School Readiness and Later Achievement

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Abstract

Using six longitudinal data sets, we estimate links between three key elements of school readiness—school-entry academic, attention, and socioemotional skills—and later school reading and math achievement. In an effort to isolate the effects of these school-entry skills, most of our regression models control for cognitive, attention, and socioemotional skills measured prior to school entry, as well as a host of family background measures.

Across all six studies, the strongest predictors of later achievement are school-entry math, reading, and attention skills. A meta-analysis of the results shows that early math skills have the greatest predictive power, followed by reading skills and then attention. By contrast, measures of socioemotional behaviors, including internalizing and externalizing problems and social skills, were generally insignificant predictors of later academic performance, even among children with relatively high levels of problem behavior. Patterns of association were similar for boys and girls and for children from high and low socioeconomic backgrounds.

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Early childhood programs and policies that promote academic skills have been gaining popularity among politicians and researchers. For example, President George W. Bush endorsed Head Start reforms in 2002 that focus on building early academic skills, observing that "[o]n the first day of school, children need to know letters and numbers. They need a strong vocabulary. These are the building blocks of learning, and this nation must provide them." The National Research Council's Committee on the Prevention of Reading Difficulties in Young Children likewise recommends providing environments that promote pre-literacy skills for all preschool children (Snow, Burns, & Griffin, 1998). Similarly, the National Association for the Education of Young Children and the National Council of Teachers of Mathematics (2002) issued a joint statement that advocated for high-quality mathematics education for children ages 3-6.

Others, however, maintain that a broad constellation of behaviors and skills enable children to learn in school. Asked to identify factors associated with a difficult transition to school, kindergarten teachers frequently mentioned weaknesses in academic skills, problems with social skills, trouble following directions, and difficulty with independent and group work (Rimm-Kaufman, Pianta, & Cox, 2000). Researchers too have made this point. The National Research Council and Institute on Medicine argued that "the elements of early intervention programs that enhance social and emotional development are just as important as the components that enhance linguistic and cognitive competence" (Shonkoff & Phillips, 2000, pp. 398-99).

These two views have emerged in the current debate about what constitutes school readiness, particularly what skills predict school achievement. Many early education programs, including Head Start, are designed to enhance children's physical, intellectual, and social competencies on the grounds that each domain contributes to a child's overall developmental competence and readiness for school. However, if early acquisition of specific academic skills or learning-enhancing behaviors forecasts later achievement, it may be beneficial to add domain-specific early skills to the definition of school readiness and to encourage interventions aimed at promoting these skills prior to elementary school. Thus, understanding which skills are linked to children's academic achievement has important implications for early education programs.

We adopt a child-centered model of school transition, which is nested within a broader ecological framework, but focuses on the set of individual skills and behaviors that children have acquired prior to school entry (Rimm-Kaufman & Pianta, 2000). A child's individual characteristics contribute to the environments in which the child interacts and the rate at which the child may learn new skills; in turn the child receives feedback from others in the environment (Meisels, 1998). Thus, by influencing both the child and the social environment, early academic skills and socioemotional behaviors are linked to academic achievement because they provide the foundation for positive classroom adaptation (Cunha, Heckman, Lochner, & Masterov, 2005; Entwistle, Alexander, & Olson, 2005).

For example, a child who enters kindergarten with rudimentary academic skills may be poised to learn from formal reading and mathematics instruction, receive positive reinforcement from the teacher, or be placed in a higher-ability group that facilitates the acquisition of

additional skills. Similarly, a child who can pay attention, inhibit impulsive behavior, and relate appropriately to adults and peers may be able to take advantage of the learning opportunities in the classroom, thus more easily mastering reading and math concepts taught in elementary school. For these reasons, the skills children possess when entering school might result in different achievement patterns in later life. If achievement at older ages is the product of a sequential process of skill acquisition, then strengthening skills prior to school entry might lead children to master more advanced skills at an earlier age, and perhaps even increase their ultimate level of achievement.

Although there are strong theoretical reasons to expect that individual differences in children's early academic skills and behavior are linked to subsequent behavior and achievement, surprisingly little rigorous research supports this hypothesis. Consequently, the purpose of this paper is to assess, as precisely as possible using six longitudinal, non-experimental data sets, the association between skills and behaviors emerging during the preschool years and later academic achievement. As with Robins's (1978) classic study of adult anti-social behavior, our approach consists of comparable analyses of a number of different longitudinal developmental studies.[1] We are especially interested in identifying academic, attention, and socioemotional skills and behaviors that may be learned or improved through experiences prior to school entry. In the following sections, we draw from developmental literature to identify key dimensions of school readiness and to derive theoretical predictions about how children's school entry skills and behaviors contribute to short- and long-term academic success.

Relations between early skills and later achievement

Academic achievement is a cumulative process involving both mastering new skills and improving already existing skills (Entwisle & Alexander, 1990; Pungello, Kuperschmidt, Burchinal, & Patterson, 1996). Information about how children acquire reading and math skills points to the importance of specific academic skills, but also indicates that more general cognitive skills, particularly oral language and conceptual ability, may be increasingly important for later mastery of more complex reading and mathematical tasks. Basic oral language skills become critical for understanding texts as the level of difficulty of reading passages increases (NICHD Early Child Care Research Network, 2005a; Scarborough, 2001; Snow et al, 1998; Storch & Whitehurst, 2002; Whitehurst & Lonigan, 1998). Likewise, mastery of foundational concepts of numbers allows for a deeper understanding of more complex mathematical problems and flexible problem-solving techniques (Baroody, 2003; Ferrari & Sternberg, 1998; Hiebert & Wearne, 1996).

Although children's academic achievement is largely stable throughout childhood, children do demonstrate both transitory fluctuations and fundamental shifts in their achievement trajectories (Kowleski-Jones & Duncan, 1998; Pungello et al., 1996). Non-experimental data show that children's achievement test scores are related to prior cognitive functioning and the attainment of basic skills in math and literacy such as number and letter recognition (Stevenson & Newman, 1986). In their meta-analysis, La Paro and Pianta (2000) find middle-range correlations in cognitive/academic skills from both preschool to kindergarten (.43) and from kindergarten to first or second grade (.48).

Attention-related skills such as task persistence and self-regulation are expected to increase the time children are engaged and participating in academic endeavors. Research has

shown that the signs of attention and impulsivity can be detected as early as age 2 ½, but continue to develop until reaching relative stability between ages 6 and 8 (Olson, Sameroff, Kerr, Lopez, & Wellman, 1999; Posner & Rothbart, 2000). Studies linking attention with later achievement are less common, but consistent evidence suggests that the ability to control and sustain attention as well as participate in classroom activities predicts achievement test scores and grades during preschool and the early elementary grades (Alexander, Entwisle, & Dauber, 1993; Raver, Smith-Donald, Hayes, & Jones, 2005). These attention skills, which are conceptually distinct from other types of interpersonal behaviors, are associated with later academic achievement, independent of initial cognitive ability (McClelland, Morrison, & Holmes, 2000; Yen, Konold, & McDermott, 2004), and of prior reading ability and current vocabulary (Howse, Lange, Farran, & Boyles, 2003). Examining attention separately from externalizing problems has clarified the role of each in achievement, suggesting that attention is more predictive of later achievement than more general problem behaviors (Barriga et al., 2002; Hinshaw, 1992; Konold & Pianta, 2005; Ladd, et al., 1999; Normandeau, 1998; Trzesniewski, Moffitt, Caspi, Taylor, & Maughan, 2006).

Children's socioemotional skills and behaviors are also expected to affect both individual learning and classroom dynamics. Inadequate interpersonal skills promote child-teacher conflict and social exclusion (Newcomb, Bukowski, & Pattee, 1993; Parker & Asher, 1986), and these stressors may reduce children's participation in collaborative learning activities and adversely affect achievement (Ladd et al., 1999; Pianta & Stuhlman, 2004). Correlational evidence linking problem behaviors to academic achievement is found in the Beginning School Study. First grade ratings on items describing a cheerful, outgoing temperament (roughly the opposite of internalizing problems) predicted adult educational attainment better than preschool or first-grade achievement scores (Entwisle et al., 2005). Other studies yield similar results. For example, children with consistently high levels of aggression from age 2 through 9 were more likely than other children to have achievement problems in third grade (NICHD Early Child Care Research Network, 2004).

Experimental evidence and cross-over effects

While many studies find associations between early achievement, attention, and behavior and later achievement, few of these studies are designed to determine which of these skills can be modified prior to school entry, or whether these changes predict achievement. Fortunately, a small, but growing, number of experimental interventions provide encouraging evidence that high quality programs for preschool children "at-risk" for school failure produce gains in cognitive and academic skills and reduce behavior problems (Karoly, Kilburn, & Cannon, 2005; Love et al., 2003; Conduct Problems Prevention Research Group, 2002). Early educational interventions have also been found to result in long-term reductions in special education services, grade retention, and increases in educational attainment (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002; Lazar & Darlington, 1982; Reynolds & Temple, 1998).

The ability of experimental studies to identify crucial academic and socioemotional skills, however, is limited in two important ways. First, many of the intervention programs influence both children's academic skills and their socioemotional behaviors. Thus, it is not possible to assess the extent to which long-term impacts on achievement are due to higher levels of early academic skills, attention skills, or lower levels of problem behavior at school entry.

Given that teachers often emphasize the importance of attention and socioemotional skills

for school readiness, it might be expected that these early skills would have "crossover" effects on later achievement outcomes. However, the second limitation of experimental evidence is that few evaluations of interventions on socioemotional behaviors assess how they affect subsequent achievement, and those that have explored this find little evidence of such cross-over effects (see Dolan et al., 1993; Kellam, Mayer, Robok, & Hawkins, 1998; Tremblay, Pagani-Kurtz, Mâsse, Vitaro, & Pihl, 1995). Nevertheless, with so few studies it is possible that even small, temporary changes in behavior that open the door for learning might set off a "multiplier" effect where rewarding experiences with classmates and school achievement improve a child's attitude toward learning and motivation for school success (Dickens, 2005). From a life-course perspective, this can have important long-term implications for social integration and economic self-reliance.

Randomized trials of intervention programs show that children can benefit from targeted direct services, but it remains unclear whether program components directed at specific academic or socioemotional skills alone are able to boost later school achievement. Given the increasing demand for early education programs to promote school readiness, it is essential to identify specific, changeable early skills and behaviors that are associated with later achievement in school.

The Present Study

This study builds upon previous school readiness research in several ways. First, the scope of the study is unprecedented. We estimate a carefully-specified set of models with data from six large-scale longitudinal studies, two of which are nationally representative of U.S. children, two are drawn from multi-site studies of U.S. children, and one each of children from Great Britain and Canada. Second, we include as predictors a wide representation of school readiness indicators used in previous research, and carefully distinguish between related but conceptually distinct skills (e.g., oral language vs. pre-literacy skills, attention vs. externalizing problems) wherever possible. Third, we examine multiple dimensions of academic achievement outcomes, including grade completion and math and reading achievement as assessed both by teacher ratings and test scores. Fourth, we implement rigorous analytic methods that attempt to isolate the effects of school-entry academic, attention, and socioemotional skills by controlling for an extensive set of prior child, family, and contextual influences that may be related to children's achievement. Finally, we assess whether the predictive power of school readiness components differs by gender and socioeconomic status, which may place some children at heightened risk of low achievement.

We test a number of hypotheses related to how school-entry academic, attention, and socioemotional skills are associated with later school achievement. Developmental theory suggests that children's informal, intuitive knowledge of early language and math concepts plays an important role in the acquisition of more complex skills formally taught in elementary school (Adams, Treiman, & Pressley, 1998; Baroody, 2003; Griffin, Case, & Capodilupo, 1995; Tunmer & Nesdale, 1998). Theoretically, children's attention and socioemotional skills should also affect achievement because they influence children's engagement in learning activities and facilitate (or disrupt) classroom processes (Ladd, Birch, & Buhs, 1999; Pianta & Stuhlman, 2004). However, some scholars point out that it is important to distinguish between behaviors that are directly relevant for learning, such as attention, and those that may be correlated with attention, but are less likely to be directly linked with achievement, such as interpersonal skills and problem behavior (Alexander et al., 1993; Cooper & Farran, 1991; McClelland et al., 2000; McWayne, Fantuzzo, & McDermott, 2004). Therefore, we expect early academic and attention-