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Preschool Enrollment, Classroom Instruction, Elementary School Context, and the Reading Achievement of Children from Low-Income Families

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Abstract

Purpose—The goal of this study was test expectations derived from sociological and developmental perspectives that the association between phonics instruction in kindergarten classrooms and reading achievement during the first year of school in the low-income population would depend on whether children had previously attended preschool as well as the socioeconomic composition of their elementary schools.

Methodological approach—Autoregressive modeling was applied to nationally representative data from 7,710 children from low-income families in the Early Childhood Longitudinal Study-Kindergarten Cohort, with a series of sensitivity tests to improve causal inference and explore the robustness of results.

Findings—The association between phonics instruction and achievement was strongest among children from low-income families who had not attended preschool and then enrolled in socioeconomically disadvantaged elementary schools and among children from low-income families who had attended preschool and then enrolled in socioeconomically advantaged elementary schools.

Research and practical implications—Insight into educational inequality can be gained by situating developing children within their proximate ecologies and institutional settings, especially looking to the match between children and their contexts. These findings are relevant to policy discussions of early education, instructional practices, and desegregation.

Keywords

Early education; instruction; reading achievement; poverty; policy; segregation

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In the U.S., children from low-income families tend to have less developed reading skills than their peers during the first year of elementary school (Ludwig & Phillips, 2007; Peisner-Feinberg et al., 2001; Reardon, 2011). This tendency reflects their less extensive learning experiences before school begins, with researchers often highly focused on how much they are exposed to cognitively stimulating activities at home as well as the degree to which their parents are able to locate and access early education programs for them (Davis-Kean, 2005; Hart & Risely, 1995; Magnuson, Meyers, Ruhm, & Waldfogel, 2004; NICHD Early Child Care Research Network [ECCRN], 2002). At the same time, this tendency forecasts reduced opportunities to learn and achieve (e.g., class assignments, program placements, teacher expectations) across elementary school and beyond (Desimone, Smith, & Frisvold, 2007; Entwisle, Alexander, & Olson, 2005; Reardon, 2011). Because of this role of early reading skills in the intergenerational reproduction of poverty, a major challenge for policy-oriented research is to elucidate the institutional practices under the control of the K-12 educational system that can support such skill development among children from low-income families upon entry into the system so that they can get the most out of the remainder of their time in the system (Crosnoe et al., 2010).

Because classroom reading instruction is the institutional practice within schools that is most proximate to children's acquisition of reading skills, it is a good starting point for research with this goal (Engel, Claessens, & Finch, 2013). Kindergarten classrooms that emphasize basic skills instruction (e.g., phonics) may be a good setting for children from low-income families to develop the level of "school-ready" reading skills that many may not have at kindergarten entry. Yet, what may be an appropriate and effective instructional strategy for classrooms serving many children from low-income families may not be well-suited to all such children in the classroom. For example, following the child $\times$ instruction model from developmental psychology, this catch-up value of phonics instruction may be greater for children from low-income families with no prior exposure to reading activities in early education programs but less so for children with those experiences who are ready to develop more advanced skills (Connor, Morrison, & Katch, 2004). Given the emphasis of sociologists on the broad organizational structures in which proximate instructional processes take place, a sociological expansion of the child $\times$ instruction model is to consider how such matches (or mismatches) vary across different types of schools—a child $\times$ instruction $\times$ context interplay. For example, the boost to reading skill development when children from low-income families are in classrooms featuring ample phonics instruction could fluctuate according to the average socioeconomic background of students in the school (Crosnoe & Benner, 2015).

Drawing on nationally representative data on U.S. children (Early Childhood Longitudinal Study-Kindergarten Cohort; ECLS-K), this study explores such a child $\times$ instruction $\times$ context model by asking the question: are links between phonics instruction and reading achievement over kindergarten more or less pronounced for children from low-income families depending on their prior enrollment in preschool and the proportion of other children from low-income families in their elementary schools? This goal integrates developmentally-oriented theoretical models with contextual insights from sociology with attention to major educational policies, such as universal pre-K and the socioeconomic desegregation of schools.

The Early Education of Children from Low-Income Families

Across several domains of academic skill, many children from low-income families are not considered by teachers to be school-ready when they enter kindergarten, and, as a result, they often have truncated long-term trajectories of educational attainment (Duncan et al., 2007; Entwisle et al., 2005; Lee & Burkham, 2003; Magnuson et al., 2004; Pianta & Walsh, 1996; Reynolds et al., 2011; Winsler et al., 2008). This general phenomenon of accumulating disadvantage is evident within the specific domain of reading. The development of reading skills is a major focus of early education programs (and parents), a key component of school readiness, and a foundation of learning throughout school (Armbruster, Lehr, & Osborn, 2001; Camilli, Vargas, Ryan, & Barnett, 2010; Farkas, 2003; NICHD ECCRN, 2005b).

Sociologists of education have offered an important theoretical perspective on how the early experiences of children from low-income families set the stage for their long-term trajectories. Specifically, the school transition model contends that children from low-income families who enter elementary school with academic skill levels even only slightly below their peers—due to experiential differences such as home learning activities and preschool enrollment—will, because of these initial skills levels, be subjected to more stratifying and less enriching school processes in the first year of school that then reduce their academic opportunities for many years in the future. Thus, the first year of school is a critical period in their educational careers (Alexander & Entwisle, 1988; Entwisle et al., 2005). Because of the emphasis of the school transition model on the critical role of school-entry skill levels, the research organized by it has often focused on the experiences of children from low-income families before they even start school, particularly how their family environments shape their school readiness. Yet, the model calls for equal attention to what happens when they are already in school and how institutional practices help or hinder the subsequent development of their entry-level skills (Crosnoe & Cooper, 2010).

Developmental scientists have provided valuable insights into these early institutional practices, focusing on the interactional ways in which children are taught. Specifically, the child $\times$ instruction model points to potential mechanisms for remedying the cumulative disadvantage captured in the school transition model. It contends that any one kind of instruction—no matter its aggregate effects—will only support the learning of an individual child to the extent that it is tailored to her or his particular needs and circumstances, especially among children who face significant academic obstacles. Thus, a uniform implementation of some instructional approach might yield positive results for a classroom as a whole but not for particular children within that classroom (Connor et al., 2010; Connor et al., 2009; Piasta, Connor, Fishman, & Morrison, 2009). Applying this model to the case of children from low-income families suggests that their reading achievement may receive a boost if the general reading instruction that their classrooms receive is well-matched to what they themselves need, a match that likely becomes more possible as more children in the school are perceived to have the same needs. One source of variation among children from low-income families in the type of instruction that they need is whether they have had formal educational opportunities to develop their academic skills prior to the start of elementary school (Duncan & Magnuson, 2013; Pianta & Walsh, 1996).

This potentially valuable perspective on proximate processes of early skill development before and after kindergarten entry, we argue, could be increased by considering the characteristics of the schools in which they are embedded. In the next section, we lay out all of the pieces of this child $\times$ instruction $\times$ context model and how they fit together.

Kindergarten Instruction, Preschool Enrollment, and Elementary School Composition

Beginning with the instruction component of the child $\times$ instruction $\times$ context model, one common instructional strategy in kindergarten, phonics, involves systematically teaching children about the relation between spoken words and written letters, which increases recognition and decoding of words in text as well as spelling and other literacy skills. Phonics mastery then supports more advanced skills like reading comprehension and fluency moving forward (Armbruster et al., 2001; Sonnenschein, Stapleton, & Benson, 2010). In other words, early phonics instruction can build a foundation of basic skills to be applied to more challenging academic activities involving higher-order inferential instruction and skill development (Connor et al., 2004; Crosnoe et al., 2010; Desimone et al., 2007; Xue & Meisels, 2004). Because children from low-income families often enter kindergarten with a weak foundation of reading skills, phonics-focused instruction may be an appropriate instructional strategy for many of them (Magnuson et al., 2004; National Reading Panel, 2000). The first hypothesis of this study, therefore, is that phonics instruction in kindergarten will predict significant gains in reading skills across the kindergarten year for children from low-income families.

Turning to the match between instruction and child in the child $\times$ instruction $\times$ context model, the link between family income and early reading skills is not universal, so that some children from low-income families will have well-developed reading skills when they enter kindergarten and may not need phonics instruction (Duncan et al., 2007; Engel et al., 2013). In a classroom serving many children from low-income families, therefore, most but not all may benefit when the teacher emphasizes phonics—such instruction might be a good match for some children from low-income families but a mismatch for others. Here, we offer a contextual twist on the conventional approach of developmentalists to how a teacher tailors instruction according to the specific academic needs of the student, instead considering how he or she tailors it according to the general academic needs of the class as a whole. One of the key mechanisms in the school transition model—attending preschool—is likely a reason why children from the same socioeconomic backgrounds have different instructional needs in kindergarten (Alexander & Entwisle, 1988). Although children from low-income families are less likely than the general population to attend preschool, many do, often in subsidized or public programs. Such attendance appears to significantly increase their kindergarten-entry reading skills. These gains, however, fade as they move into and through the rest of the primary grades, partly because the instructional practices in these grades do not build on the skills that low-income graduates of preschool programs bring into kindergarten (Brooks-Gunn, 2003; Duncan & Magnuson, 2013).

Thus, whether children from low-income families attended preschool may influence the degree to which phonics instruction is a match or mismatch for their academic needs in kindergarten. If they enter kindergarten without having previously attended preschool, they will likely benefit more from phonics instruction aimed at building up that foundation of basic reading skills. If they transition from preschool into kindergarten, they will likely benefit less, as they would be more likely to already have developed some basic skills and be ready for new challenges (Connor et al., 2009; Sonnenschein et al., 2010). The second hypothesis of this study, therefore, is that children from low-income families will achieve more in reading during kindergarten when they are in classrooms in which the general instructional practices match their pre-kindergarten exposure to formal education.

Adding the context to the child $\times$ instruction $\times$ context model, the degree to which the match between children's academic needs and their classroom instruction matters may depend on the kind of schools in which the classrooms that children enter are housed. Many different aspects of school context can be studied in this way. Our focus is on school socioeconomic composition, as it is emphasized by the school transition model (Alexander & Entwisle, 1988) and has become a major policy issue in the last decade (Kahlenberg, 2001; Lauen & Gaddis, 2013). Of the many reasons that such composition matters, one is that the literature suggests that schools tailor their curricula and pedagogical practices to the normative skill level of students (Pianta et al., 2007; Pianta & Walsh, 1996), and another is that administrators and teachers often have lower expectations for what children from low-income families may be capable of mastering. Thus, having more children from low-income families in the school could increase the prevalence of a basic skills instructional strategy like phonics, regardless of whether most children actually need it or not (Desimone et al., 2007; Diamond, Randolph, & Spillane, 2004; Jussim & Harber, 2005; Plank, 2000). Consequently, the likelihood that children from low-income families who did not attend preschool will enter a kindergarten classroom with a general instructional strategy that is a match for them (i.e., phonics-focused) could increase as the proportion of children from low-income families in the student body rises and decrease as it drops (Buttaro, Catsambis, Mulkey, & Steelman, 2010; Pianta et al., 2007; Willms, 2010).

The third hypothesis of this study, therefore, is that the expected achievement gains associated with a match between preschool history $\times$ classroom phonics instruction among children from low-income families will be greater to the extent that their background mirrors the general socioeconomic profile of other children in school. More specifically, within the low-income population, phonics instruction in kindergarten should lead to higher reading growth for children who did not attend preschool and then enroll in socioeconomically disadvantaged elementary schools and for children who did attend preschool and then enroll in socioeconomically advantaged elementary schools.

Method

Sample

ECLS-K is a nationally representative sample of American children in kindergarten during the 1998–99 school year (Denton & West, 2002). The National Center for Education Statistics (NCES) constructed the sample with a dual-frame multistage design. Sampling

began with the selection of 100 primary sampling units (typically counties) from across the U.S. and then about 1,000 schools with kindergartens within these units. Approximately 23 students from each school were then randomly selected (22,780 total). Data—from interviews with parents and school personnel and the administration of diagnostic tests to children—were collected in the fall and spring of kindergarten and first grade (note: the fall first grade data collection targeted only a small subsample to explore summer learning loss issues) and in the spring of third, fifth, and eighth grades. Approximately 95% of the sample (and 99% of schools) maintained participation through the two kindergarten data collections. Sampling weights correct for biases or departures from representativeness due to oversampling of some groups (e.g., Asian American children) or cross-wave attrition.

The primary sample for this study focused on the subset of children in ECLS-K from families with annual incomes at or below 185% of the federal poverty line for their household sizes during the kindergarten data collections ($n = 7,710$). Throughout this manuscript, n 's are rounded to the nearest 10, in accordance with NCES requirements for restricted-use data.

Measures

Here, we rely on ECLS-K data from interviews with teachers, administrators, and parents as well as direct child assessments. Table 1 presents descriptive statistics for all study measures.

Reading development—Children completed untimed, individually administered, two-stage standardized assessments in reading with reliabilities generally over .90. Items touched on print familiarity, letter recognition, sight vocabulary, decoding, receptive vocabulary, and passage comprehension. Children's performance on the uniform first stage determined whether they took the low-, medium-, or high-difficulty version of the second stage. Item Response Theory was used to develop single scores across stages; these scores are directly comparable across data collection waves, as they represent specific points along the same ability continuum (Baker, 2001; Reardon, 2005). Because this continuum is not artificially bounded, it does not have a set range, but increases in test scores designate real growth in reading skills on a level that can be quantified by standard deviation units. The average score in the fall of kindergarten (just over 19 points with a range from 10 to 66) indicates a low initial level of skills, which is to be expected at the start of elementary school. Also expected is the increase in scores (e.g., the mean rose to 28 by the end of kindergarten) as children were exposed to more instruction over time. To give a sense of what these scores mean in the scope of primary education, the average score on the reading test was 51 by the end of first grade and 99 by the end of third.

Of note is that children from families in which English was not the primary language took an oral language screening test. Those who met a pre-set threshold then took the reading achievement tests in English, and those who did not were screened out of testing. As explained below, our analytical procedure included a powerful missing data estimator, so that children who did not take the test were not dropped from the sample. Also as explained below, autoregressive models predicted test scores at time t by covariates plus test scores at t

–1, essentially measuring the predictors of changes in test scores across waves. This strategy is made more sound by the fact that the ECLS-K tests were designed with adaptive procedures that eliminated the potential for floor and ceiling effects (Rock, 2007).

Classroom phonics instruction—In the spring of kindergarten, teachers rated the frequency of nine phonics-related instructional activities (work on learning the names of the letters, work on phonics, alphabetizing, reading multi-syllable words, reading aloud fluently, rhyming words and word families, matching letters to sounds, writing own name, alphabet and letter recognition) since the beginning of the year. Items were rated from 1 (*once a month or less*) to 5 (*daily*) and averaged (Cronbach's $\alpha = .71$), with higher mean scores indicating greater phonics instruction in the classroom (Crosnoe & Cooper, 2010; Xue & Meisels, 2004). Recall that this study shifts the focus of the child $\times$ instruction model from individualized instruction to the match between a child and the general instruction going on in her or his classroom. In this way, a classroom-level measure of instruction was appropriate. One limitation of this measure, however, is that it cannot account for changes in phonics instruction over time as a response to children's needs and performance. As a retrospective summary measure of the whole year, it assesses what generally happened in the classroom overall.

Because we recognize that phonics instruction is likely one of several instructional practices that are used in a classroom and that the overall instructional context may explain some of phonics instruction's apparent contributions to achievement (Desimone et al., 2007; Pianta et al., 2007), we supplemented our attention to phonics instruction with several other measures tapping into the classroom instructional context. Teachers' whole-language activities, such as retelling stories or using context clues for comprehension, were assessed with the mean of 17 items ($\alpha = .72$), which ranged from 0 (*never*) to 5 (*daily*). Teachers identified how many minutes per day they used reading achievement groups, from 1 (*1–15 minutes per day*) to 4 (*more than 60 minutes per day*). They also indicated how frequently they used four support activities for reading instruction: extra individual assistance from the teacher, individual tutoring from an aide/volunteer, individual tutoring by a specialist, and pull-out instruction in small groups. Each was rated on a scale from 1 (*never*) to 5 (*daily*). Like phonics instruction, all of these measures came from the kindergarten spring wave and summarized the whole year.

Preschool attendance—In the fall of kindergarten, parents were asked a series of questions regarding their children's care arrangements in the year before kindergarten. Using these data, NCES created an aggregate variable capturing the primary nonparental care arrangement in the year before kindergarten across nine possible arrangements. Those parents reporting center-based care also reported on the type of center-based program the child attended (1 = *day care*, 2 = *nursery school*, 3 = *preschool*, 4 = *prekindergarten program*). For the current study, those children whose primary child care before kindergarten was center-based care *and* who attended either a nursery school, preschool, or prekindergarten were coded as one (1) and labeled as *preschool attendees*; all other children were coded as zero (0) and labeled as *non-preschool attendees* (Lee & Burkham, 2003;

Magnuson et al., 2004). Children in Head Start were not included in the preschool category initially, although supplemental analyses did also examine the Head Start children.

School poverty level—In the spring of kindergarten, administrators reported the percentage of children in their schools who were eligible for and participated in the Free or Reduced-Price Lunch (FRPL) program.

Child/family characteristics—Analyses controlled for a number of child and family characteristics (all drawn from the kindergarten fall wave), including child age, gender, race/ethnicity (dummy variables for White, African American, Asian American, Latino/a, other), family structure (binary variable differentiating two biological parent families from other family structures), and parent education (highest level of education on a 5-point scale, from *less than high school graduate* to *graduate degree or higher*, across parents). To account for differences in exposure to instruction, we created a binary marker of whether the child was a first-time kindergartener. To control for spuriousness due to place of residence and to account for the role of residence in the ECLS-K sampling frame, region (dummy variables for south, northeast, west, south) and urbanicity (dummy variables for central city, city fringe/large town, small town) were measured for use as controls. In addition, analyses explored how parents' educational activities in the home, another early childhood component of the school transition model (Crosnoe & Cooper, 2010; Lee & Burkham, 2003), might supplement phonics instruction. First, home learning was the mean of seven items assessing engagement in activities such as nature lessons or building games ($\alpha = .71$); each item was rated from 1 (*never*) to 4 (*everyday*). Second, parents reported the frequency of their home reading activities from 1 (*never*) to 4 (*everyday*).

School/teacher characteristics—School-level controls included sector (dichotomous variable for public or private school) and size (1 = 0 – 149 to 5 = 750 or more), both from the spring of kindergarten. Teacher-reported controls included teachers' education (dichotomous variable from spring of kindergarten capturing whether the teacher had a master's degree or higher) as well as race/ethnicity (dummy variables for White, African American, Asian American, Latino/a, other) and years at current school (Crosnoe & Cooper, 2010), both measured in the fall of kindergarten.

Plan of Analysis

Independent and interactive associations among phonics instruction, preschool attendance, and school poverty level for young children's reading achievement were examined in a series of stepwise linear regressions. These integrated autoregressive models partially addressed possible influences of unobserved confounds, in that they estimated reading achievement while accounting for prior achievement (Glazerman, Levy, & Myers, 2003). In this autoregressive framework, the spring test score was regressed on the fall score and the child, family, school, and teacher controls. The main effects of the focal variables (classroom phonics instruction, preschool attendance, school poverty level) were added to the model as predictors, followed by all two-way interactions among the three focal variables and then the three-way interaction (as multiplicative products of the constituent variables in observed form). Finally, the full set of classroom instructional variables was added to the model to

gauge the extent to which any observed results reflected patterns related to phonics instruction per se or more generally to the classroom instructional environment.

Analyses were conducted in Mplus v6.12 (Muthén & Muthén, 1998–2010). The dataset included some missing data, and Mplus employed the full-information maximum likelihood (FIML) method to allow data for all cases to be estimated. Missing data are a potential source of concern for all longitudinal studies, and FIML is a preferred method to allow generalization of results to the population. It does not impute the missing data, as is the case with mean- or regression-based imputation techniques; rather, it fits the covariance structure model directly to the observed (and available) raw data for each participant (Enders, 2001).

Models also employed the ECLS-K longitudinal sampling weights (child-level weights encompassing each data collection wave used), which corrected for sampling design effects and differential attrition across waves. Models were estimated with the CLUSTER procedure, which is designed to address violations to independence assumptions related to the multilevel nature of the data (e.g., the clustering of student data within schools). Using schools and/or classrooms (with one nested in the other) as the clustering unit made no difference. Although the Mplus procedure does not explicitly partition variance into between- and within-cluster estimates that can then be independently analyzed (as in conventional multilevel linear modeling), it does adjust the standard errors of estimates to account for the non-independence of cases within clusters, thereby achieving a similar statistical end. We did, however, reanalyze the data using the explicit multilevel modeling procedure in Mplus (including a three-level model with students in classrooms in schools). Doing so revealed intraclass correlations for reading test scores around .20 for classrooms and schools. As expected, the focal results (i.e., the classroom phonics instruction $\times$ preschool attendance $\times$ school poverty level interaction) changed only minimally in terms of size and significance of the coefficient.

Results

The Role of Preschools, Classrooms, and Schools in Reading Achievement

Table 2 presents the results from a series of focal models with reading test scores in the spring of kindergarten as the outcome and reading tests scores in the fall of kindergarten as a key control—thus, the models can be interpreted as gauging the relevance of the child $\times$ classroom instruction $\times$ school context interplay for reading gains over the course of kindergarten. When classroom phonics instruction (measured in a summary assessment since the start of the year), preschool attendance, and school poverty level were entered as main effects (see Model 1), only classroom phonics instruction was related to the reading achievement of children from low-income families, net of the child, family, teacher, and school controls (see appendix for coefficients for the controls). Specifically, children earned higher test scores across the kindergarten year when they were enrolled in classrooms with a greater focus on phonics instruction. Although this general association did support our first hypothesis, it was quite weak, with an effect size of only about 1% of a standard deviation in the outcome.

Next, the inclusion of three two-way interaction terms (preschool attendance $\times$ classroom phonics, preschool attendance $\times$ school poverty level, classroom phonics $\times$ school poverty level) in Model 2 revealed no significant interplay among the focal variables within the subsample of children from low-income families, once the aforementioned control variables were taken into account. Thus, the second hypothesis of the study about the effects of a child $\times$ classroom instruction match (i.e., preschool history $\times$ phonics instruction) was not supported.

In Model 3, the three-way interaction (preschool attendance $\times$ classroom phonics instruction $\times$ school poverty level) tapping into the third hypothesis was included, and it was statistically significant. To interpret this three-way interaction term, we calculated predicted spring of kindergarten reading test scores for children from low-income families who varied on preschool attendance (attender, non-attender), classroom phonics instruction (high vs. low, with the high cutpoint set at phonics instruction 3 – 4 times per week or more), and school poverty level (high vs. low, with the high cutpoint set at 50% of the student body eligible for FRPL) but who were similar on the control variables, including the fall kindergarten reading test score. In line with the hypothesis, the three-way interaction appeared to be driven by variation in the association between preschool attendance and phonics instruction across schools differing in the poverty rate among students. Figure 1 depicts these patterns.

Among children from low-income families, preschool attendees generally started kindergarten with more reading skills, but they did not always end kindergarten in this advantaged position because of a combination of classroom and school characteristics. Preschool attendees who entered kindergarten classrooms with high levels of phonics instruction ended kindergarten with the highest reading scores, net of their higher starting position. The real action, however, was in test score gains across the year, and here is where school poverty level mattered.

Among children from low-income families in high poverty schools, non-preschool attendees who received high levels of phonics instruction in kindergarten classrooms posted the most reading gains (10.4 points, or a 52% change compared to percent changes in the lower 40s for all other groups). They started the year on par with other non-preschool attendees but then gained over the year. By the end of kindergarten, they scored a point higher than children from low-income families who attended preschool but then received low levels of phonics instruction and only one point lower than children from low-income families who attended preschool and then received high levels of such instruction. This gain relative to the low-income preschool attendees who received high phonics instruction represented a fifth of a standard deviation in the starting test score distribution and, for an additional comparison, nearly a fourth of the starting test score gap between children from low-income and higher-income families in ECLS-K.

Of note is that the standardized reading assessment administered in ECLS-K was not strictly a phonics assessment. It covered a number of skills. Unfortunately, there was no way to pull out children's scores on the phonics-focused components of the assessment, which would have been the most effective way to test the child $\times$ classroom instruction $\times$ school context

interaction. NCES did provide 10-point proficiency scores to gauge the skills that any overall test score would suggest had been mastered. Looking at these proficiency scores across the different groups of children from low-income families in high poverty schools gave further insight into the significant three-way interaction. In such schools, the children who had not attended preschool had an average proficiency score in the fall of kindergarten in the lowest category, which indicated “non-mastery of the lowest proficiency level”, whereas the preschool attendees had an average score in the next category, indicating that they had mastered letter recognition. By the end of the year, the non-preschool attendees who had been exposed to high levels of phonics instruction in their kindergarten classrooms had joined the preschool attendees in the third proficiency category, which indicated mastery of beginning sounds, while the non-preschool attendees who had been exposed to low levels of phonics instruction in their kindergarten classrooms were still in the second category.

The story was not as clear among children from low-income families in low poverty schools. If we compare only preschool attendees (i.e., preschool attendees receiving high levels of phonics vs. preschool attendees receiving low levels) and then compare only non-preschool attendees (i.e., preschool non-attendees receiving high levels of phonics vs. preschool non-attendees receiving low levels), the preschool attendees seemed to derive more benefit from phonics instruction than the non-attendees. When making comparisons between children from low-income families receiving high levels of phonics, however, the preschool non-attendees seemed to gain slightly more over the year than the preschool attendees. In the low poverty schools, the only group of children from low-income families who had not reached the third proficiency category, on average, by the end of kindergarten were non-preschool attendees who were exposed to low levels of phonics instruction.

Finally, because the phonics instruction variable could have been a proxy for a variety of classroom processes or could have been more or less common in classrooms serving particular types of families, we also examined models that controlled for multiple classroom instructional processes. These processes included group instruction time and the frequency of extra individual assistance, individual tutoring from an aide/volunteer, individual tutoring by a specialist, pull-out instruction in small groups, and whole-language activities. We also included educational processes in the home (home learning and reading activities) that signify selection into different kinds of schools, preschools, and classrooms and highlight primary early childhood mechanisms of inequality in the school transition model. As seen in Model 4 in Table 2, the results shifted with the presence of these classroom and family control variables, but the bottom line was the same. The three-way interaction term remained significant and had a similar effect size.

In sum, classroom phonics instruction appeared to promote reading gains in kindergarten for children who did and did not attend preschool prior to kindergarten. This pattern was more pronounced among the preschool non-attendees in high poverty schools, providing qualified support for our third hypotheses that phonics instruction would matter more when there was, effectively, a match between preschool history of the child and the family background of school peers. Although we could not control for all possible instructional and home learning processes that might go along with phonics instruction, the analyses did indicate that the observed interaction of phonics instruction with children’s preschool histories and school

poverty level was independent of several classroom instructional activities and home educational supports.

Sensitivity Analyses

As in any study, multiple modeling choices presented themselves that could have affected the final results. At the same time, the observed effects from the models we have presented could have been confounded with other factors, resulting in misleading conclusions. Consequently, we conducted a number of supplemental analyses to determine the robustness of the findings. For the most part, these analyses revealed a high degree of consistency in results.

First, we examined whether the findings persisted when taking into account school-wide preschool attendance rates (i.e., what percentage of children in each school attended preschool). Doing so was important because of a possible contagion of the treatment effect (i.e., preschool attendance); in other words, the possibility that high poverty schools in which large portions of the incoming students have attended preschool might adjust their instructional norms compared to the average high poverty school. Unfortunately, neither teachers nor administrators reported on aggregate preschool attendance levels in ECLS-K. Instead, we created a proxy variable based on the percentage of students participating in ECLS-K at the school who had attended preschool prior to kindergarten. Although not ideal, this estimate was as strong as the random assignment of children into ECLS-K. When the stepwise models for children from low-income families controlled for this variable, results were identical to those reported in Table 2.

Second, preschool, classroom, and school characteristics are highly endogenous, so that the observed effects of these factors on child outcomes may reflect the selection of children into such settings more than their developmental significance (McCarthy, Burchinal, & Bub, 2007). For example, as Table 3 demonstrates, children from low-income families in different combinations of preschool attendance, kindergarten classroom instruction, and school poverty level differed on key markers of social stratification. Our autoregressive framework reduced this endogeneity problem, as the fall test score likely captured many confounds associated with selection into different settings that would have been relevant to spring test scores. We also conducted propensity score analyses, in which we estimated logistic regressions with each of the combinations of preschool attendance, kindergarten classroom instruction, and school poverty level (hereafter, setting categories) from Table 3 as outcomes, regressing them on all independent variables from the analyses presented in Table 2, additional variables tapping reading achievement culled from other ECLS-K studies, and the two-way interactions. The predicted values for each setting category generated from these models—representing the index of all observed factors selecting children into all possible combinations of factors in the three-way interaction—were entered into the reading achievement model in two ways: 1) as covariates alongside the three-way interaction and 2) as weights, which adjusted the degree to which cases were counted in the analyses according to how well they fit the profile of treatment and control group (Imbens, 2000; Dearing, McCartney, & Taylor, 2009; Frank et al, 2008). This statistical check produced no

meaningful alteration in the main results presented above. No matter which propensity score was used or how it was used, the three-way interaction was highly stable.

Third, Head Start is one of the major preschool opportunities in low-income communities. Up to this point, we separated the Head Start children from other children from low-income families attending preschool prior to kindergarten. Including the Head Start children in the category of preschool attendees eliminated the three-way interaction among preschool history, classroom phonics instruction, and school poverty level, suggesting that Head Start did less to differentiate children from low-income families on entry-level reading skills, thereby obviating the potential impact of classroom and school context.

Fourth, shifting the time frame from kindergarten to first grade revealed no two- or three-way interactions among preschool history, classroom phonics instruction, and school poverty level in the low-income population. Thus, the child $\times$ classroom instruction $\times$ school context model conceptualized and studied here only applied to the first year of elementary school and did not persist as children moved further into school (in line with evidence of fading effectiveness of phonics instruction as children leave kindergarten; National Reading Panel, 2000).

Fifth, although our focus was on children from low-income families, we wanted to provide a counterpoint to put these observed effects in a broader context. Estimating the same set of models revealed that the focal three-way interaction among preschool attendance, classroom instruction, and school poverty did not hold for kindergarteners from families that were not low-income. For such children, phonics instruction was associated with reading achievement across kindergarten in general, but this association was not related to whether they went to preschool or attended high poverty schools.

Discussion

According to the results of this study, the achievement benefits of going through kindergarten in a classroom generally characterized by phonics skills instruction depended on what children had done before they entered school as well as the larger school context in which their classrooms were situated. The complexity of this pattern suggests the value of sociological approaches to educational policy that emphasize the interactive effects of the different educational processes and contexts (from child to preschool to school) within which the educational career—and the transition into K-12 schooling in particular—unfolds. Building on the strengths of developmental theory with the insights of sociological perspectives emphasizing context and inequality in this way is important because it takes the focus off of low-income parents and what they may or may not be doing and shifts it to aspects of the institutional context that are amenable to policy intervention.

To summarize, children from low-income families who attended preschool typically entered elementary school classrooms with high levels of phonics instruction in reading, and they had more developed reading skills at the start of elementary school and posted greater gains in reading skills by the end of kindergarten than other children from low-income families. Yet, in line with expectations, this trend subsumed variation, including somewhat orthogonal

patterns according to the socioeconomic composition of the elementary schools in which kindergarten classrooms were embedded. In general, phonics instruction was related to reading gains (supporting the first hypothesis), but the child $\times$ classroom instruction match did not seem to differentiate children on reading achievement (contradicting the second hypothesis). Yet, the child $\times$ classroom instruction $\times$ school match did (supporting the third hypothesis). In high-poverty schools, kindergarteners from low-income families who had not attended preschool the year before actually appeared to gain more from phonics instruction than kindergarteners from low-income families who had attended preschool. In low-poverty schools, some evidence indicated that the preschool attendees did better over time.

Although the approach of this study differed from the child $\times$ instruction model by considering classroom-level instruction rather than individualized instruction, its results suggest the same conclusion as this developmental literature: instruction should be tailored to the needs of individual children within classrooms rather than the average student in the classroom (Connor et al., 2010; Connor et al., 2009; Connor et al., 2004; Morrison & Connor, 2002). The results also echo the basic insights of sociological research, which suggests that some of the benefits of moving socioeconomically disadvantaged children into socioeconomically advantaged schools may be chipped away due to the negative effects on teacher treatment and self-evaluation of being different from peers (Crosnoe, 2009). Connecting these two literatures, the results of this study can be explained in terms of how organizational efficiency is influenced by school and classroom composition. In schools serving predominantly low-income populations, more children tend to enter school with fewer basic skills and less preschool instruction. Consequently, phonics instruction could reflect a more efficient (and experience-based) pedagogical approach to serving the pressing needs of the student body. In this sense, children from low-income families without preschool experience who require an introduction to basic skills like phonics are a better match with the general thrust of curricular and instructional needs in their schools and, therefore, could benefit more from the modal instruction in these schools. Children who are less of a match with the normative profile (and schoolwide needs)—in other words, those who have attended preschool and have a better foundation of basic reading skills—would benefit less from what they will likely encounter in their classrooms. The opposite pattern would apply to schools serving a more middle class population.

Another explanation of our child $\times$ classroom instruction $\times$ school context results is that basic skills instruction may be qualitatively different across elementary schools varying in the socioeconomic composition of their student bodies. Unfortunately, we cannot directly test this explanation. In ECLS-K, teachers reported the frequency of certain basic skills instructional activities, but teachers might provide similar counts that mean different things. Perhaps phonics instruction is truly targeting the acquisition of basic skills in low-income schools but is more transitional in middle class schools, targeting the reinforcement of already acquired skills before moving onto new academic challenges like fluency and comprehension (Connor et al., 2004). If so, phonics instruction in schools serving low-income populations would be more of a service for children with no preschool history, but what is labeled phonics instruction in schools serving middle class populations would be of greater service for children coming in with some preschool experience. Process-related data on classrooms, especially from observations, is needed in the future to delve into this

potential for classrooms patterns with the same label to tap different processes and different levels of systematic organization (Pianta et al., 2007). Such data might also allow for a greater exploration of additional resources and strategies provided in more socioeconomically advantaged schools.

As already discussed, drawing strong conclusions from analyses of observational data is challenging. The ability to do so here is limited by several factors common to this kind of work, including the difficulty of adequately addressing threats to causal inference posed by unknown or unmeasurable confounds, such as genetically heritable traits or local and state policies and programs (Duncan, Magnuson, & Ludwig, 2004; Raudenbush, 2008). Also noteworthy is the absence of assessments of the *quality* of kindergarten classroom instruction. For example, prior evaluations of phonics instruction suggest that it works through a systematic and explicit plan that links a set of activities within a logical sequence that balances instruction and practice (Armbruster et al., 2001). Similarly, national and local studies have documented the extreme variability in the quality of preschool settings, particularly in relation to cognitive stimulation. Preschools also likely differ in terms of whether they explicitly prepare children for school as well as in the degree to which they emphasize supporting social development versus the acquisition of cognitive skills or try to balance these two goals (Clarke-Stewart, & Allhusen, 2005; Duncan & Magnuson, 2013; Gormley et al., 2008; NICHD ECCRN, 2005a). Thus, not all preschool attendance is equivalent, as evidenced by the divergence in results for Head Start and non-Head Start preschools. That distinction is only one source of diversity among preschools attended by low-income children, which needs to be examined more deeply.

The results of this study, therefore, should be viewed as preliminary until much stronger tests of the focal associations can be conducted. If these results can be further vetted, then they say something important about inequality. Specifically, adding to the many educational disadvantages faced by children from low-income families is that they have greater need than other children for individualized instructional support that speaks to where they are academically, which makes the rarity of such supports in U.S. schools more generally a more significant problem for them and magnifies the challenges associated with their lower exposure to quality early childhood education programs before they get to formal schooling. This conclusion has practical implications for educational policy and practice. For example, it supports the general push for universal pre-K, which would help to raise the overall skill level of children from low-income families and reduce heterogeneity among them so that instructional strategies targeting the classroom level would be more likely to match the needs of all children, especially in socioeconomically segregated schools (Zigler et al., 2006). As another example, the PK-3 policy agenda calls for greater coordination of curriculum and pedagogy between early childhood education programs and the primary grades of elementary school in order to create a more consistent pathway into the K-12 system (Bogard & Takanishi, 2005). Such coordination would enable elementary school teachers to have a better sense of what their students—individually and in aggregate—need instructionally. Finally, the Gates Foundation (2014) has supported efforts to use classroom technology and data collection to better tailor instruction to children's skill levels in a dynamic way, and the preliminary evidence suggest that these efforts have effects on test

scores suggests that they may be a strategy for achieving a better child $\times$ instruction $\times$ context match.

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Appendix

Coefficients for Control Variables Predicting the Spring Kindergarten Reading Achievement Reading Achievement of Children from Low-Income Families ($n = 7,710$)

	β	<i>SE</i>
Child controls		
African American	-.06***	.01
Latino/a	-.03*	.01
Asian American	.00	.01
Other race/ethnicity	-.02	.01
Gender (female)	.04***	.01
Age (in months)	.00	.01
Repeated kindergarten	-.04***	.01
Family controls		
Highest parent education	.05***	.01
Two parent biological family	.03**	.01
Residence in South	.05*	.02
Residence in Midwest	.03*	.02
Residence in West	.05*	.02
Residence in small town/rural area	-.01	.02
Residence in city fringe/large town	.01	.02
School/teacher controls ^a		
School sector (private)	.01	.01
School size	.01	.01
Teachers with Masters degree	.02	.01
Tenure at current school	.01	.01
Teacher race/ethnicity – Black	-.03*	.01
Teacher race/ethnicity – Latino/a	.01	.01
Teacher race/ethnicity – Asian	-.01	.01
Teacher race/ethnicity – Other	-.01	.01

Note. Results are net of fall kindergarten achievement, preschool attendance, phonics instruction, and school poverty level. All n 's rounded to the nearest 10 per NCES requirements.

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Figure 1. Kindergarten reading test scores, by phonics instruction and preschool attendance, for children from low-income families in high poverty and low poverty schools

Table 1

Descriptive Statistics for Study Variables among Children from Low-Income Families (n = 7,710)

	<i>M</i>	<i>SD</i>	%
Primary study variables			
Reading achievement (fall K)	19.1	6.6	
Reading achievement (spring K)	28.3	9.0	
Classroom phonics instruction (spring K)	4.6	0.6	
Preschool attendance			18.6
School poverty level ^a	54.5	29.8	
Child characteristics			
White			52.0
African American			26.0
Latino/a			15.5
Asian American			3.0
Other race/ethnicity			3.5
Gender (female)			48.4
Age (in months)	68.6	4.5	
Repeated kindergarten			5.8
Family characteristics			
Highest parent education	2.2	0.9	
Two parent biological family			47.3
Residence in Northeast			14.4
Residence in South			42.7
Residence in Midwest			19.6
Residence in West			23.3
Residence in small town/rural area			23.3
Residence in large city			45.3
Residence in city fringe/large town			31.4
Home learning activities	2.7	0.6	
Time spent on reading at home	3.1	0.8	
School/teacher characteristics ^b			
School sector (private)			5.1
School size	3.5	1.1	
Teacher has Masters degree			34.8
Teacher tenure at school	9.1	8.0	
Teacher race/ethnicity – White			77.0
Teacher race/ethnicity – Black			9.4
Teacher race/ethnicity – Latino/a			10.9
Teacher race/ethnicity – Asian			1.6
Teacher race/ethnicity – Other			1.1
Freq. achievement-based reading groups	2.9	1.6	
Frequency of extra reading assistance	3.7	1.1	

	<i>M</i>	<i>SD</i>	%
Frequency of reading tutoring by aide	3.1	1.4	
Frequency of reading tutoring by specialist	1.7	1.2	
Frequency of pull-out reading instruction	2.5	1.5	
Frequency of whole-language activities	3.6	0.9	

Note: *n*'s rounded to the nearest 10 per NCES requirements.

^aPercentage of students in school receiving free/reduced price lunch.

^bDescriptive statistics for school and teacher characteristics reported at the individual level.

Table 2

Predicting the Spring Kindergarten Reading Achievement of Children from Low-Income Families (n = 7,710)

	β (SE)			
	1	2	3	4
Main effects				
Reading (fall K)	.73*** (.01)	.73*** (.01)	.73*** (.01)	.73*** (.01)
Classroom phonics (spring K)	.07*** (.01)	.06 (.03)	.08* (.03)	.06* (.03)
Preschool attendance	-.00 (.01)	.04 (.08)	.34* (.16)	.33* (.15)
School poverty level	.03 (.02)	-.08 (.11)	.02 (.11)	-.01 (.11)
Two-way interactions				
Preschool $\times$ phonics		-.08 (.08)	-.38* (.16)	-.37* (.16)
Preschool $\times$ school poverty		.04 (.02)	-.35* (.17)	-.34* (.17)
Phonics $\times$ school poverty		.11 (.11)	.01 (.12)	.03 (.12)
Three-way interaction				
Phonics $\times$ preschool $\times$ school poverty			.40* (.18)	.39* (.17)

Note: All analyses controlled for parent education, family structure, child gender, child age, child race/ethnicity, repeated kindergarten, school size, school sector, teacher education, teacher tenure, region, and urbanicity. Model 4 included an additional set of classroom instructional (whole language instructional practices, frequency of achievement-based reading groups, frequency of tutoring by aide, frequency of tutoring by specialist, frequency of pull-out reading instruction) and home environment controls (home learning activities, home reading with parents). All n 's rounded to the nearest 10 per NCES requirements.

Table 3
Comparison of Groups Varying on Preschool Attendance, Classroom Phonics Instruction, and School Poverty Level

	% or <i>M</i> (<i>SD</i>)							
	Preschool, low poverty, high phonics (<i>n</i> = 100)	Preschool, low poverty, low phonics (<i>n</i> = 260)	Preschool, high poverty, high phonics (<i>n</i> = 260)	Preschool, high poverty, low phonics (<i>n</i> = 620)	No Preschool, low poverty, high phonics (<i>n</i> = 530)	No Preschool, low poverty, low phonics (<i>n</i> = 1,380)	No Preschool, high poverty, high phonics (<i>n</i> = 1,030)	No Preschool, high poverty, low phonics (<i>n</i> = 2,770)
Child characteristics								
White	54.5%	52.5%	56.7%	67.9%	35.6%	46.1%	55.7%	53.1%
African American	35.4%	26.2%	21.7%	13.9%	33.9%	28.3%	24.5%	21.7%
Latino/a	6.1%	13.3%	14.1%	10.4%	16.5%	13.9%	19.8%	13.4%
Asian American	3.0%	6.5%	5.7%	6.4%	11.4%	6.1%	8.9%	7.3%
Other race/ethnicity	1.0%	1.5%	1.9%	1.3%	2.7%	5.6%	2.5%	4.6%
Gender (female)	51.5%	52.1%	47.9%	50.2%	49.0%	49.3%	47.6%	49.1%
Age (in months)	68.51 (4.24)	68.42 (4.04)	67.77 (3.91)	68.86 (4.43)	68.22 (4.19)	68.84 (4.79)	68.24 (4.52)	68.41 (4.53)
Repeated kindergarten	6.1%	3.8%	4.2%	4.5%	4.7%	6.6%	5.3%	4.9%
Family characteristics								
Highest parent education	2.31 (0.83)	2.25 (0.81)	2.56 (1.07)	2.71 (1.05)	2.13 (0.83)	2.07 (0.83)	2.13 (0.89)	2.25 (0.92)
Two parent bio. family	47.5%	50.6%	59.2%	62.5%	46.1%	45.7%	49.4%	48.0%

Note. Low poverty = less than 50% of student body qualifies for Free or Reduced-Price Lunch; high poverty = 50% or more of student body qualifies for Free or Reduced-Price Lunch. High phonics = high phonics instruction (3–4 times per week or more). All *n*'s rounded to the nearest 10 per NCES requirements.