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Predicting Academic Achievement and Attainment: The Contribution of Early Academic Skills, Attention Difficulties, and Social Competence

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Abstract. Research predicting academic achievement from early academic, attention, and socioemotional skills has largely focused on elementary school outcomes and rarely included peer assessments of social competence. We examined associations between these early child characteristics and academic outcomes into young adulthood using the Fast Track normative sample (n = 386). Reading achievement after fifth grade was significantly higher in children with better early reading skills and significantly lower in children with early attention difficulties. Math achievement was predicted by early reading and math skills, while school grades were significantly lower in children with lower peer acceptance and higher attention difficulties. Children with early attention difficulties were 40% less likely to graduate from high school. Years of education by young adulthood was significantly reduced in children with lower early reading skills, lower social acceptance, and higher attention difficulties; these early child characteristics affected long-term academic outcomes indirectly through their impact on intermediate academic outcomes.

Which early child characteristics predict long-term academic achievement and educational attainment? Research has focused on the role of early academic skills, learning-enhancing behaviors, and socioemotional competencies as precursors of academic success. Identifying the relative contribution of each to children's long-term academic achievement is important as it can inform the skills on which early education programs should focus.

Early academic skills include basic literacy (e.g., being able to recognize letters, phonemic awareness) and numeracy (e.g., knowledge of numbers and understanding the order of numbers) abilities that position a child to learn from formal instruction (Duncan et al., 2007). Learning-enhancing behaviors include attending to classroom activities, following classroom rules, working cooperatively in groups, and persisting at academic tasks. Chil-

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dren's ability to sustain attention is especially important because "few constructs have a more direct impact on children's academic achievement than their ability to pay attention in the classroom" (Trentacosta & Izzard, 2007, p. 78). Socioemotional competence encompasses a broad range of skills and abilities, including being able to identify and express emotions, engage in adequate self-regulation, and develop positive relations with peers and teachers.

Following from Bronfenbrenner's bioecological model of development (Bronfenbrenner & Morris, 2006), multiple interacting factors influence the development of these skills including child characteristics, processes of recurring social interactions the child experiences (i.e., proximal processes), and the environmental contexts in which these processes occur. For example, the emergence of basic literacy skills depends on the child's ability to absorb and master such knowledge, his or her exposure to experiences that promote early literacy skills, and how proximal and more distal environments support or inhibit his or her acquisition. Moreover, the extent to which these skills—along with attention and socioemotional skills—have developed by school entry may influence children's early educational experiences in a reciprocal manner. As Duncan et al. (2007) noted, "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" (p. 1429). This feedback can influence children's motivation to learn and engage in academic work and their subsequent academic trajectory.

PATHWAYS TO LONG-TERM ACADEMIC ACHIEVEMENT

Children who enter school with better developed literacy and numeracy skills are likely to receive more positive teacher feedback that motivates subsequent learning; they may also benefit from placement with more advanced students that facilitates additional skill acquisition (Duncan et al., 2007). Poorly developed attention skills at school entry may undermine basic academic skill acquisition because attention difficulties decrease the benefit that children obtain from formal instruction (Rabiner, Coie, & Conduct Problems Prevention Research Group [CPPRG], 2000). Moreover, failing to master basic academic skills can lead to falling further behind over time and becoming less engaged in academic work, thus adversely affecting students' academic trajectory over an extended period (Rabiner, Carrig, & Dodge, 2013). Children with poorly developed social skills are more likely to experience peer rejection and have difficulty establishing supportive relationships with teachers. This can result in an aversion to school and reduced classroom participation (Buhs & Ladd, 2001; Hamre & Pianta, 2001). Over time, rejected students may gravitate toward deviant peers (Fergusson, Woodward, & Horwood, 1999), thus further reducing their academic engagement and undermining their long-term academic success (Veronneau & Dishion, 2011).

These pathways reflect a subset of multiple ways that early deficits in academic, attention, and social skills may adversely affect children's long-term academic outcomes. While identifying these pathways is an important task, examining how the differential acquisition of these skills affects children's early school experience and academic trajectories is also important. This knowledge can help inform the skills that early education programs should work to develop. For example, knowing that early attention difficulties reduce high school graduation rates irrespective of IQ, socioeconomic status (SES), and early academic skills would highlight the importance of identifying and remediating attention deficits as early as possible.

Prior research has consistently highlighted the importance of early academic and attention skills for subsequent achievement. For example, Rabiner et al. (2000) reported that first-grade reading and math skills, as well as first-grade attention skills, predicted reading and math achievement after fifth grade; the adverse impact of early attention difficulties persists even when difficulties subsequently

decline (Rabiner et al., 2013). Duncan et al. (2007) analyzed six longitudinal datasets and found that early math, reading, and attention skills consistently predicted academic achievement, whether achievement was assessed via standardized tests or teachers' ratings. Early attention skills have even been found to predict high school graduation (Pingault et al., 2011).

Results linking early social and emotional skills to subsequent achievement, however, are more limited. Studies reporting this link either have not examined academic outcomes beyond first grade (Buhs & Ladd, 2001; Rhoades, Warren, Domitrovich, & Greenberg, 2011; Trentacosta & Izzard, 2007) or have assessed social competence in ways not truly distinct from attention difficulties (McClelland, Acock, & Morrison, 2006; McClelland, Morrison, & Holmes, 2000). Furthermore, these studies did not simultaneously include early attention and academic skills as "competing" predictors of academic achievement; when this has been done, effects for early social competence have been absent (Duncan et al., 2007; Rabiner et al., 2000).

LIMITATIONS IN PRIOR RESEARCH

Despite extensive prior research, important gaps remain in our knowledge of how early academic, attention, and socioemotional skills affect long-term academic achievement. In studies that have simultaneously considered these early child characteristics as predictors, which is necessary to evaluate their relative importance, academic outcomes generally have been restricted to elementary school and have not extended beyond middle school (Duncan et al., 2007). Thus, information on whether and how these early child characteristics affect important academic outcomes such as high school graduation is lacking.

The contribution of early socioemotional competence to subsequent achievement remains especially unclear. Although early socioemotional competence did not predict academic outcomes above and beyond school-entry academic and attention skills (Duncan et al., 2007; Rabiner et al. 2000), peer reports of social competence were not included in these studies. This is problematic for several reasons. First, peers are privy to aspects of children's social worlds that teachers and parents are not and thus provide unique information about children's social competence (Parker & Asher, 1987). Second, peer ratings of early social acceptance are a strong predictor of high school graduation (Parker & Asher, 1987) and thus are especially important to consider when examining long-term academic outcomes. Finally, in addition to the exclusion of peer assessments, the aspects of social competence assessed in these studies were children's behavior and emotional difficulties and/or social skills rather than their social acceptance by peers. Thus, studies comparing early academic, attention, and social competence skills as predictors of academic achievement have omitted an indicator of early social competence with demonstrated predictive validity.

STUDY HYPOTHESES

The primary goal of this study was to examine how early academic, attention, and socioemotional skills predict academic outcomes across children's school careers and into young adulthood. We also sought to address an important limitation in prior research by using peers to measure children's social acceptance, rather than relying on teacher and/or parent report of behavioral and social skill difficulties. Three specific hypotheses were tested: (a) In addition to the importance of early academic and attention skills, socioemotional skills assessed via peer report of social acceptance will predict children's academic achievement through the end of elementary school. (b) These early acquired skills will also predict more distal academic outcomes, including academic performance in middle school, high school graduation, and educational attainment by young adulthood. (c) Early child characteristics will not affect children's long-term educational outcomes directly but will do so indirectly through their impact on intermediate academic outcomes. Results may inform whether developing chil-

Table 1. Descriptive Statistics

	n	*M*	*SD*	Minimum	Maximum	Proportion
Letter–word score—first grade	335	93.20	17.36	54.00	141.00	
Calculation score—first grade	335	98.04	11.68	51.00	147.00	
Reading score—fifth grade	303	96.34	19.65	34.00	139.00	
Calculation score—fifth grade	304	98.66	13.32	57.00	161.00	
Average grades—fifth grade	334	8.74	2.82	2.00	12.00	
Average grades—middle school	341	8.17	2.63	3.00	12.00	
Years of education by age 25 years	322	12.43	2.25	8.00	17.00	
Letter–word score—kindergarten	355	89.95	16.25	46.00	155.00	
Calculation score—kindergarten	352	92.28	15.72	77.00	139.00	
Inattention score—first grade	351	6.88	5.96	0.00	18.00	
SES	384	26.39	13.26	4.50	66.00	
Estimated IQ score	384	93.02	18.46	51.00	147.00	
Peer-rated social preference—first grade	336	–0.04	1.01	–2.72	2.35	
Peer-rated aggression—first grade	336	0.04	0.97	–1.14	3.36	
Male	384					0.46
Urban African American	384					0.52
Rural White	384					0.23
Urban White	384					0.25

Note. SES = socioeconomic status.

dren's attention and socioemotional skills, in addition to early academic skills, should be an important focus of early schooling.

METHOD

Participants were 386 nonintervention children from the Fast Track Project, a multisite clinical trial designed to prevent conduct problems (CPPRG, 1992; Table 1). Kindergarteners were selected from Durham, North Carolina; Nashville, Tennessee; Seattle, Washington; and central Pennsylvania. Within each site, schools with large populations of children at risk for conduct problems were selected to participate.

Although intervention and control samples were at high risk for developing conduct problems, the normative sample used here represented the complete population of kindergarteners at Fast Track schools. To obtain this sample, 100 kindergarten children per site (86 in Seattle) were recruited such that children's race, sex, and level of teacher-reported behavior problems reflected the distribution of these variables within participating schools at each site. Children's mean age across sites at entry into first grade was 6.5 years (SD = 0.44). Of the children comprising the sample, 51.2% were male, 48.8% were racial minorities (42.5% African American and 6.3% other), 40.3% were from single-parent families, and 60.7% came from the two most disadvantaged socioeconomic groups based on Hollingshead's (1975) categorical SES scale.

Predictor Variables

Predictor variables included measures of children's early academic skills, attention skills, and peer assessments of their social competence. The measurement of these variables is described below.

Academic Skills in Reading and Math

Children's academic skills were assessed during the summer after kindergarten using the Woodcock–Johnson Psychoeducational Battery–Revised (WJ-R; Woodcock & Johnson, 1989). The Letter–Word Identification subtest assessed children's ability to sound out letters and read simple words. The

Calculation subtest measured early numerical understanding and the ability to solve simple arithmetic problems. Both subtests have a mean of 100 and standard deviation of 15. The internal consistency of these subtests among children of similar age to those in the current study exceeds 0.90 (Woodcock & Mather, 1989); among first graders, the test–retest reliability across a 2-week interval was 0.96 and 0.64 for the Letter–Word Identification subtest and Calculation subtest, respectively (Shull-Shen, Weatherly, Morgan, & Bradley-Johnson, 1995). The Broad Reading and Broad Math scores on the WJ-R, which include the Letter–Word Identification subtest and Calculation subtest, respectively, also show significant and substantial correlations with other standardized achievement measures (Woodcock & Mather, 1989). Within this sample, the internal consistency of the Letter–Word Identification and Calculation subtests was 0.88 and 0.80, respectively. The stability coefficients between kindergarten and first grade, between kindergarten and fifth grade, and between first grade and fifth grade were 0.64, 0.56, and 0.78, respectively, for the Letter–Word Identification subtest and 0.31, 0.47, and 0.45, respectively, for the Calculation subtest. Comparable data from other studies could not be located.

Attention Skills

Children's inattentive behavior was assessed in first grade using the ADHD Rating Scale (DuPaul, 1991), capturing attention deficit hyperactivity disorder symptoms as defined by the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised*. Teachers rated how often children displayed each behavior using a 0 (*not at all*) to 3 (*very much*) scale. Consistent with prior work (Rabiner et al., 2013), six items capturing attention difficulties—and not hyperactive–impulsive behavior—were averaged ($\alpha = 0.94$). First-grade rather than kindergarten ratings were used because greater academic demands provide a better context for observing attention difficulties. Because normative data for the derived scale were not available, and to be consistent with prior work (Rabiner, Malone, & CPPRG, 2004; Rabiner et al., 2013), scores were standardized within the sample ($M = 0$, $SD = 1$). In prior research, attention difficulties assessed using this scale have been shown to be negatively correlated with reading achievement (Rabiner et al., 2000), to predict diminished reading achievement across first grade (Rabiner et al., 2004), and to reduce the beneficial impact of individual tutoring in reading during first grade (Rabiner et al., 2004).

Peer Assessments of Social Competence

Social competence was operationalized as children's social acceptance by peers using a sociometric procedure similar to that described by Coie, Dodge, and Coppotelli (1982). During individually administered interviews in the spring of first grade, all children in classes with Fast Track participants nominated classmates they liked most, they liked least, and who "start fights and say mean things." To increase measurement stability, an unlimited number of nominations were permitted and children could nominate peers of both sexes (Terry & Coie, 1991). To control for class-size differences, the number of nominations received by each participant was standardized within the classroom ($M = 0$, $SD = 1$).

Each child's social-preference score was computed by subtracting the standardized liked-least score from the standardized liked-most score. The social-preference score measures a child's acceptance by classroom peers, with positive scores reflecting above-average acceptance and negative scores indicating below-average acceptance. The stability of social preference within a 3-month interval exceeds 0.80 and has been reported to range from 0.32 to 0.77 for 3- to 18-month intervals (Jiang & Cillessen, 2005); the reliability and validity of social-preference scores for children of similar age to those in our sample have also been demonstrated (Wasik, 1987). Within this sample, social-preference stability between first and fourth grade was 0.54.

A peer-rated aggression score was also computed, reflecting the standardized score

each child received in response to the item "Who are the kids who start fights and say mean things?" High scores indicate that peers believe the child is frequently aggressive. The stability of peer-rated aggression between first and fourth grade was 0.52. Peer-rated aggression was included as a predictor because it is linked to antisocial and criminal outcomes (Parker & Asher, 1987), which could also undermine educational attainment.

Intelligence, Race, and SES

IQ, race, and SES were included as control variables. IQ was estimated after kindergarten by summing the Vocabulary and Block Design scales from the Wechsler Intelligence Scale for Children–Revised; these subtests were selected because they show the highest correlations with the Verbal and Performance IQ scales, respectively (Wechsler, 1974). Because race and site were highly linked (only 1 of 98 youth in rural Pennsylvania was African American and only 13 of 100 Durham participants were not African American), they were combined into a series of indicator variables: African American in urban setting (Durham, Nashville, or Seattle), White in an urban setting, and White in a rural setting (University Park, PA). By use of the formula of Hollingshead (1975) and items from the Family Information Form (CPPRG, 2003), a continuous measure of SES was constructed by multiplying the parent's occupation code (0 if unemployed) by 5 and adding 3 times the parent's education code. For two-parent families (59.7% of the sample), the average score across parents was used.

Academic Outcomes

Academic outcomes were assessed at the end of elementary school, during middle school, and in young adulthood. The assessment of academic outcomes at each time period is described below.

Academic Achievement at End of Elementary School

During the summer following fifth grade, the WJ-R (Woodcock & Johnson, 1989) measure was administered. A Broad Reading score was created from the Letter–Word and Passage Comprehension subtests, while the Calculation subtest measured math achievement.

Children's year-end grades in math, language arts, science, and social studies comprised a second academic outcome; because grades reflect children's work quality over the entire year, they may better reflect typical performance than do individual achievement test results. As grading systems varied by site, Fast Track guidelines recommend categorizing grades as low (1), medium (2), or high (3) and summing across the four grading periods to create an annual subject score ranging from 4 to 12 (Griner, Bruschi, & Greenberg, 2001). Averaging across the annual subject scores created a final composite grade-based achievement score that was standardized ($M = 0$, $SD = 1$, $\alpha = 0.9$). This method, consistent with prior research (Hamre & Pianta, 2001), is equivalent to calculating an overall grade point average for participants, a common approach for deriving a composite academic performance indicator.

Middle School Grades

Academic performance was measured using year-end grades in math, language arts, science, and social studies during sixth, seventh, and eighth grade; standardized achievement tests were not administered. Annual composite grades were averaged, yielding a single indicator of middle school grades ($\alpha > 0.9$ in each year). The correlation was 0.65 between Grades 6 and 7, 0.69 between Grades 7 and 8, and 0.53 between Grades 6 and 8.

Long-Term Educational Outcomes

At age 24 or 25 years, participants completed the Education Information questionnaire, an eight-item instrument designed to establish educational achievement. Following the methods of Howe and Frazis (1992) for the National Longitudinal Surveys, two variables were coded: a high school graduation indicator and years of schooling completed.

Procedure

During the summer following kindergarten and fifth grade, trained research assistants administered the WJ-R as part of the annual survey. In the spring of first grade, teachers reported on children's attention problems and sociometric data were collected. In the summer following Grades 5 through 8, school records were obtained using a modified version of the School Archival Records Search (SARS; Walker, Block-Pedego, Todis, & Severson, 1991). Educational attainment at age 24 or 25 years was collected via a paper or online survey completed by participants, with or without interviewer assistance (in person or over the phone depending on participants' preference).

Missing Data

Rates of missing data for the outcomes ranged from 12% to 22%. Consistent with published Fast Track research (CPPRG, 2014), for each outcome measure, we evaluated differences (using *t* tests) between missing and retained youth across 20 baseline covariates (including the problem behavior screening score). No statistically significant differences were found at age 25 years, suggesting that the retained sample is representative of the original sample. To account for data missing at random, we created 50 imputed datasets using MPlus. The model described in the next section was estimated for each imputed dataset and the results were combined (Rubin, 1987).

Data-Analytic Plan

We estimated the direct effects of early academic skills, attention skills, and socioemotional skills on academic achievement after fifth grade, after middle school, and at age 25 years; these analyses build on earlier work (Duncan et al., 2007) by using these early child characteristics to predict academic outcomes not only during elementary and middle school but into young adulthood. These maximum likelihood path models estimated in MPlus controlled for sex, race, SES, and IQ; covariates were standardized ($M = 0$, $SD = 1$). Standard errors were clustered by kindergarten school to account for the sampling structure, consistent with prior Fast Track research (CPPRG, 2010; Dodge, Godwin, & CPPRG, 2013).

A limitation of this approach is that it does not test whether early child characteristics affect academic outcomes in middle school and young adulthood directly or primarily through earlier academic achievement. To test this, fifth-grade academic achievement (i.e., grades and achievement test results) was added to the model predicting middle school grades. Similarly, academic achievement during fifth grade and middle school was added to the model predicting high school graduation and years of education at age 24 or 25 years.

RESULTS

Table 2 presents results for each academic outcome predicted from early acquired skills alone (i.e., without accounting for intermediate academic outcomes). Only results pertaining to early acquired skills—and not variables included as controls—are discussed.

Fifth-Grade Achievement Tests

As seen in Table 2, reading achievement after fifth grade was predicted by early reading achievement and attention difficulties but not by social-competence measures. A standard deviation increase in the kindergarten letter–word score was associated with a 0.30-standard deviation increase in the fifth-grade reading score ($p < .01$), while a standard deviation increase in the first-grade inattention score was associated with a 0.16-standard deviation decrease in the fifth-grade reading score ($p < .01$). Math achievement after fifth grade was predicted only by early academic skills: A standard deviation increase in the kindergarten letter–word score was associated with a 0.21-standard deviation increase in the fifth-grade calculation score ($p < .01$), and a 1-standard deviation increase in the kindergarten calculation score was associated with a 0.15-standard deviation increase ($p < .05$).

Table 2. Predicting Academic Achievement

Parameter	Reading Score—Fifth Grade		Calculation Score—Fifth Grade		Grades Fifth Grade		Middle School Grades		Years of Education by Age 25 Years		High School Graduate by Age 25 Years	
	b	*SE*	*b*	*SE*	*b*	*SE*	*b*	*SE*	*b*	*SE*	*OR*	*SE*
Male	0.04	0.09	–0.09	0.11	–0.24*	0.11	–0.39*	0.10	–0.2	0.11	0.44	0.42
Urban African American	–0.67*	0.10	–0.51*	0.11	–0.30*	0.11	–0.35*	0.11	–0.03	0.11	0.82	0.46
Rural White	–0.16	0.11	–0.03	0.15	0.38*	0.12	0.64*	0.12	0.21	0.13	4.2	1.96
SES—kindergarten	0.12*	0.04	0.13*	0.05	0.07	0.04	0.16*	0.05	0.29*	0.05	2.04*	0.23
IQ—kindergarten	0.20*	0.04	0.18*	0.05	0.19*	0.05	0.09	0.05	0.18*	0.06	1.72*	0.24
Letter–word score—kindergarten	0.30*	0.05	0.21*	0.06	0.06	0.05	0.09	0.06	0.07	0.06	1.30	0.25
Calculation score—kindergarten	0.07	0.04	0.15*	0.06	–0.01	0.05	0.02	0.05	0.02	0.06	0.72	0.22
Inattention—first grade	–0.16*	0.05	–0.08	0.07	–0.25*	0.07	–0.09	0.06	–0.13*	0.07	0.60*	0.25
Peer-rated social preference—first grade	–0.07	0.05	0.08	0.06	0.14*	0.06	0.11	0.06	–0.03	0.06	1.00	0.25
Peer-rated aggression—first grade	–0.07	0.06	0.07	0.06	0.10	0.06	0.04	0.06	–0.07	0.06	1.03	0.23

Note. *b* = standardized coefficient; *OR* = odds ratio; SES = socioeconomic status.
* $p < .05$.

Table 3. Estimating Average Middle School Grades: Direct and Indirect Effects

Predictors	Middle School Grades	
	b	*SE*
Direct effects		
Male	–0.31*	0.09
Urban African American	–0.22	0.12
Rural White	0.52*	0.12
SES	0.13*	0.04
IQ	0.01	0.05
Letter–word score—kindergarten	0.06	0.06
Calculation score—kindergarten	0.02	0.05
Inattention—first grade	0.00	0.06
Peer-rated social preference—first grade	0.06	0.06
Peer-rated aggression—first grade	0.00	0.06
Reading score—fifth grade	0.00	0.07
Calculation score—fifth grade	0.06	0.05
Average grades—fifth grade	0.34*	0.06
Total indirect effects		
Letter–word score—kindergarten	0.03	0.03
Calculation score—kindergarten	0.01	0.02
Inattention—first grade	–0.09*	0.03
Peer-rated social preference—first grade	0.05*	0.02
Peer-rated aggression—first grade	0.04	0.02
Significant individual indirect paths		
Inattention through grades—fifth grade	–0.08*	0.03
Peer-rated social preference through grades—fifth grade	0.05*	0.02

Note. *b* = standardized coefficient; SES = socioeconomic status.
* $p < .05$.

Grades During Fifth Grade

Average grades in fifth grade were not predicted by early academic skills. However, a standard deviation increase in first-grade attention problems was associated with a 0.25-standard deviation decrease in average grades in fifth grade ($p < .01$). Moreover, a 1-standard deviation increase in peer-rated social preference in first grade was associated with a 0.14-standard deviation increase in average grades ($p < .05$).

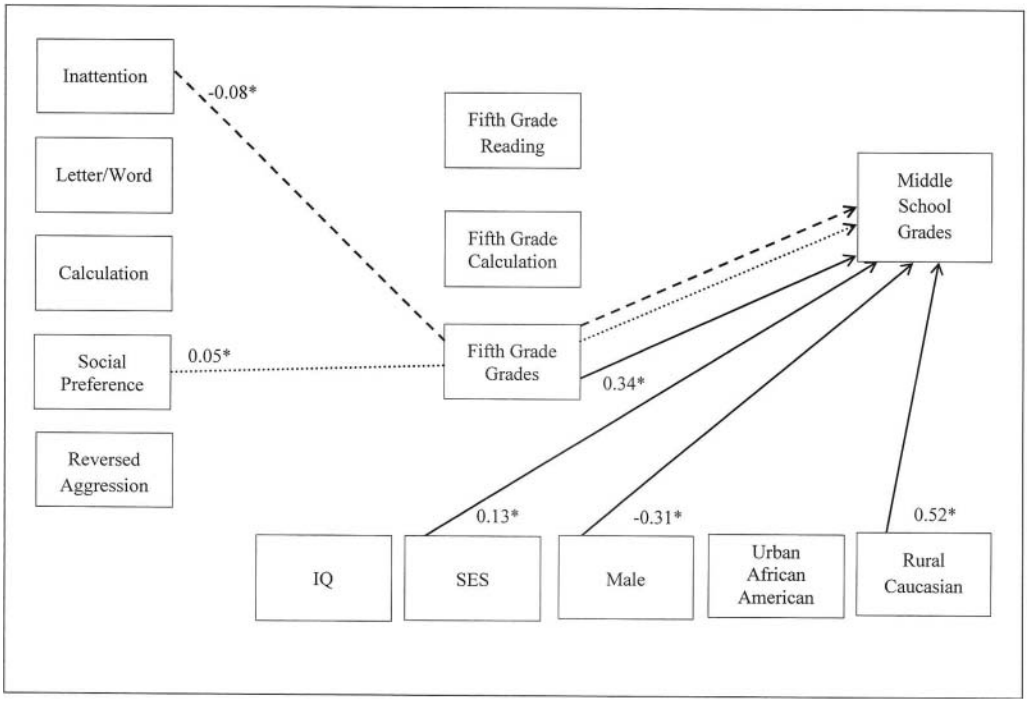
Middle School Grades

Middle school grades were not predicted by school-entry academic or attention skills. Social preference was a marginally significant predictor of middle school grades: A 1-standard deviation increase in peer-rated social preference was associated with a 0.11-standard deviation increase in average grades ($p = .07$).

Educational Attainment by Young Adulthood

Attention problems in first grade decreased the probability of high school graduation ($OR = 0.60$, $p < .05$), indicating that children with attention problems 1 standard deviation above the mean were 40% less likely to graduate than children with mean level attention problem scores. Similarly, a standard deviation increase in attention problems was

Figure 1. Significant Paths Affecting Average Middle School Grades



Note. All direct and indirect paths were estimated but only the significant standardized coefficients are shown. SES = socioeconomic status. * $p < .05$.

associated with a 0.13-standard deviation decrease in years of education ($p < .05$). Early academic and socioemotional skills did not predict either outcome.

Indirect Impact of Early Acquired Skills on Later Educational Attainment

Early acquired skills may also impact long-term educational outcomes indirectly through their effect on more proximal academic outcomes. Analyses that examine this issue are reported below.

Middle School Grades

We also tested whether early acquired skills affect middle school grades directly or indirectly through their impact on fifth-grade achievement (Table 3). Although none of the direct effects were significant, the total standardized indirect effects of inattention ($b = -0.09$, $p < .01$) and social preference ($b = 0.05$, $p < .05$) on middle school grades were significant. Figure 1 depicts the individual indirect paths that drive these significant indirect effects. A 1-standard deviation increase in inattention indirectly decreased average middle school grades by 0.08 standard deviations through fifth-grade grades ($p < .01$). A 1-standard deviation increase in peer-rated social preference was associated with a 0.05-standard deviation increase in middle school grades through fifth-grade grades ($p < .05$).

High School Graduation

Table 4 presents the estimated direct and indirect paths by which early acquired skills affect high school graduation and years of education through intermediate academic achievement (i.e., academic outcomes in fifth grade and middle school). Early acquired skills were allowed to predict each intermediate academic outcome, and each prior academic outcome was allowed to affect later

Table 4. Estimating Educational Outcomes at Age 25 Years: Direct and Indirect Effects

Predictors	Years of Education		High School Graduation		
	b	*SE*	*OR*	*b*	*SE*
Direct effects					
Male	–0.05	0.11	0.65	–0.44	0.49
Urban African American	0.27*	0.12	1.74	0.55	0.60
Rural White	–0.02	0.13	2.07	0.73	1.81
SES	0.20*	0.05	1.87*	0.63	0.28
IQ	0.08	0.05	1.49	0.40	0.29
Letter–word score—kindergarten	–0.04	0.06	1.03	0.03	0.30
Calculation score—kindergarten	0.00	0.05	0.69	–0.38	0.25
Inattention—first grade	–0.03	0.07	0.70	–0.36	0.30
Peer-rated social preference—first grade	–0.07	0.06	0.88	–0.13	0.32
Peer-rated aggression—first grade	–0.08	0.06	0.94	–0.06	0.26
Reading score—fifth grade	0.24*	0.07	1.54	0.43	0.33
Calculation score—fifth grade	–0.02	0.07	1.1	0.10	0.39
Average grades—fifth grade	0.15*	0.06	1.74	0.55	0.33
Average grades—middle school	0.33*	0.06	2.41*	0.88	0.33
Total indirect effects					
Letter–word score—kindergarten	0.11*	0.04	1.30	0.26	0.14
Calculation score—kindergarten	0.02	0.03	1.07	0.06	0.10
Inattention—first grade	–0.10*	0.03	0.75*	–0.29	0.13
Peer-rated social preference—first grade	0.04	0.03	1.17	0.16	0.12
Peer-rated aggression—first grade	0.01	0.03	1.07	0.06	0.11
Significant individual indirect paths					
Letter–word score through fifth-grade reading	0.07*	0.03			
Inattention through fifth-grade reading	–0.04*	0.02			
Inattention through fifth-grade grades	–0.04*	0.02			
Inattention through fifth-grade and middle school grades	–0.03*	0.01	0.93*	–0.07	0.04
Social preference through fifth-grade and middle school grades	0.02	0.01			

Note. *b* = standardized coefficient; *OR* = odds ratio; SES = socioeconomic status.
* $p < .05$.

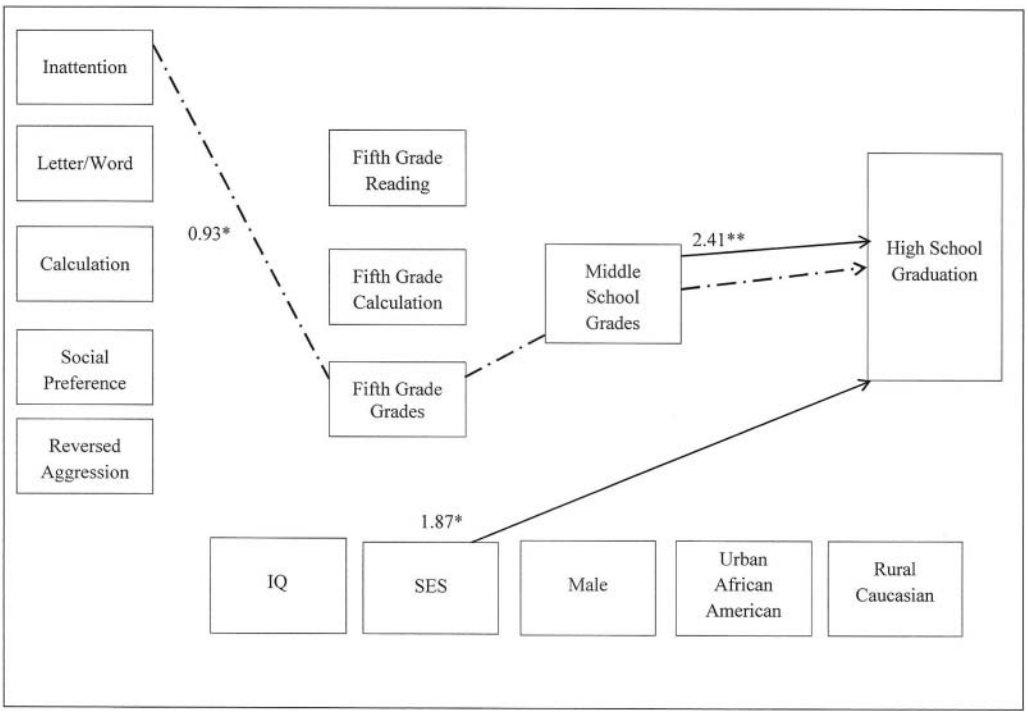
academic outcomes. Because our main interest lies in high school graduation and years of education by young adulthood, only those results are presented.

After controlling for intermediate academic outcomes, no early child characteristic had direct effects on the probability of high school graduation. Only higher middle school grades directly increased the probability of graduation ($OR = 2.41$, $p < .01$). In addition, only the total indirect effect of first-grade attention problems was significant ($OR = 0.75$, $p < .05$). As seen in Figure 2, this was driven by the impact of attention problems on grades during fifth grade and middle school.

Years of Education Through Young Adulthood

After controlling for intermediate educational achievement, no early acquired skills had a significant direct effect on years of education completed. However, as seen in Table 4, a standard deviation increase in fifth-

Figure 2. Significant Paths for Probability of Graduating From High School by Age 25 Years



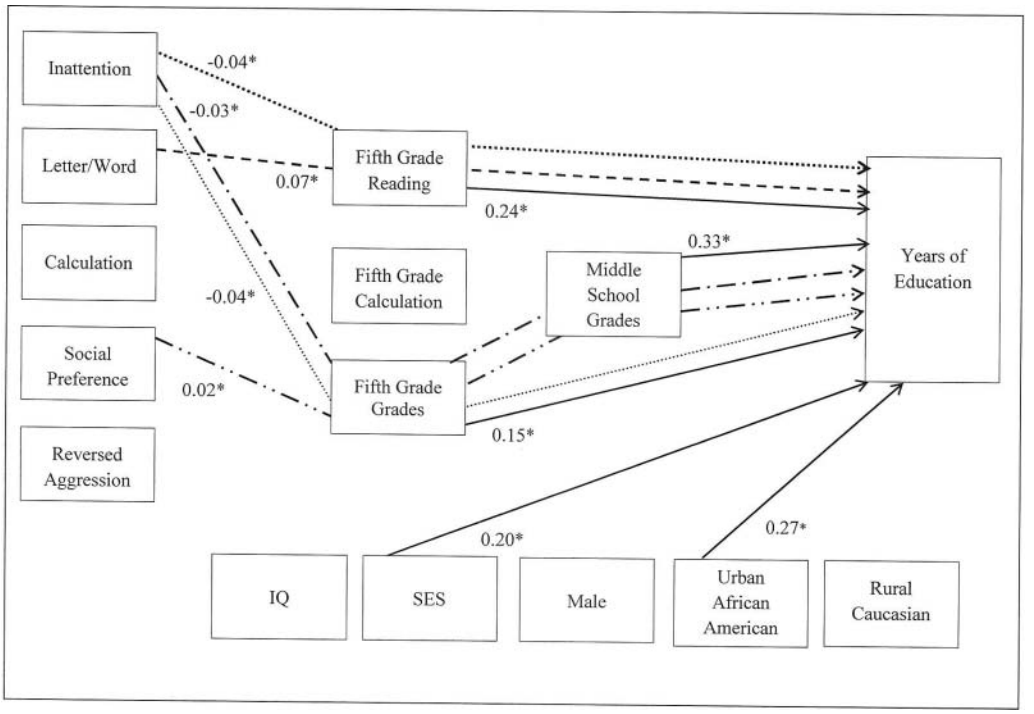
Note. All direct and indirect paths were estimated but only the significant odds ratios are shown. SES = socioeconomic status. * $p < .05$; ** $p < .01$.

grade reading score was associated with a 0.24-standard deviation increase in years of education ($p < .01$) and a standard deviation increase in average grades during fifth grade was associated with a 0.15-standard deviation increase in years of education ($p < .05$). Similarly, a standard deviation increase in average grades in middle school was associated with a 0.33-standard deviation increase in years of education ($p < .01$).

Although early attention problems did not directly reduce years of education, they did reduce it indirectly ($b = -0.10$, $p < .01$). Similarly, the direct effect of kindergarten letter–word score was not significant, but letter–word score indirectly increased years of education attained ($b = 0.11$, $p < .01$).

Figure 3 presents the significant direct paths of early acquired skills, demographic characteristics, and intermediate achievement on years of education completed, as well as the significant individual indirect paths. Although direct and indirect impacts of early acquired skills on all intermediate academic outcomes were estimated, they are not presented given that our primary interest is young adult educational attainment. The significant total indirect effect of early attention problems on years of education was driven by the impact of these problems on fifth-grade reading scores, grades during fifth grade, and grades across middle school. The significant indirect effect of kindergarten letter–word scores was driven by its predictive association with fifth-grade reading scores. Finally, while the total indirect effect of social preference was not statistically significant, its indirect effect through fifth-grade and middle school grades was significant.

Figure 3. Significant Paths Affecting Years of Education by Young Adulthood



Note. All direct and indirect paths were estimated but only the significant standardized coefficients are shown. SES = socioeconomic status. * $p < .05$.

DISCUSSION

We examined the contribution of early academic, attention, and social competence skills to children's academic outcomes during elementary school and into young adulthood. Our study builds on prior work in this area by examining academic outcomes across a broader age span, by incorporating peer assessments of social competence, and by assessing the indirect paths through which early acquired skills affect long-term academic outcomes.

Support for Study Hypotheses

Support for the hypothesis that educational achievement at the end of elementary school is predicted by early social competence, attention, and academic skills was mixed. Consistent with the findings of Duncan et al. (2007), early social competence, even when assessed via peer ratings, did not predict achievement test scores after fifth grade. However, peer-rated social preference, but not peer-rated aggression, did predict grades in fifth grade.

Early attention problems predicted reading achievement and grades after fifth grade, but not math achievement, while early reading skills predicted reading and math achievement after fifth grade, but not grades. Early acquired math skills only predicted math achievement after fifth grade. Thus, unlike Duncan et al. (2007), we did not find early math skills to be a stronger or more consistent predictor of academic outcomes through elementary school than early reading skills. This may have occurred because our measure of early math achievement was less stable over time than our measure of early reading achievement.

Our second hypothesis was that early acquired academic, attention, and social com-

petence skills affect academic outcomes into young adulthood. Support for this hypothesis was limited. Early academic skills did not directly affect middle school grades, high school graduation, or years of education completed by young adulthood. Similarly, early acquired social competence as reflected by children's social-preference scores did not affect educational attainment in young adulthood and had only a marginally significant direct effect on middle school grades. However, early attention problems decreased both the probability of high school graduation and years of education completed by age 25 years.

Our final hypothesis was that early acquired academic, attention, and social competence skills indirectly affect distal academic outcomes through their impact on intermediate academic outcomes; support for this hypothesis was found in several domains. Early attention problems predicted lower grades in fifth grade, which subsequently predicted lower grades across middle school; they also reduced the odds of high school graduation and years of education completed by age 25 years through grades in fifth grade and middle school. Early social difficulties as reflected by low social acceptance scores reduced grades in fifth grade, which had subsequent adverse effects on middle school grades. Early reading skills reduced years of education through their impact on fifth-grade grades.

The Prediction of Academic Outcomes From Early Social Preference and Peer-Rated Aggression

To our knowledge, this is the first study to document that early peer relations predict important academic outcomes when early academic skills and attention problems are accounted for. Specifically, children with lower Grade 1 social-preference scores attained lower grades in fifth grade and, through this, lower grades in middle school and fewer years of education by age 25 years. However, early social preference had no relation to reading and math achievement at the end of elementary school.

Why might low social preference predict grades but not achievement test scores? Compared with achievement results, grades relate more strongly to personality characteristics such as self-control (Hofer, Kuhnle, Kilian, & Fries, 2012) that are often compromised in children with low social preference (Bolger & Patterson, 2001; Coie et al., 1982). Poorly accepted children are also at risk for affiliating with deviant peers (Fergusson et al., 1999), which may reduce their engagement in classes and homework, thus lowering school grades (Veronneau & Dishion, 2011). In addition, children disliked by peers struggle to establish positive relations with their teachers (Howes, 1999; Hughes, Cavell, & Willson, 2001; Lynch & Cicchetti, 1997), which predicts lower grades (Baker, 2006; Hamre & Pianta, 2001), perhaps because poor student–teacher relationships reduce student engagement in classroom activities (Hughes & Kwok, 2007). Finally, because grading is partially subjective, teachers may assign higher grades to students with whom they have more positive relationships. Early peer ratings of aggression did not predict academic outcomes at any age; this is consistent with Parker and Asher's (1987) finding that peer ratings of children's aggression are more predictive of later criminality than dropping out while the reverse was true for low social acceptance in childhood.

The Essential Role of Early Attention Difficulties

Early attention skills clearly emerged as the most consistent predictor of academic outcomes, predicting grades, achievement results, high school graduation, and years of education. Particularly noteworthy was that a 1-standard deviation increase in first-grade attention problems reduced the odds of graduating from high school by 40%. This likely reflects the fact that early attention difficulties reduce both reading achievement and grades in fifth grade, both of which adversely affect subsequent academic outcomes. In addition, childhood attention problems predict poorer executive functioning in late adolescence, which would compromise academic perfor-

mance in multiple domains (Friedman et al., 2007).

Study Limitations and Future Directions

Our sample was not nationally representative, and all participants attended schools selected because of high concentrations of students at risk for developing conduct problems. In addition, we did not have access to achievement results after elementary school or grades during high school. Directly comparing teacher versus peer ratings of early social competence would be interesting to examine in subsequent work. Furthermore, we had only fifth-grade academic outcomes, not peer assessments of social competence or teacher-rated attention problems, to examine in relation to middle school, high school, and young adult academic outcomes. Because only intermediate academic outcomes were included as intervening variables by which early child characteristics could affect long-term academic achievement, our findings do not address several other potential mechanisms of influence discussed previously. For example, Buhs and Ladd (2001) suggested that children with poor peer relations experience school as aversive, which reduces their classroom participation and ultimately their achievement. Fergusson et al. (1999) noted that achievement in children with peer difficulties is reduced because they tend to affiliate with deviant peers who are less engaged in school (Veronneau & Dishion, 2011). Poorly developed attention skills at school entry undermine basic academic skill acquisition (Rabiner et al., 2000), which can lead to children falling further behind over time and becoming less engaged in academic work, thus adversely affecting their academic trajectory over an extended period (Rabiner et al., 2013). Unfortunately, our study sheds no light on these hypothesized mechanisms, which should be investigated in subsequent work.

Practice and Policy Implications

Our results indicate that children's early social acceptance contributes to long-term academic success. This suggests that in addition to promoting academic skills, early childhood education programs should help children develop skills that contribute to positive peer relationships. Among the programs that have reported promising findings in this regard are Promoting Alternative Thinking Strategies (PATHS) (Domitrovich, Cortes, & Greenberg, 2007) and the Dinosaur School curriculum, part of the Incredible Years program (Webster-Stratton & Reid, 2004).

The consistently adverse impact of attention difficulties on subsequent achievement argues for the early identification of children whose attention skills lag behind their peers and intervening to prevent them from falling behind academically. Systematically screening children for attention problems during first grade could identify many children whose problems might otherwise go unnoticed. Identifying young children who struggle with attention may be easier than keeping them on track academically, however, as approaches that are effective for children with adequate attention skills (e.g., tutoring) are substantially less helpful for highly inattentive children (Rabiner et al., 2004). Developing interventions to enhance academic achievement of students with attention difficulties should thus be an important research priority.

From a prevention perspective, our findings highlight the importance of developing effective methods for enhancing early attention skills so that fewer children enter formal schooling with significant attention deficits. This is especially important given that attention difficulties during first grade predict diminished achievement across elementary school, even when those attention difficulties subsequently decline (Rabiner et al. 2013).

However, despite findings that consistently document the adverse impact of early attention problems on academic achievement, as well as the call by Posner (2003) over a decade ago to develop attention training programs for preschoolers, attempts to develop and test such interventions have been limited. Initial efforts have included computerized training programs to promote the efficiency

of the executive attention network (Rueda, Checa, & Cómbita, 2012), to enhance attention via working memory training (Thorell, Lindqvist, Nutley, Bohlin, & Klingberg, 2009), and to promote better attentional functioning through efforts to induce changes in brain structure and function via a program that combines specific parent–child activities and physical exercises (Halperin, Bedard, & Curchack-Lichtin, 2012). Training children in "mindfulness" practices has also shown promise (Napoli, Krech, & Holley, 2005) and should be examined further. It is hoped that findings from the current study will stimulate additional efforts to develop attention training programs for young children and to make such efforts an important funding priority.

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