer predict reading achievement. Thus, prediction from early family measures to this set of achievement outcomes in first grade was almost entirely due to associations of these predictors with children’s competence at 54 months or kindergarten.

In contrast, even with prior child competence in the model, maternal education remained a significant predictor of children’s phoneme knowledge in first grade, indicating that the presence of a more educated mother accounted for the relative increase in this area of achievement from 54 months to first grade. Child gender followed a similar pattern in predicting math achievement, suggesting that being male accounted for relative increases in math skills during the transition to first grade. Lastly, family income-to-needs ratio served as a significant predictor of children’s phoneme knowledge, indicating that children from lower income families showed relative increases in phoneme knowledge between 54 months and first grade.

The first-grade classroom quality indicators accounted for significant variance in relative change in achievement scores at the block level. More specifically, children who experienced higher levels of literacy, language, and math instruction from their teach-

Table 4
Prediction of Achievement Outcomes in First Grade^a

Predictor	Reading (<i>n</i> = 831)		Mathematics (<i>n</i> = 830)		Phoneme Knowledge (<i>n</i> = 830)	
	Early Family/ Child Care	Child/Current Family/ School	Early Family/ Child Care	Child/Current Family/ School	Early Family/ Child Care	Child/Current Family/ School
<i>R</i> ²	0.16	0.32	0.21	0.48	0.16	0.30
Model <i>F</i>	8.13***	14.38***	11.67***	28.88***	8.19***	13.40***
Site (ΔR^2)		0.02*		0.01		0.02*
Family past (ΔR^2)		0.13***		0.20***		0.14***
Female	0.06	0.03	-0.10***	-0.15***	-0.00	-0.04
Percentage partnered	-0.01	0.01	-0.02	0.02	-0.01	0.01
White child	0.05	-0.00	0.09**	0.04	0.11**	0.07
Maternal education	0.16***	0.08	0.13**	0.03	0.19***	0.12**
Income-to-needs ratio	0.01	-0.03	0.05	0.02	-0.06	-0.08*
Depression level	-0.03	-0.02	0.00	0.01	-0.05	-0.04
Home learning environment	0.17***	0.02	0.16**	-0.05	0.09	-0.05
Sensitivity level	0.05	-0.02	0.14**	0.05	0.10*	0.04
Child care (ΔR^2)		0.00		0.01		0.00
Hours level	0.02	0.02	0.05	0.04	0.03	0.03
Quality level	0.06	0.02	0.06	-0.01	0.04	-0.00
Child at school entry (ΔR^2)		0.14***		0.26***		0.12***
Outcome 54/K		0.48***		0.67***		0.44***
Social and emotional competence		0.07*		0.07*		0.08*
Family concurrent (ΔR^2)		0.00		0.00		0.00
Sensitivity level		-0.02		-0.06		-0.03
First-grade classroom quality (ΔR^2)		0.02***		0.00		0.02***
Instructional quality		0.03		-0.03		-0.02
Emotional quality		0.01		0.02		0.04
Literacy/language instruction		0.15***		0.06		0.16***
Mathematics instruction		0.08*		0.06		0.10**

^aStandardized betas from final model.
^{*}*p* < .05. ^{**}*p* < .01. ^{***}*p* < .001.

Table 5
Prediction of Cognitive Outcomes in First Grade^a

Predictor	Long-Term Retrieval (n = 826)		Short-Term Memory (n = 825)		Auditory Processing (n = 825)		Verbal Comprehension (n = 826)	
	Early Family/ Child Care	Child/ School	Early Family/ Child Care	Child/ School	Early Family/ Child Care	Child/ School	Early Family/ Child Care	Child/ School
R ²	0.12	0.16	0.21	0.40	0.13	0.24	0.32	0.46
Model F	6.00***	5.81***	11.09***	20.70***	6.07***	9.61***	20.06***	26.19***
Site (ΔR ²)		0.02*		0.03**		0.03**		0.06***
Family past (ΔR ²)		0.10***		0.18***		0.09***		0.26***
Female	-0.15***	-0.16***	-0.00	-0.04*	-0.06*	-0.08**	-0.14***	-0.17***
Percentage partnered	-0.03	-0.02	-0.04	-0.02	-0.05	-0.03	-0.04	-0.01
White child	-0.00	-0.03	0.07	0.02	0.07	0.03	0.04	-0.01
Maternal education	0.08	0.04	0.12**	0.03	0.07	0.00	0.16***	0.09*
Income-to-needs ratio	0.10*	0.09*	0.06	0.02	-0.03	-0.05	0.04	0.00
Depression level	0.04	0.04	0.02	0.01	0.00	0.01	0.06	0.05
Home learning environment	0.09	0.02	0.19***	0.00	0.17***	0.02	0.27***	0.12**
Sensitivity level	0.15**	0.10*	0.12**	0.03	0.10*	0.01	0.15***	0.05
Child care (ΔR ²)		0.00		0.01		0.00		0.00
Hours level	0.05	0.05	0.03	0.02	0.06	0.05	0.04	0.02
Quality level	-0.01	-0.03	0.09*	0.03	0.04	-0.00	0.05	0.01
Child at school entry (ΔR ²)		0.02***		0.19***		0.11***		0.14***
Outcome 54/K		0.22***		0.59***		0.42***		0.49***
Social and emotional competence		0.02		-0.01		0.07*		-0.01
Family concurrent (ΔR ²)		0.00		0.00		0.00		0.00
Sensitivity level		0.01		-0.01		0.03		0.03
First-grade class quality (ΔR ²)		0.01		0.00		0.00		0.00
Instructional quality		-0.05		0.04		-0.01		-0.01
Emotional quality		0.05		-0.01		-0.00		0.02
Literacy/language instruction		0.09*		0.01		0.04		-0.04
Mathematics instruction		0.03		0.01		0.02		-0.01

^aStandardized betas from final model.
*p < .05. **p < .01. ***p < .001.

ers in first grade also showed greater relative increases in reading achievement and phoneme knowledge, though not in math achievement. There were no significant findings for the concurrent family context block in relation to children's first-grade achievement.

First-grade cognitive functioning. Table 5 displays results for children's cognitive functioning in first grade (long-term retrieval, short-term memory, auditory processing, verbal comprehension). In the Early Family/Child Care model, the family block accounted for significant increments in explained variance for all the measures of first-grade cognitive functioning, whereas the child care block did not account for a significant amount of variance in any cognitive outcome. Specifically, children scored as follows: higher on long-term retrieval, auditory processing, and verbal comprehension when boys; higher on short-term memory and verbal comprehension when their mothers were more educated; higher on long-term retrieval when their families had a larger income-to-needs ratio; higher on short-term memory, auditory processing, and verbal comprehension when they experienced a rich home learning environment; and higher on all four cognitive tests when their mothers were observed as more sensitive. High quality of nonmaternal care also uniquely predicted greater child performance on short-term memory tasks in the Early Family/Child Care model.

In the Child/Current Family/School model, the early family predictor block remained significant for all first-grade cognitive outcomes, and the child care block continued to account for little variance in children's cognitive functioning. Upon entry into this model, the prior child competence block was a highly significant predictor of child cognitive functioning; stability in academic competence was significant for each outcome, whereas prior social competence predicted a relative increase in auditory processing from 54 months to first grade. Also in the Child/Current Family/School model, concurrent family context and observed classroom quality did not ac-

count for a significant amount of the variance in children's first-grade cognitive functioning.

When accounting for prior child competence in the Child/Current Family/School model, maternal education, maternal sensitivity, and home learning environment no longer predicted short-term memory. In addition, home learning environment and maternal sensitivity did not continue to predict auditory processing, nor did maternal sensitivity continue to predict verbal comprehension. And yet, even with prior child competence in the model, boys showed greater relative increases in all areas of cognitive functioning. Children with more educated mothers and a rich home learning environment demonstrated greater relative increases in verbal comprehension, whereas children with more sensitive mothers and from families with higher income-to-needs ratios exhibited greater relative increases in long-term retrieval from 54 months to first grade. Thus, several of the early child and family predictors (child gender, income-to-needs ratio, maternal education, maternal sensitivity, home learning environment) accounted for significant increments in explained variance in first-grade cognitive functioning even when academic and social competence at entry to school were controlled.

At the block level and for most individual predictors, relative changes in children's cognitive functioning from 54 months to first grade were unrelated to concurrent family context and observed qualities of the children's first-grade classrooms. However, observed literacy/language instruction in the first-grade classroom was a unique, significant predictor of long-term retrieval. This finding indicates that children who were exposed to greater amounts of language and literacy instruction experienced a greater relative increase in long-term retrieval from 54 months to first grade.

Formal Mediation Tests

As noted previously, for the early predictors that accounted for significant increments in explained variance, additional tests were conducted to examine the extent to which their effects on first grade achievement

and cognitive outcomes were mediated by either academic or social functioning at entry to school. Thus, for each significant association in the Early Family/Child Care model between an individual predictor and an outcome, possible mediation effects were examined when the pattern of correlations of these variables and the putative mediators (achievement and social functioning prior to school entry) were met (Baron & Kenny, 1986). There were 20 predictors for which tests of mediation were conducted using prior achievement as the putative mediator and 11 predictors for which tests of mediation were conducted using prior social functioning as the mediator. All 20 tests conducted for prediction of first-grade achievement and cognitive outcomes as a function of prior stable functioning on the same measure(s) were significant, as were all 11 tests conducted for social competence prior to first grade as the putative mediator.

We examined, for each mediation test conducted, the variance attributable to mediation using the z mediation statistic (Sobel, 1982). In Table 4, when the “child at school entry” block was added to the models, effects of child race or ethnicity and maternal sensitivity on math and phoneme knowledge were reduced to nonsignificance, as was the case for maternal education and early home learning environment predicting reading and math achievement. In contrast, maternal education remained a significant predictor of phoneme knowledge even when prior academic skills and prior social competence had significant mediating effects ($z = 10.10$ and $z = 4.24$, $p < .001$, respectively).

Similar patterns of mediation occurred in the prediction of cognitive outcomes (Table 5). Effects of family income-to-needs ratio ($z = 5.36$, $p < .001$) and sensitivity ($z = 5.21$, $p < .001$) on long-term retrieval were partially mediated with the addition of earlier academic competence. In predicting short-term memory in first grade, effects of maternal education, home learning environment, sensitivity, and child care quality were reduced to nonsignificance by the addition of 54-month academic competence to the model. Effects of home learning environment and sensitivity on audi-

tory processing were also completely mediated by the combination of early social skills ($z = 3.60$ and $z = 3.87$, $p < .001$, respectively) and earlier achievement ($z = 9.95$ and $z = 9.84$, $p < .001$, respectively). Finally, for first-grade verbal comprehension, partial mediation occurred for maternal education ($z = 11.80$, $p < .001$) and home learning environment ($z = 12.22$, $p < .001$), whereas complete mediation transpired for sensitivity ($z = 12.26$, $p < .001$) owing to introduction of early academic competence into the model.

Thus, to the extent that family and child care experiences from birth to preschool predicted first-grade achievement and cognitive functioning, it appears that a large proportion of these predictive associations from early experience were actually a function of associations with preacademic and early social functioning at entry to school that remained stable into first grade. And yet some early family experiences continue to be related to first-grade child outcomes, even after controlling for academic and social competencies prior to school entry.

Discussion

In line with expectations, the findings provide further support for an ecological-transactional perspective as applied to children's development of early academic and cognitive skills during the transition into school (Bronfenbrenner, 1979; Christian, Morrison, & Bryant, 1998; NICHD ECCRN, 2004; Rimm-Kaufman & Pianta, 2000). Child characteristics (e.g., gender), early experience in the family (e.g., maternal sensitivity), child care (e.g., quality), and concurrent experience in school classrooms (e.g., mathematics instruction) each accounted for unique increments in explained variance in early academic and cognitive functioning. Not surprisingly, early experiences predicted first-grade academic performance primarily (although not completely) as a function of associations with emergent academic and cognitive skills at the end of preschool, which are then sustained into elementary school. Despite stability in cognitive and academic skills from preschool

to elementary school, children's social competence prior to school entry plays a secondary yet significant mediating role between early experience and initial elementary school academic functioning. Also of note are the findings of consistent but small increments in variance explained by concurrent classroom learning experiences, above and beyond effects of early experience and prior performance.

Child Characteristics and Early Contexts as Predictors of First-Grade Functioning

This study provides an extension of past work that highlights the significant role that family context plays in contributing to children's functioning across the preschool to elementary school transition. The well-documented positive influence of a responsive and cognitively stimulating home environment during the early years was replicated (Bradley & Caldwell, 1984; NICHD ECCRN, 2000; NICHD ECCRN & Duncan, 2003). Early, cumulative maternal sensitivity and home learning environment were consistently among the strongest predictors of academic and cognitive functioning in first grade. Mothers observed as warm, responsive, and sensitive during interactions with their children from infancy through preschool were more likely to have higher achieving children. Similarly, children who experienced a stimulating and supportive home setting across their early years were more likely to have better academic and cognitive functioning in first grade. Although maternal depression was expected to follow a similar pattern, it failed to predict any of the academic and cognitive outcomes. Notably, there is a solid research base that demonstrates the association of depressive symptoms with reduced maternal sensitivity (Albright & Tamis-LeMonda, 2002; Campbell, Cohn, & Meyers, 1995). Given that both variables were entered into the Early Family/Child Care model, the effects attributed to maternal sensitivity may mask effects that would have been attributed to maternal depression if sensitivity had not been included in the analyses.

Another family resource, mothers' education, was a significant and robust predictor

of both academic and cognitive outcomes in first grade. Maternal education is commonly related to young children's language development and cognitive abilities (Burchinal et al., 2002; NICHD ECCRN, 2000; Smith, Brooks-Gunn, & Klebanov, 1997); in the current sample, mothers with more education had children who were achieving more and functioning cognitively higher. This finding is consistent with the idea that parent education is linked with specific parent-child interactions, such as reading and playing, which are cognitively stimulating for young children (Bradley et al., 1989). Other more distal indicators of family context, such as income-to-needs ratio and percentage of time spent living in a single-parent household, were not significant predictors of children's functioning at first grade, though again this may be a function of proximal variables masking the effects of these more distal factors.

To a lesser degree than family factors, child gender and ethnicity also predicted academic achievement and cognitive functioning in first grade. Whereas other recent large-scale investigations have failed to uncover a relationship between gender and early achievement (Denton & West, 2002), within this sample girls scored lower than boys in the area of math achievement and across several cognitive outcomes (long-term retrieval, auditory processing, verbal comprehension). More consistent with evidence that shows children of color at greater risk for academic difficulties (Denton & West, 2002), ethnic minority children scored lower than White children in the areas of math and phoneme knowledge.

Beyond the role of child characteristics and early family factors, cumulative child care hours and quality from birth to 54 months were examined as potential predictors of first-grade academic and cognitive functioning. Child care hours were unrelated to first-grade academic and cognitive functioning, whereas cumulative quality of early child care experiences was only a significant predictor of short-term memory skills in first grade. These results corroborate past findings from similar analyses using the NICHD SECC data set—namely, that child care quality accounts for a

small amount of variance in children's first-grade school functioning, whereas hours spent in child care typically does not (NICHD ECCRN, 2003; NICHD ECCRN, 2004). These inconsistent and weak associations between quality child care and children's outcomes suggest that child care effects might vary in their persistence over time (Scarr, 1998).

Preschool Competence and Mediation of Early Predictors

As just discussed, a central issue addressed by this investigation was whether early family and child care factors uniquely contributed to variance in first-grade academic and cognitive functioning, beyond these stable effects of cognitive ability from 54 months to first grade. However, because social competence and academic skills are so inter-related in early years (Burchinal et al., 2002; Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Hamre & Pianta, 2001), a secondary issue was whether social competence prior to first grade also served as a mediator between early family and child care factors and first-grade academic and cognitive functioning. Put another way, was there evidence that sensitive parenting, for example, led to good academic performance not only because sensitive parents teach preacademic precursor skills but also because their children behave in socially competent ways that enable them to cooperate with and attend to instructional experiences offered in the classroom?

Clearly, the most potent predictor of first-grade functioning was a child's own cognitive skills at 54 months, though a child's social competence prior to school entry was also found to be a significant predictor of first-grade achievement and cognitive functioning. For the most part, it appears that the apparent influences of early experiences on first-grade achievement and cognitive outcomes were primarily being maintained from preschool through first grade. In other words, the inclusion of preschool social and academic competence in the models predicting first-grade academic and cognitive functioning overwhelmingly led to reduced or loss of significant

effects for child characteristics, early family, and child care factors. This pattern indicates that processes related to cognitive functioning during the early years result in a relatively stable developmental trajectory through early elementary school. Although amenable to first-grade classroom environments, academic readiness appears to be already well established toward the end of a child's preschool years and endures the transition into school.

However, individual differences in children's academic and cognitive functioning were not wholly determined by stability in these domains; in fact, performance also changed between preschool and first grade as a function of early context influences on preschool *social* competence. So, although preschool cognitive competence is the driving force behind prediction of first-grade cognitive outcomes, findings clearly indicated that child characteristics and early family factors also predict a child's academic adjustment to school as a function of their influence on early social and relational skills that carry forward into first grade. Because children's early social competence is associated with reduced conflict and increased closeness with their teachers, this may allow them to gain more consistent access to the instructional benefits of teacher-child interactions, as reported elsewhere (Burchinal et al., 2002; Howes & Ritchie, 2003). In recognition of this interplay between social competence and achievement, teachers, counselors, and school psychologists are encouraged to incorporate integrated social and academic learning into the school context.

Classroom Quality and Family Process as Value Added to Child Functioning in First Grade

In addition to considering the legacy of early predictors for forecasting first-grade functioning, this investigation had a further interest in determining the relative contributions of contemporaneous family processes and the classroom context to predicting variation in academic and cognitive outcomes. With regard to family processes, there was no association between concurrent maternal sen-

sitivity and first-grade outcomes, after accounting for early experience and abilities. This is perhaps best explained by the stability of maternal sensitivity over time.

Our analysis of the contributions of classroom context to change in child functioning during the transition to school allows for examination of the unique value of school experiences for young children's cognitive development, above and beyond many experience and demographic factors that the child has been exposed to prior to school entry. Schooling effects were addressed via four observed dimensions of classroom context: quality of instructional and emotional support as well as the amount of literacy/language and mathematics instruction provided to children in the classroom (NICHD ECCRN, 2002b). Although the global observations of classroom instructional and emotional quality were not associated with first-grade performance, the amount of content-specific instruction did make a significant contribution to the relative change in reading achievement, phoneme knowledge, and long-term retrieval ability across the transition to school. Interestingly, language/literacy and math instruction both had strong effects on emergent literacy areas and long-term retrieval, but neither was related to early math skills or other cognitive abilities. These findings provide evidence that children's exposure to instruction at school does seem to make a difference in their enhanced development of some academic and cognitive skills and is consistent with other findings from these data and other studies (Juel & Minden-Cupp, 2000; Morrison & Connor, 2002; NICHD ECCRN & Duncan, 2003; Stockard & Mayberry, 1992).

Limitations

This investigation had limitations that should be taken into account when interpreting findings. First, the sample, although large and diverse, reflected original exclusion criteria; therefore, families with children showing signs of disability or illness at birth, adolescent mothers, non-English-speaking mothers, and mothers living in dangerous neighbor-

hoods were not part of the sample. In addition, selective attrition throughout the course of this longitudinal study led to a current sample with fewer educated mothers, non-White children, and low socioeconomic status families than in the original group. The absence of families with these maternal and child characteristics may restrict the ability to detect associations, which could be particularly true for schooling effects given evidence that at-risk children receive greater relative benefits from school experience (Rutter & Maughan, 2002).

Second, despite the rich quality of observational data included in these analyses, these data are limited in terms of breadth and length. Children were observed in their classrooms on one day only, which falls short of the best practice for classroom observation that ideally calls for multiple assessments across varied contexts (Wharton-McDonald, Pressley, & Hampton, 1998). Therefore, observational data in this investigation may undervalue the predictive magnitude of classroom processes in relation to academic and cognitive functioning. A longer, more extensive observation period would likely result in a stronger, more reliable indicator of classroom context. However, it is important to note that observational constructs in the current study showed some external validity, whereas similar global-rating assessments of prekindergarten classrooms have been found to have relatively high stability (NICHD ECCRN, 2005).

Running counter to existing research literature, a number of family and child care factors were not significantly related to children's achievement, and the magnitude of schooling effects fell in a range from small to moderate. Such limited effects are likely due to the particular child assessments selected for this investigation. The indicators of achievement and cognitive abilities were highly stable, and because this study focused on predicting aggregate change in individual differences in these indicators (rather than patterns of individual growth), this reduced the marginal variance that could be accounted for by any predictor(s). The use of curriculum-based or criterion-referenced tests may be more sensi-

tive to change in early learning skills and may identify more variability across the transition to school.

Conclusions

Overall, the findings provide support for the persistent role of early cognitive development in predicting subsequent academic and cognitive functioning as children move from family and child care settings into school, as well as the role of family and child care settings in shaping early cognitive development. Social competence played a secondary yet significant role in determining relative change within the academic and cognitive domains across the preschool to first-grade transition. The results also provide evidence for significant but fairly limited effects, evaluated as value added beyond early experiences, of schooling on academic and cognitive functioning—mostly in terms of the support to achievement and cognitive development provided by direct mathematics and language and literacy instruction. The results support efforts that focus on early intervention to improve children’s school outcomes and on attention to both cognitive and achievement inputs as well as social interactions as they support learning.

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