

**Predicting Early and Later Reading Achievement of Children from Low-Income Families
from Skills Measured at Kindergarten Entrance**

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Background

There is currently a great deal of policy interest in the questions of how and to what extent the academic achievement of children from low parent-education, low-income and minority families can be bolstered through preschool programs and other early interventions. In particular, the U.S. Department of Education has focused on reading proficiency as being central to overall academic achievement. The Department has sponsored research into preschool and early elementary interventions that seek to bolster the reading achievement of at-risk students through early instruction in phonological awareness and letter and word decoding skills. These are skills like print awareness, letter recognition, and letter-sound associations that the psychologists Whitehurst and Lonigan (1998) have called “inside-out” skills. The U.S. Department of Health and Human Services has sponsored similar research seeking to improve early literacy activities in the nationwide Head Start program.

But past studies have shown that even when disadvantaged children participate in compensatory preschool programs and do reasonably well in the early grades of elementary school, their achievement gains tend to “fade out” as they reach the third grade of elementary school and beyond. The gap between their achievement and that of their peers from middle-class family backgrounds widens as learning tasks become more complex and involve comprehension, reasoning, and problem-solving. The achievement slump that disadvantaged students experience is often attributed to the inadequate resources and inferior instruction available to them in public schools in impoverished communities. But it may be that the slump occurs because a different set of skills comes into play as learning tasks become more complex. These skills may be ones in which disadvantaged children are particularly weak – even if they have participated in early compensatory programs. With respect to reading, Whitehurst and Lonigan (1998) differentiate the “inside-out” skills involved in decoding printed language from what they call “outside-in” skills like vocabulary, syntax, and general knowledge. It is the latter set of skills that becomes more important, according to Whitehurst and Lonigan, as young readers progress from sounding out words and sentences to comprehending the meaning of what they read and how it relates to other things they have learned about the physical, biological, and social world. A possible implication of this skill differentiation is that preschool programs might reduce or prevent the late-elementary-school slump by placing more emphasis on bolstering vocabulary, general knowledge, and even mathematics skills of their pupils, as well as phonemic and decoding skills.

This paper examines how well different skills measured at kindergarten entrance predict the tested reading achievement of students at the end of kindergarten, first grade, and third grade. We use multiple regression analysis with data from the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K), fall 1998 – spring 2002, to examine how well direct child assessments at the start of kindergarten predict to the later achievement of U.S. elementary-school children in general and graduates of Head Start in particular.

Research Framework

This paper builds upon prior research work on the predictive validity of child assessments conducted during the preschool years to children’s tested achievement at the end of kindergarten and first grade. This research was conducted with national samples of Head Start children who were followed into elementary school in the Head Start Family and Child Experiences Survey (Zill et al., 2003). In these studies, early reading skills like letter and word recognition were found to be strongly predictive of early reading skills at the end of kindergarten and first grade.

At the same time, preschool assessments of vocabulary knowledge were found to be strongly predictive of children's tested general knowledge at the end of kindergarten and first grade. Vocabulary was not as strongly predictive of early reading skills, once letter knowledge was taken into account.

The research also builds on a series of studies conducted by the economist Greg Duncan and his collaborators (Duncan et al., 2005). Utilizing several large-scale longitudinal studies, including the ECLS-K, Duncan et al. (2005) undertook to examine how predictive cognitive assessments at entrance to school were of later achievement, compared to assessments or ratings of children's self-regulation or social-emotional development. Like the present study, Duncan and colleagues found that early reading, math, and general knowledge scores were highly predictive of future reading achievement outcomes. What we focus on here is the extent to which there are cross-domain effects to children's achievement at later stages in the schooling process, the extent to which children's later reading achievement is related not only to early reading skills but also to early mathematical skills and general knowledge. Duncan and colleagues found that early math skills are as important a predictor of later reading achievement as they are of later mathematics achievement. On the other hand, early reading skills are not nearly as predictive of later mathematics achievement as they are of later reading achievement.

Data and Methodology

Description of Sample

Our analysis uses four waves of longitudinal data from the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K). The ECLS-K is a multi-source, multi-method study that focuses on children's early school experiences beginning with kindergarten (West et al., 2000). The study follows a nationally representative cohort of children (21,260) from kindergarten through fifth grade though fifth grade data are not yet available. For our analyses, we limited the sample to children who had completed cognitive assessments in four of the currently-available waves, namely fall kindergarten (1998), spring kindergarten (1999), spring first grade (2000), and spring third grade (2002). Thus, the sample size for all children in the study was 9,263. For the analysis of children in Head Start the year before entrance into kindergarten, i.e. fall 1997 – spring 1998 school year, we used children who had been verified by Head Start programs to have been in that program in the year prior to entrance into kindergarten. This verification process followed up on initial information provided by either parents or schools that the children had been in Head Start in the year before entering kindergarten. The sample size for Head Start children was 807.

Statistical Analysis Method

Ordinary least-squares multiple regression models have been run regressing fall kindergarten reading, math, and general knowledge scores on spring reading scores of the same children in kindergarten, 1st grade and 3rd grade. Multilevel models are in the process of being run that also incorporate school, teacher/classroom, and child/family characteristics along with the children's early test scores. In descriptive and regression analyses, Wesvar software with replicate weights have been used to account for the effects of sample clustering on standard errors.

Core Variables

The direct cognitive assessment battery contained items in reading, mathematics, and general knowledge in the fall and spring of kindergarten, spring of 1st grade, and spring of 3rd grade (West et al., 2000). In each subject area, children received a 12- to 20- item routing test. Performance on the routing items guided the selection and administration of one of several second-stage forms. The second-stage form contained items of appropriate difficulty for the level of ability indicated

by the routing items. For these analyses, Item Response Theory (IRT) scale scores were used as both dependent and independent variables.

Preliminary Results

The results indicate that the combined use of fall kindergarten assessments of early reading skills, early math skills, and early general knowledge (the last well correlated with vocabulary) was highly predictive of children's tested reading performance in the spring of kindergarten, spring of first grade, and spring of third grade. This was true for the children in the full sample (see Chart 1) and for the children in the Head Start attendee subsample as well (see Chart 2). For U.S. students in general, the multiple regression models were able to account for 66 percent of the variance in end-of-kindergarten reading scores, 48 percent of the variance in end-of-first-grade scores, and 46 percent of the variance in end-of-third-grade scores (Chart 1). But the relative importance of the reading, math, and general knowledge predictors changed dramatically from the model predicting early reading to the model predicting later reading (see Chart 3). The size of the standardized regression coefficient (beta) for early reading skills declined from .63 to .36 to .16. By contrast, the size of the regression coefficient for general knowledge increased from .03 to .10 to .35. Early math skills contributed to the prediction of later reading achievement at all three time points (betas = .21, .31, and .27, respectively).

A similar pattern of results was obtained with the regression models for Head Start graduates (Charts 2 and 4). The total variance accounted for by each model was substantial, though somewhat less than that achieved with the full sample (r-squares of .62, .39, and .39, for end of kindergarten, first grade, and third grade). The pattern of decreasing predictive importance of early reading skills and increasing importance of general knowledge was also found among Head Start graduates. Early math skills were predictive of later reading achievement among the Head Start graduates as well, with their relative importance even more pronounced than in the general sample (Chart 4).

Conclusions

The notion that the school readiness skills that are important for early reading achievement are different from those needed for later reading achievement was strongly supported by the regression analyses results. Early cognitive assessment measures were strongly predictive of children's tested reading achievement in all three grades. But the relative predictive importance of the component skills changed dramatically. Early reading skills, like letter recognition and letter-sound associations, were highly predictive of reading scores at the end of kindergarten, but less predictive of scores at the end of first grade and third grade. By contrast, general knowledge at kindergarten entrance (and presumably, related "outside-in" skills like vocabulary) was not a significant predictor of reading scores at the end of kindergarten, but became the leading predictor of reading scores by the end of third grade. Interestingly, early math skills contributed to the prediction of reading scores at all three grades. A similar pattern of results was obtained with the subsample of children from low-income families who had attended Head Start as with the full sample of all U.S. elementary school students.

The results suggest that preschool programs aimed at boosting the long-term reading proficiency of children from low parent-education, low income, and minority families should seek to strengthen the vocabulary, general knowledge, and early math skills of their pupils, as well as striving to bolster phonemic awareness and letter and word decoding skills. The results show that there are substantial cross-domain effects in children's acquisition of knowledge and skills as they progress through the early elementary school grades. The results also show that school readiness skills assessed at kindergarten entrance do indeed forecast later achievement, not only in the earliest grades but also in the later grades of elementary school.

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Chart 1
Predictive Power of Early Cognitive Assessments in Forecasting
Children's Reading Performance in Elementary School

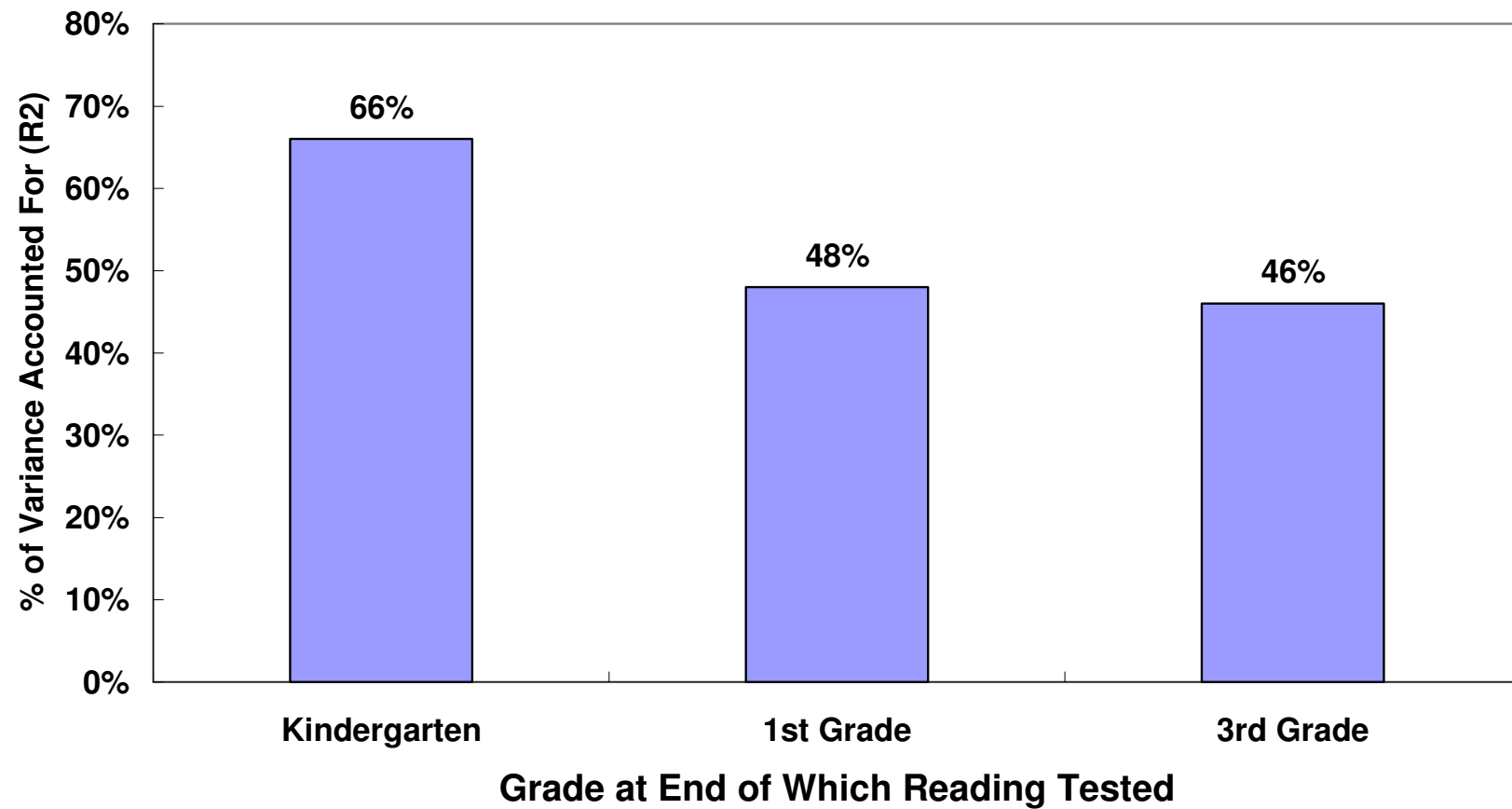


Chart 2
Predictive Power of Early Cognitive Assessments and Approaches to Learning Ratings in Forecasting Reading Performance of Head Start Graduates in Elementary School

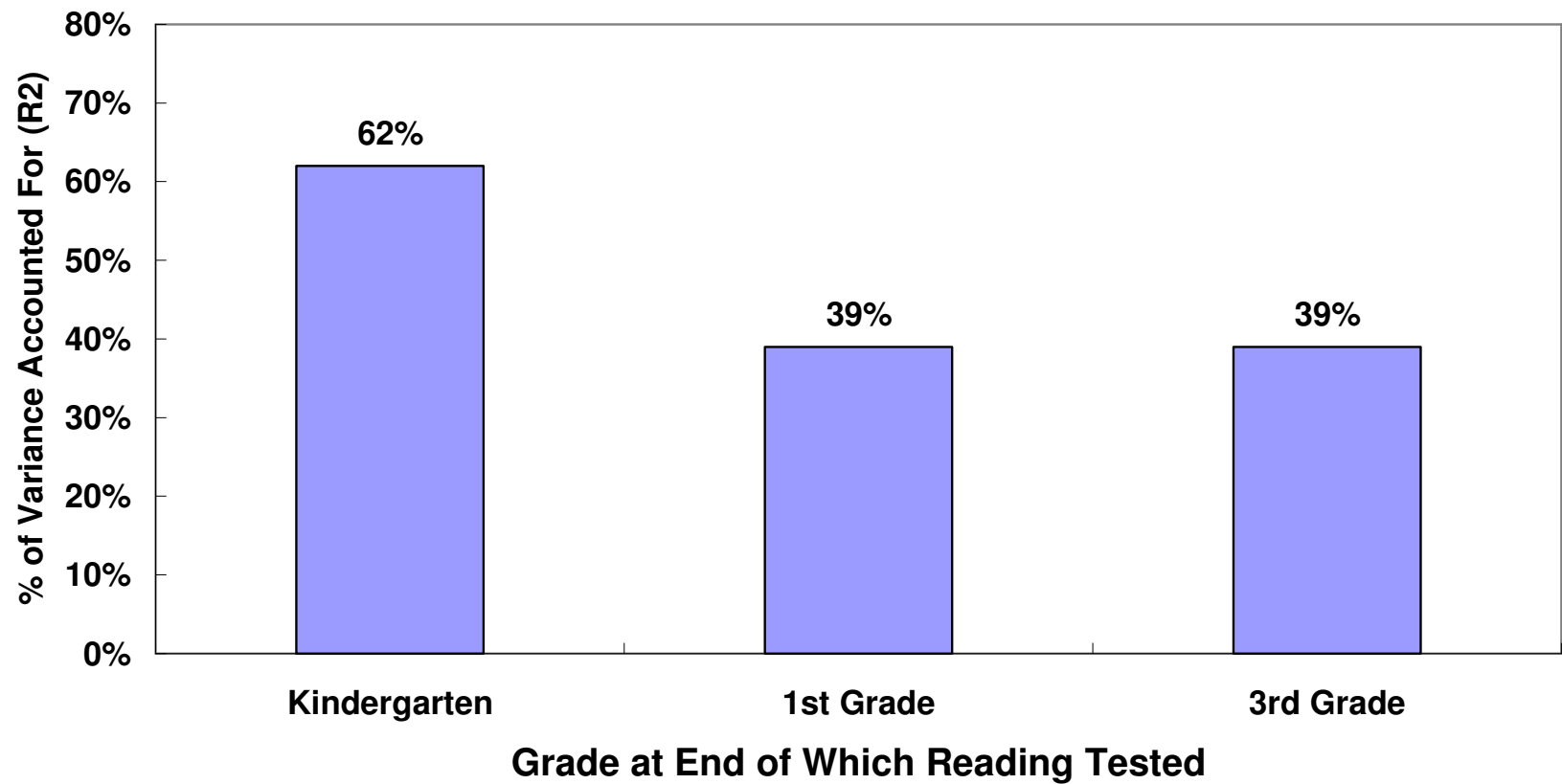


Chart 3
Relative Predictive Value of Different Subtests Administered at Start of Kindergarten to Children's Reading Performance in Elementary School

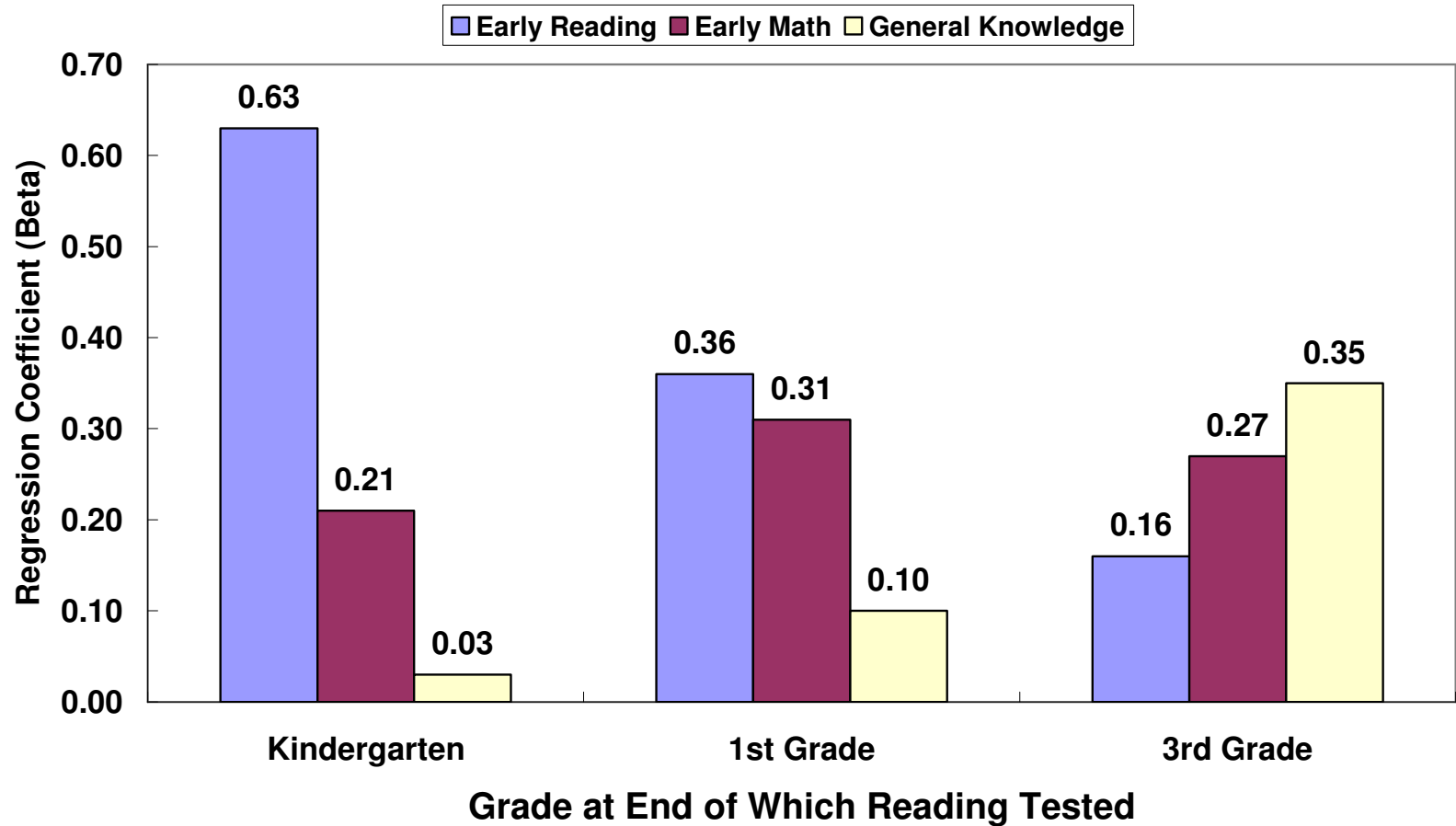


Chart 4
Relative Predictive Value of Different Subtests Administered at Start of Kindergarten to Reading Performance of Head Start Children in Elementary School

