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Behavioral and Cognitive Readiness for School: Cross-domain Associations for Children Attending Head Start

Karen L. Bierman, Marcela M. Torres, Celene E. Domitrovich, Janet A. Welsh and Scott D. Gest, *The Pennsylvania State University*

Abstract

Utilizing a diverse sample of 356 four-year-old children attending Head Start, this study examined the degree to which behavioral aspects of school readiness, including classroom participation, prosocial behavior, and aggression control were related to direct assessments of child cognitive readiness (academic knowledge, executive function skills) at the start of the prekindergarten year. Classroom participation and prosocial behavior each accounted for unique variance in cognitive readiness. Aggressive behavior, in contrast, was not correlated with academic knowledge, and was associated with low levels of executive function skills. In multiple regressions, aggressive behavior paradoxically enhanced the prediction of child cognitive readiness. Profile analyses strengthened the conclusion that the promotion of competencies associated with classroom participation and prosocial behavior may be particularly critical to cognitive readiness in prekindergarten. Implications are discussed for developmental models of school readiness and preschool classroom practice.

Keywords: school readiness; academic achievement; executive functions; social behavior

Introduction

Over the last seven years, the number of children living in poverty in the USA has grown by 11.3 percent to approach 13 million, approximately one in five American children (Children's Defense Fund, 2005). Many of these children experience delays in early cognitive and social–emotional development, typically entering grade school with skills significantly below those of their socioeconomically advantaged peers (Campbell & von Stauffenberg, 2008). The achievement gap widens over time, such that children living in poverty experience elevated rates of serious learning problems and underachievement as they move through the educational system, and many drop out prior to completing high school (Ryan, Fauth, & Brooks-Gunn, 2006). Although programs like Head Start were designed to remediate this socioeconomic gap by enhancing school readiness during early childhood, significant questions remain

Correspondence should be addressed to Karen Bierman, The Pennsylvania State University, 251 Moore Building, University Park, PA 16802, USA. Email: *kb2@psu.edu*

concerning optimal preschool practices for economically disadvantaged children (Love, Tarullo, Raikes, & Chazan-Cohen, 2006).

Evidence that emergent literacy skills (such as letter identification and phonemic sensitivity) are strong predictors of later achievement has encouraged the increased use of direct instruction in preschools to foster cognitive readiness and children's academic knowledge (Lonigan, Burgess, & Anthony, 2000). In Head Start programs, as well as many other prekindergarten programs, direct assessments of child academic knowledge are increasingly being used to evaluate program effectiveness and to assess child readiness for school (Konold & Pianta, 2005). At the same time, researchers and practitioners alike have stressed the importance of supporting social–emotional development and positive socialization to school during the preschool years to assure that children are ready for the behavioral demands of school (Ladd & Profilet, l996). Campbell and von Stauffenberg (2008) define behavioral school readiness as the set of social and self-regulatory skills that allow children to control their attention, emotions, and interpersonal behavior in order to meet expectations of the school classroom. Behavioral readiness includes the capacity to approach learning tasks effectively with focused interest and sustained engagement, and it involves the capacity to relate positively to peers and teachers, with co-operative initiative and appropriate aggression control (La Paro & Pianta, 2001).

The purpose of this study was to examine the relationship between three aspects of behavioral readiness (classroom participation, prosocial behavior, and aggressive behavior) and child cognitive readiness (academic knowledge and executive function [EF] skills) in a large, diverse sample of four-year-old children attending Head Start programs. The study had three specific aims: (1) to examine the inter-relations among the behavioral and cognitive indices of school readiness; (2) to determine whether the three dimensions of behavioral school readiness were associated in unique ways with the two types of cognitive skills studied (academic knowledge and EF skills); and (3) to explore the cognitive school readiness of children who showed different profiles of behavioral readiness (e.g., deficits in prosocial competencies and/or inadequate control of aggressive behavior) using a person-oriented approach. In addition, we explored gender differences in these dimensions of school readiness and evaluated whether gender moderated the relationship between behavioral and cognitive readiness for school.

Behavioral Readiness

Estimates suggest that, on average, 16 percent of children in the USA enter school with significant deficits in behavioral readiness (Rimm-Kaufman, Pianta, & Cox, 2000). Broadly defined, behavioral readiness represents the child's capacity to exhibit behaviors associated with school adjustment and attainment. Often, these are defined as learning behaviors or approaches to learning that involve the capacity to engage effectively in classroom routines and learning activities—also sometimes called classroom participation (Ladd, Buhs, & Seid, 2000).

Classroom Participation

Classroom participation refers to a child's ability to organize his/her behavior in a manner consistent with classroom expectations, including obeying classroom rules, following teacher directions, and participating in classroom activities in a compliant

and co-operative manner (Ladd et al., 2000; Pianta & Castaldi, 1989). High levels of classroom participation predict greater maturity on cognitive tasks in preschool (Reynolds, l991; Reynolds & Bezruczko, l993), and predict achievement test scores in kindergarten (Ladd et al., 2000). Importantly, Ladd et al. (2000) also found that classroom participation displayed early in the kindergarten year predicted growth in achievement when prior achievement was controlled, demonstrating that classroom participation fostered enhanced learning during kindergarten.

Similarly, other investigators have demonstrated that the capacity to comply with school behavioral demands and stay on-task in the classroom show self-reliance and initiative, and complete work effectively predicts academic achievement in elementary school (Finn, 1993; Hughes & Kwok, 2006; Ladd et al., 2000). Conversely, children who show attention problems in school, including poor task persistence, distractibility, and impulsivity typically experience underachievement, as assessed by a wide array of measures (Hinshaw, l992).

In addition to the importance of a child's classroom participation, social behavior may also make unique contributions to school readiness and learning, particularly during the preschool years (Coolahan, Fantuzzo, Mendez, & McDermott, 2000).

Prosocial Behavior

Normatively, first friendships are established during the preschool years (Howes, Hamilton, & Philipsen, 1998). The acquisition of prosocial friendship skills (such as helping, sharing, and taking turns) during preschool and the corresponding development of positive preschool peer relations, predict kindergarten and later elementary school engagement and academic success (Howes et al., 1998; Ladd, Price, & Hart, l988). Conversely, low levels of prosocial play in preschool signal increased risk for anxious–withdrawn and/or aggressive–disruptive behavior problems in elementary school, and forecast stable peer difficulties across the transition from preschool to kindergarten (Ladd & Profilet, l996; Vitaro, Gagnon, & Tremblay, 1990).

Only rarely do investigators include assessments of both prosocial behavior with peers and classroom participation in the same study, making it unclear whether compliant classroom behavior and prosocial peer behavior make similar or distinct contributions to children's school adjustment and learning (Konold & Pianta, 2005). It may be that both types of behavior contribute to learning in the same way—by promoting compliance and co-operative participation in the classroom. However, it is also possible that prosocial play enhances school readiness in unique ways.

For example, prosocial behavior may foster positive relationships with teachers and peers, thereby motivating school bonding and creating feelings of social–emotional security and comfort in the classroom that support exploration and thereby enhance learning (Coolahan et al., 2000; Konold & Pianta, 2005). In addition, prosocial behavior may enhance the quantity and quality of peer play, which may have a direct influence on cognitive development. Theoretically, the repeated interpersonal interactions that occur in peer play provide emotional support, motivate empathic responding, and provide unique opportunities for the development of conflict resolution and co-operative learning skills (Coolahan et al., 2000; Howes, 1996). Preschool peer interactions are also grounded in fantasy play that stimulates imagination and allows children to explore and consolidate their understanding of various social roles, social routines, and conventions (Coolahan et al., 2000). Indeed, preschool children engage in more elaborate and co-operative play with friends than with non-friends, and show

more responsive and reciprocal sequences (Sebanc, 2003), suggesting that children who have prosocial play skills may experience a more stimulating and supportive preschool learning environment than children without those skills.

Aggressive Behavior

Another social behavior that has a particularly negative impact on school functioning is aggressive–disruptive behavior. In general, rates of aggression decline during the preschool years, as children gain the self-regulatory skills that allow them to inhibit reactive aggression in favor of socially appropriate alternatives (Cole, Michel, & Teti, 1994). Elevated rates of aggressive and oppositional behavior are associated with low levels of peer acceptance (Denham & Holt, 1993), increasing rates of peer rejection across the preschool year (3.5 to 4.5 years old) (Ladd et al., 1988), and escalating conflicts in the classroom that disrupt learning (Campbell & von Stauffenberg, 2008). Preschool aggression also predicts behavior problems and peer difficulties at the transition into kindergarten (Ladd et al., 1988).

By the end of first grade, aggressive behavior at school is highly predictive of chronic school adjustment problems (Hill, Lochman, & the Conduct Problems Prevention Research Group [CPPRG], 2004). However, several investigators have suggested that aggressive behavior is considerably less predictive of chronic difficulties and future maladjustment during the preschool years, and have cautioned against interpreting aggressive behavior in preschool as a unique risk indicator. For example, Vaughn and colleagues (Vaughn, Vollenweider, Bost, Azria-Evans, & Snider, 2003) found that many of the socially effective preschool children they studied showed moderate levels of aggressive or coercive behavior, which they used to access resources and influence play. Vaughn et al. (2003) noted that highly sociable preschool children naturally encounter more frequent conflicts than children who are less engaged. They and other theorists have speculated that the aggressive exchanges that occur around resource control and dominance during the preschool years represent normative opportunities for learning to manage conflict and promoting social–emotional learning (Shantz & Hartup, 1992). These findings suggest that the future risk for school maladjustment associated with a particular child's aggressive behavior varies depending upon the child's concurrent development of prosocial competencies. Aggressive behavior may indicate poor school readiness primarily when it is accompanied by prosocial skill deficits that are needed to foster its future regulation.

Associations with Cognitive Readiness

Although each of these dimensions of behavioral school readiness (e.g., classroom participation, prosocial behavior, and aggression control) has been studied, the degree to which they have unique associations with cognitive skill acquisition in a preschool sample is unknown. Very few studies have examined more than one dimension of behavioral readiness simultaneously, leaving unanswered questions about the degree to which these dimensions of behavioral readiness are inter-related, and whether they are uniquely associated with children's learning. The present study measured these three dimensions of behavioral readiness (classroom participation, prosocial behavior, and aggression control), and explored the degree to which they explained unique variance in cognitive readiness. In addition, this study included person-oriented profile analyses to determine whether different profiles of behavioral readiness (those characterized

primarily by deficits in prosocial behavior vs. those characterized primarily by excessive levels of aggressive behavior) would show different patterns of covariation with measures of cognitive readiness.

Cognitive Readiness

There is no consensus regarding the specific attributes that qualify a child as cognitively 'ready' for formal schooling (Blair, 2002). However, at least two different kinds of cognitive readiness may be important. One involves the academic knowledge that represents a proximal antecedent of early achievements in the domains of emergent literacy and emergent numeracy. The other involves more fluid cognitive reasoning skills—the EF skills that provide a foundation for reasoning and problem solving (Blair, 2006). These two types of cognitive skills may show different associations with behavioral indices of school readiness. Academic knowledge may reflect the quality of instructional content to which the child has been exposed, as well as the child's capacity to attend to and acquire new information in the school context (Konold & Pianta, 2005), and hence may be particularly related to classroom participation and prosocial behavior. In contrast, EF skills have been linked theoretically with a child's capacity to approach problem solving with anticipatory planning, inhibitory control, and cognitive flexibility (Blair, 2006). Hence, EF skills may show a relationship to behavioral readiness in areas that also require inhibitory control and sustained attention—in particular, the regulation of aggressive behavior. In all analyses examining associations between behavioral and cognitive readiness, brief proxy measures of verbal and performance IQ were used as control variables to adjust for overall individual differences in ability.

Hypotheses

It was hypothesized that the three dimensions of behavioral readiness would be interrelated, but that they would show unique (as well as shared) associations with the two types of cognitive skills assessed in the study. Specifically, we hypothesized that classroom participation and prosocial engagement with peers would be associated with the acquisition of academic knowledge in the classroom. We anticipated that difficulties with behavioral regulation (elevated levels of aggressive behavior) would show unique associations with EF skills. In terms of differences among children who showed different profiles of behavioral readiness, we expected that children with prosocial skill deficits (with or without concurrent aggressive behavior) would show delayed acquisition of cognitive readiness skills, particularly academic knowledge. Conversely, we expected that children with elevated aggressive behavior would show deficits in EF skills, and children with dual-problem profiles (prosocial deficits and elevated aggression) to show deficits in both dimensions of cognitive readiness.

Gender Differences

Girls typically exceed boys in scholastic progress during the early primary years (Cryan, Sheehan, Weichel, & Brandy-Heden, l992). Girls often show higher rates of prosocial behavior in preschool compared with boys (Coolahan et al., 2000; Howes et al., l998) whereas boys show higher rates of overt aggression and disruptive behavior (Coolahan et al., 2000). Hence, this study also explored sex differences in behavioral

and cognitive readiness skills, and tested whether patterns of association among these dimensions differed for boys and girls.

Method

Participants

Participants included two cohorts of four-year-old children (total N = 356, 19 percent Hispanic, 26 percent African-American; 55 percent European American; 54 percent girls) in 44 Head Start classrooms in three counties in Pennsylvania. At the beginning of the school year, brochures describing the study were distributed to parents of all four-year-old children in the participating classrooms. Parents returned the brochures, providing contact information if they were interested in participating. Identified primary caregivers (89 percent mothers, 4 percent fathers, 4 percent grandparents, and 3 percent other, including step-parents or foster parents) were contacted, the study was explained, and informed consent was obtained. Overall, only 14 eligible families declined to participate, but an additional 21 primary caregivers were very difficult to reach and failed to complete the preassessment. Two children were dropped because they had a twin or sibling in the study, and 19 families withdrew early from Head Start and hence completed only parts of the assessment procedures. Hence, study participants represent 86% of the initially eligible population. At the time of assessment, children were, on average 4.59 years old (SD = .32, range = 3.87–5.82).

Procedures

Child assessments were conducted at school by trained research assistants during two individual 'pull-out' sessions (30–45 minutes each), scheduled in co-ordination with the teacher. Child assessments were not initiated until three weeks after the start of the school year to give children time to acclimate to the classroom setting, and they continued through the end of October. Space was at a premium in the Head Start centers, so testing sessions were conducted in any available secluded areas where distractions could be minimized. Children earned stickers.

Approximately six to eight weeks after the start of the school year, a research assistant met with each teacher (lead and assistant) to explain the teacher-rating measures and obtain informed consent. All teachers agreed to participate. Teachers completed the ratings on their own time, and they were collected by a research assistant two weeks later. Teachers were compensated $20 to provide general information about themselves and their classrooms, and an additional $7 per student to complete student ratings. One lead teacher and one assistant teacher in each classroom provided independent ratings of child behavior. Ratings provided by lead and assistant teachers were highly correlated (rs ranged from .60 for prosocial to .76 for aggression, $p < .001$) and were averaged.

Measures

Classroom Participation. Classroom participation was assessed using eight items from a school readiness inventory developed for this study. Each item was rated on a six-point Likert scale, with anchors ranging from 1 = strongly disagree to 6 = strongly agree. Items reflected self-regulation ('child can follow the rules and routines that are part of the school day'), learning motivation ('child seems enthusiastic about learning

new things'), compliance ('child is able and willing to follow teacher directions'), and conscientiousness ('child is careful with his/her work'). A summed score reflected classroom participation (alpha = .95)

Prosocial Behavior. Prosocial behavior was assessed using seven items from the social competence scale (CPPRG, 2003), with a few minor wording adjustments to make the items developmentally appropriate for preschool children. Items included: 'shares with others', 'helps others', 'understands other people's feelings', and 'resolves problems with other children on his or her own'. Teachers rated each item using a six-point Likert scale, ranging from 1 ('almost never') to 6 ('almost always'). A summed score was used (alpha = .93).

Aggressive–Oppositional Behavior. Aggressive–oppositional behavior was assessed using seven items taken from the teacher observation of child adaptation-revised (TOCA-R) (Werthamer-Larsson, Kellam, & Wheeler, 1991), with minor wording adaptations to assure that the items were developmentally appropriate for preschool children. Items included: 'stubborn', 'yells at others', 'fights with other children', 'breaks things on purpose'. Teachers rated each item using a six-point Likert scale, ranging from 1 ('almost never') to 6 ('almost always'). A summed score was used (alpha = .93).

Intellectual Ability. Standard scores on the block design subtest of the Wechsler preschool and primary scale of intelligence–III (WPPSI–III; Wechsler, 2002) were used as a control variable, serving as a proxy for non-verbal intellectual ability. Block design tests perceptual organization and non-verbal reasoning, as children use multi-colored blocks to reproduce two-dimensional patterns. For children four to seven years old, performance on block design is highly related to full-scale IQ, with a correlation of .72 (Wechsler, 2002). In addition, the expressive one-word picture vocabulary test (EOWPVT; Brownell, 2000) served as a proxy control for verbal IQ. On this measure, children were asked to give the word that best described pictures they were shown. Past research has demonstrated high levels of internal reliability (alphas in the .93–.98 range) and predictive validity for this test.

Academic Knowledge. Four measures contributed to a composite score representing academic knowledge. Three of these measures assessed emergent literacy skills, and were drawn from the TOPEL: test of preschool early literacy (formerly preschool comprehensive test of phonological and print processing—pre CTOPP) (Lonigan, Wagner, Torgesen, & Rashotte, 2007). The *blending* subtest assessed phonological processing, specifically the child's capacity to construct new words using separate words or phonemes (e.g., 'hot' and 'dog'; 'f' and 'ox'). The *elision* subtest required the child to manipulate words by removing part of each word to create a new word (e.g., 'batman' without 'bat'). *Print awareness* measured children's early awareness and recognition of printed letters and words, as well as sounds of letters and letter combinations. Each of these scales showed strong internal consistency: *blending* (alpha = .89), *elision* (alpha = .87), and *print awareness* (alpha = .95). The fourth measure in the composite was the *applied problems* subtest of the Woodcock-Johnson (Woodcock, McGrew, & Mather, 2001) which assessed mathematical skills, including showing two fingers, counting objects, and adding or subtracting small numbers. These four measures of academic knowledge were significantly inter-correlated, ranging from

$r = .29$ (blending and print awareness) to $r = .50$ (elision and applied problems), with an average $r = .37$, all ps $< .001$. The four scores were standardized and averaged to create a score reflecting academic knowledge.

Executive Function Skills. Three tasks contributed to the composite score representing EF skills. In the *peg tapping task* (Diamond & Taylor, 1996), which assessed working memory and inhibitory control, the child was asked to tap his/her peg following the interviewer's example, tapping twice when the interviewer tapped once, and visa versa. Scores represented the number of trials (out of 16) that the child did correctly. For the *backward word span* task, the child was asked to repeat a list of words in backwards order. Similar tasks have been used as tests of working memory in young children (Davis & Pratt, 1996). The practice list and the first list each contained two words; the second and third lists each contained three words; the fourth and fifth lists each contained four words; and the sixth list contained five words. The score represented the maximum number of words that the child repeated correctly in reverse order. The third EF task, dimensional change card sort (DCCS) (Frye, Zelazo, & Palfai, 1995), involved target cards that varied along the dimensions of color and shape (e.g., a blue rabbit and a red boat). After learning to sort the cards according to one dimension, the children were asked to sort the cards according to the other dimension. Scores represented the number of trials (out of 6) that the child correctly sorted the objects after the sorting criteria changed. These three EF measures were significantly inter-correlated (peg tapping with backward word span, $r = .42$, peg tapping with DCCS, $r = .31$, and backward word span with DCCS, $r = .23$). They were standardized and averaged to create a composite score representing EF skills.

Results

Preliminary Analyses

The four dimensions representing behavioral school readiness were significantly inter-correlated (prosocial and aggressive behaviors: $r = -.69$, prosocial and classroom participation: $r = .82$, and classroom participation and aggression: $r = -.65$). These associations suggest that the developmental capacity to engage effectively with peers is highly intertwined with the capacity to organize oneself for learning, both in terms of following rules and focusing attention. Subsequent analyses (presented below) examined each of these three dimensions of behavioral readiness in terms of common and unique variance shared with the two kinds of cognitive readiness scores. The two cognitive readiness scores were also significantly inter-correlated—academic knowledge and EF skills, $r = .67$, $p < .001$.

Preliminary analyses also examined sex differences in the independent and dependent variables. Overall, children in this sample showed lower than average vocabulary and block design scores, as is typical among socioeconomically disadvantaged children (Ryan et al., 2006) (see Table 1). No significant sex differences emerged for either of the composite scores representing cognitive readiness (e.g., academic knowledge or EF skills), ps $> .10$. However, compared with boys, girls showed higher levels of classroom participation (girls $M = 5.07$ vs. boys $M = 4.72$, $t(347) = 3.83$, $p < .001$), and prosocial behaviors (girls $M = 4.13$ vs. boys $M = 3.78$, $t(356) = 3.85$, $p < .001$). Compared with girls, boys showed higher levels of aggression (boys $M = 2.14$ vs. girls $M = 1.75$, $t(356) = -4.16$, $p < .001$.)

Table 1. Descriptive Statistics for All Variables

	M	*SD*	Range
Block design	8.00	2.88	1.00–17.00
Vocabulary	82.72	13.57	55–121
Academic achievement composite	–.08	.72	–2.45–2.01
Applied problems	95.25	13.27	46–134
Elision	7.98	3.47	0–17
Blending	11.56	4.27	1–21
Print awareness	8.45	8.94	0–36
Executive function composite	–.03	.84	–1.18–3.01
Pencil tapping	8.45	6.32	0–17
DCCS (card sort)	3.20	2.67	0–6
Backward word span	1.17	.47	1–4
Behavioral readiness			
Classroom participation	4.92	.87	2.25–6.00
Prosocial behavior	3.99	.88	1.50–6.00
Aggressive behavior	1.89	.84	1.00–5.00

DCCS = dimensional change card sort.

Table 2. Social Behavior, Approaches to Learning, and Cognitive Skill Acquisition

	Class participation	Prosocial	Aggressive
Block design	.33***	.22***	–.15**
Vocabulary	.28***	.23***	–.02
Academic achievement composite	.41***	.32***	–.08
Applied problems	.33***	.28***	–.10
Elision	.33***	.27***	–.07
Blending	.27***	.27***	–.05
Print awareness	.30***	.17**	–.04
Executive function composite	.47***	.32***	–.20***
Pencil tapping	.38***	.29***	–.15**
DCCS (card sort)	.35***	.29***	–.15**
Backward word span	.17**	.09	.03

** $p < .01$; *** $p < .001$.

Behavioral and Cognitive Readiness

Simple correlations were computed between the three dimensions of behavioral readiness and the performance measures that represented cognitive skills (see Table 2). Classroom participation and prosocial behavior showed consistent patterns of association, correlating significantly with all of the individual measures of cognitive skills, as well as with the two composite scores. In contrast, aggressive behavior was not correlated with any of the measures of academic knowledge. Aggressive behavior did

Table 3. Predicting Academic Achievement from Social Behavior and Approaches to Learning

Predictors	B	SEB	β	R^2	ΔR^2
Step 1				.41	.41***
Child sex	–.14	.06	–.10*		
Block design	.05	.01	.22***		
Vocabulary	.03	.002	.56***		
Step 2				.46	.05***
Class participation	.20	.06	.25***		
Prosocial behavior	.08	.06	.10		
Aggressive–oppositional	.15	.05	.18**		
Step 3				.48	.02**
Sex by participation	.07	.10	.07		
Sex by prosocial	–.31	.11	–.31**		
Sex by aggressive	–.12	.08	–.12		

Note: F (3, 339) = 78.78 for step 1, F (3, 336) = 10.67 for step 2, F (3, 333) = 3.94 for step 3.
* $p < .05$; ** $p < .01$; *** $p < .001$.

show a significant (inverse) correlation with two of the three EF skills and with the corresponding composite score.

Next, hierarchical multiple regressions were computed in order to examine the shared and unique variance in cognitive readiness accounted for by the various dimensions of behavioral readiness. Separate regressions were run with academic knowledge as the dependent variable and EF skills as the dependent variable. Child sex and the IQ proxy variables (block design and vocabulary) were entered first to serve as controls. Classroom participation, prosocial, and aggressive behavior were entered at the second step, representing behavioral indicators of readiness. Finally, interactions between each of the behavioral readiness scores and child sex were entered to determine whether child sex moderated the relationship between behavioral and cognitive readiness. The models did not show problematic levels of multi-collinearity (e.g., tolerance values were less that .10, ranging from .27 to .98, and VIF statistics were less than 10, ranging from 1.08 to 3.60.)

Results for academic knowledge acquisition are shown in Table 3. Significant increments in variance were explained by steps 1 through 3, indicating that beyond IQ and gender, behavioral readiness accounted for an additional 5 percent of the variance in academic knowledge, and interactions with child sex accounted for an additional 2 percent of the variance. When individual measures were examined, classroom participation and aggressive behavior each explained unique variance in academic knowledge. Although aggressive behavior was not correlated with academic knowledge in simple correlations, it emerged (paradoxically) as a *positive* predictor of academic knowledge when the other variables (e.g., IQ, classroom participation, and prosocial behavior) were controlled. The contribution of prosocial behavior to academic knowledge was moderated by gender, producing a significant interaction term. Prosocial behavior was correlated positively with academic knowledge for both girls and boys, but the strength of the correlation was greater for girls ($r = .44$, $p < .001$ vs. $r = .19$,

Table 4. Predicting Executive Function Skills from Social Behavior and Approaches to Learning

Predictors	B	SEB	β	R^2	ΔR^2
Step 1				.24	.24***
Child sex	−.15	.07	−.10*		
Block design	.06	.01	.25***		
Vocabulary	.02	.003	.37***		
Step 2				.31	.07***
Class participation	.23	.07	.27**		
Prosocial behavior	.12	.07	.14		
Aggressive–oppositional	.16	.06	.18**		
Step 3				.32	.01
Sex by participation	−.01	.12	−.01		
Sex by prosocial	−.16	13	−.15		
Sex by aggressive	−.13	.10	−.13		

Note: F (3, 339) = 35.48 for step 1, F (3, 336) = 11.73 for step 2, F (3, 333) = 1.01 for step 3.
* $p < .05$; ** $p < .01$; *** $p < .001$.

$p < .05$). When the regression model was run separately by sex, prosocial behavior made a unique positive contribution to the prediction of academic knowledge only for girls (standardized β = .25, $p < .01$) and not for boys (standardized β = .16, $p = .18$)

Results for EF skills are shown in Table 4. Significant increments in variance were explained by Steps 1 and 2, indicating that in addition to sex and the two estimates of IQ, behavioral readiness shared an additional 7 percent of unique variance with EF skills. The interaction terms with child sex did not explain additional variance, suggesting that the relations between behavioral readiness and EF skills were consistent for boys and girls. When individual measures were considered, classroom participation and aggressive behavior made unique contributions. Although aggressive behavior by itself (in simple correlations) was inversely associated with EF skills, in this multiple regression (with other concurrent characteristics controlled), aggression made a *positive* contribution to the prediction of EF skills. The nature of this paradoxical aggression effect, which was also observed in the prediction of academic knowledge, is clarified by the person-oriented analyses of child skill profiles.

Aggressive–Prosocial Profiles

The value of aggressive behavior as a unique predictor of risk during the preschool years is controversial (Vaughn et al., 2003), and concurrent levels of prosocial competencies may be important determinants of the adaptive and developmental significance of preschool aggression. To better understand the cognitive readiness of children showing different profiles of behavioral readiness (e.g., prosocial deficits, elevated aggression, or the combination), four subgroups of children were identified. Using cutoffs of 1 standard deviation (*SD*), children were considered to be either aggressive (aggression score > 1 *SD* above the mean) or non-aggressive (aggression score < 1 *SD* above the mean), and they were considered to have prosocial skill deficits (prosocial

score < 1 *SD* below the mean) or not to have prosocial deficits (prosocial score > 1 *SD* below the mean.) Four subgroups were created representing children who were: (1) low problem (neither aggressive nor prosocial deficit, N = 252); (2) prosocial deficit (but not aggressive, N = 39); (3) aggressive (but not prosocial deficit, N = 18); and (4) both prosocial deficit and aggressive (N = 46).

Analyses of variance were then conducted, revealing significant group differences on block design, $F\ (1,\ 3) = 7.24$, $p < .001$, vocabulary, $F\ (1,\ 3) = 6.07$, $p < .001$, classroom participation, $F\ (1,\ 3) = 133.25$, $p < .001$, academic knowledge, $F\ (1,\ 3) = 10.37$, $p < .001$, and EF skills, $F\ (1, 3) = 8.85$, $p < .001$. Significant group differences, as ascertained by *post hoc* comparisons using a Bonferonni correction, are presented in Table 5.

In terms of classroom participation, prosocial deficits and aggressive behavior combined in an additive fashion to predict lower scores. The children who exhibited both social problems showed the lowest level of classroom participation whereas children who exhibited only one problem (prosocial deficits or aggressive behavior) fared worse than children with no problems, but not as poorly as children with both social difficulties.

However, a different pattern of group differences emerged for the cognitive readiness variables. For both academic knowledge and EF skills, children who exhibited prosocial deficits (only) had the poorest cognitive skills, significantly lower than the non-problem group. Children who exhibited elevated aggression without concurrent prosocial deficits showed cognitive readiness that was equivalent to that of children with no problems, despite their lower levels of classroom participation. Children with the combined profile (aggressive behavior plus prosocial skill deficits) exhibited deficits in EF skills (relative to the non-problem group), although not as low as the low prosocial (non-aggressive) group.

Discussion

The No Child Left Behind Act, along with the growing rates of children living in poverty in the USA, have increased concerns regarding the significant socioeconomic gaps that exist in school readiness, school performance, and academic attainment (Love et al., 2006). One response has been to increase emphasis on the promotion of emergent literacy and numeracy skills in Head Start programs, utilizing performance assessments of child cognitive skill acquisition as indices of child school readiness (Konold & Pianta, 2005). Although such efforts are clearly important (Lonigan et al., 2000), concurrent research is needed to better understand the behavioral readiness needs of children growing up in poverty, and the role that they play in promoting motivation, engagement, and learning at school (Campbell & von Stauffenberg, 2008; La Paro & Pianta, 2001). Focusing on four-year-old children attending Head Start programs, this study examined three dimensions of behavioral readiness (e.g., classroom participation, prosocial skills, and aggressive behavior), assessing their interrelations, and their shared and unique associations with academic knowledge and EF skills for girls and boys.

Classroom Participation and Prosocial Behavior

By elementary school, a child's ability to participate actively, co-operatively, and conscientiously in the classroom, including following classroom rules, obeying teacher

Table 5. Child Competencies among Children Showing Different Profiles of Aggressive-Prosocial Problems

	Child Problem Profile			
	Low problem	Prosocial deficits	Aggression	Prosocial deficits and aggression
Child competencies	N = 252	N = 37	N = 19	N = 49
Block design	8.41 (2.77)[a]	6.59 (2.62)[b]	7.39 (2.85)[ab]	6.89 (3.04)[b]
Vocabulary	83.56 (13.42)[a]	74.38 (12.38)[b]	87.78 (12.96)[a]	81.74 (13.92)[ab]
% Female	60%	65%	47%	22%
Participation	5.29 (55)[a]	4.10 (.71)[c]	4.74 (.43)[b]	3.59 (.77)[d]
Academic knowledge	.02 (.68)[a]	−.61 (.48)[b]	−.12 (.69)[a]	−.16 (.85)[a]
Executive function	.12 (.05)[a]	−.50 (.12)[c]	−.12 (.17)[abc]	−.17 (.11)[b]

Note: Means with different subscripts in each row are significantly different ($p < .05$) using Bonferroni adjustment for multiple comparisons. Standard deviations are shown in parentheses.

directions, and working with care promotes academic achievement (Finn, 1993; Hughes & Kwok, 2006). Similarly, in this study of four-year-olds, classroom participation explained unique variance in both acquired knowledge and EF skills (with sex, IQ, prosocial, and aggressive behavior controlled). Because this study was cross-sectional, it is not possible to draw conclusions about direction of causality. However, prior work with elementary students suggests the relationship is transactional (Ladd et al., 2000). That is, classroom participation likely enhances cognitive skill acquisition which in turn makes school tasks more interesting and enables focused engagement.

Prosocial behavior with peers was highly correlated with classroom participation, and showed similar patterns of significant association with academic knowledge and EF skills, suggesting that these two patterns of adaptive classroom behavior share some developmental determinants and consequences. Children who have more positive teacher and peer interactions may experience elevated mood and more positive arousal at school, fostering learning (Izard, Fine, Schultz, Mostow, Ackerman, & Youngstrom, 2001). Sustained positive interactions with teachers and peers may also expose children to rich language and social exchanges that promote cognitive development and foster social problem-solving skills (Coolahan et al., 2000; Howes, 1996; Sebanc, 2003).

It is important to note that children who showed marked deficits in prosocial skills (in the group comparisons) exhibited a broad range of other school readiness deficits, including lower vocabulary and non-verbal IQ scores, lower levels of classroom participation, less academic knowledge, and lower EF skills than children without prosocial skill deficits. Apparently, prosocial skill deficits often appear as part of a risky school readiness profile. For example, developmentally delayed preschool children and learning disabled elementary school students show higher rates of solitary play and unoccupied time, less sophisticated social play, and briefer social interactions than their normative peers (Gottlieb, Gottlieb, Berkell, & Levy, l986; Guralnick & Groom, l987; LaGreca, l981; Nabuzoka & Smith, l993). Transactional influences may evolve, as children with lower cognitive ability and language delays find it difficult to initiate and sustain effective peer interactions, resulting in social isolation that reduces exposure to the learning opportunities associated with positive peer play (Howes et al., 1998; Guralnick & Groom, l987). Additional longitudinal studies may further elucidate the developmental interplay between prosocial skill development, classroom participation, and academic performance.

Aggression

Aggressive behavior was the one dimension of behavioral readiness that was not associated with academic knowledge, but was correlated (inversely) with EF skills. Somewhat surprisingly, however, and counter to our hypotheses, aggressive behavior showed a paradoxical effect in the regressions, demonstrating a unique *positive* association with academic knowledge and EF skills when other factors (IQ, sex, classroom participation, and prosocial behavior) were controlled. Examining the behavioral profiles of aggressive children helped explain this effect. Nineteen of the 68 children (28 percent) identified as aggressive (scores 1 *SD* or more above the sample mean) did not show concurrent prosocial skill deficits. These skilled aggressive children were not significantly different from their non-problem peers on the composite measures of academic knowledge or EF skills, although they did show significantly lower levels of classroom participation. However, the other 49 aggressive children who showed

concurrent prosocial deficits had significantly lower levels of classroom participation than the aggressive-only subgroup, and also showed significant delays in EF skill development. Apparently, aggressive behavior was associated with delays in the acquisition of cognitive skills only when it was accompanied by prosocial skill deficits. A prior study has demonstrated low EF skills among highly aggressive preschool children (Hughes, White, Sharpen, & Dunn, 2000), and it may be that deficits in inhibitory control associated with poor executive functioning are most characteristic of preschool children who are highly aggressive and have a concurrent array of regulatory deficits.

The present findings are consistent with prior research by Vaughn and colleagues (Vaughn et al., 2003), who found moderate levels of aggressive behavior among a group of children identified as 'socially effective'. The children in the Vaughn et al. (2003) study did not appear dysregulated, but rather used aggression strategically to gain dominance, access resources, and influence play. Similarly, Hawley (2002) identified a group of sociable preschool children who she described as 'bistrategic', in that they used high levels of both prosocial and aggressive strategies to control resources in play. It is quite possible that high rates of peer interaction in preschool, which typically involve shared play materials, increase peer conflict. Developmentally, exposure to this type of peer conflict in preschool, which requires resource-sharing and negotiation, may stimulate problem solving and thereby foster the development of thinking skills, even as it elicits dominating resource control strategies from some children (Shantz & Hartup, 1992). Hence, aggressive behavior in preschool children may not necessarily indicate deficits in inhibitory control or EF skills, unless it is accompanied by concurrent deficits in prosocial and emotion regulation skills and/or occurs at very high levels.

Interestingly, in this sample, children who showed a combined profile of aggressive behavior and prosocial deficits showed *higher* levels of academic knowledge and EF skills than did children who showed prosocial deficits alone despite similar IQ scores. The low prosocial group was viewed by teachers as more compliant in the classroom, but these children were perhaps learning less because of their disengagement with peers and overall passivity in the classroom. In terms of cognitive outcomes, it may be better to be actively engaged with teachers and peers, even if argumentative and dominating, than to be passive and disengaged.

The relative contributions that aggressive and prosocial behavior make to the prediction of academic problems may change with age, with aggression becoming more strongly (and prosocial behavior becoming less strongly) related to academic achievement during the elementary school grades (Miles & Stipek, 2006). That is, under positive developmental conditions, rates of aggression decrease sharply during the preschool years, as children develop the verbal, emotional, and social skills that allow them to inhibit their first impulses and resolve disagreements in more acceptable ways (Cole et al.,1994; Greenberg, Kusche, & Speltz, 1991). By the end of the first grade, elevated rates of aggressive behavior are non-normative and predict stable behavioral difficulties (Kokko, Tremblay, Lacourse, Nagin, & Vitaro, 2006).

These findings do not mean that aggressive behavior should not be of concern to preschool teachers. Prior studies have identified aggressive behaviors as predictive risk factors for school adjustment (Denham & Holt, 1993; Ladd & Profilet, l996). However, aggressive preschool children may be at highest risk for ongoing problems when they show low rates of concurrent prosocial behavior and associated self-regulatory skill deficits (Ladd & Profilet, 1996). Several longitudinal studies suggest that deficits in prosocial skills and emotion regulation in kindergarten predict the emergence of both aggressive and withdrawn behaviors in first grade (Dodge, Bates, &

Pettit, 1990; Farmer, Bierman, & the CPPRG, 2002; Ladd & Burgess, l999). These results suggest that preschool interventions designed to reduce aggression should emphasize the promotion of emotion regulation and social problem-solving skills that foster effective conflict management skills rather than rely on prohibitions and exclusionary controls (e.g., time out) that might reduce aggression without building the critical social skills needed for long-term adjustment (Bierman, Miller, & Stabb, 1987).

Sex Differences

Consistent with several prior studies, we found sex differences in behavioral readiness (Coolahan et al., 2000; Howes et al., l998). On average, girls were more compliant and co-operative in the classroom and more prosocial with peers, and boys exhibited more aggressive behavior. Despite these behavioral differences, we found no sex differences in cognitive readiness scores—academic knowledge or EF skills. For the most part, behavioral readiness and cognitive readiness showed similar patterns of association for girls and boys. The one exception was that prosocial behavior was more strongly associated with academic knowledge for girls than for boys. However, even in this instance, prosocial behavior was significantly correlated with academic knowledge for both boys and girls. In recent years, concerns about the poor school performance of boys, particularly boys growing up in poverty from minority ethnic groups, has motivated more attention to gender differences in school readiness. Evidence that sex differences in school readiness stem more from behavioral features than cognitive skill acquisition challenges us to think carefully about preschool and early elementary school policies and practices regarding behavioral expectations for school. On the one hand, the present findings suggest that more systematic attention to and support for the promotion of self-regulation and prosocial interaction skills in preschool may be helpful to all children, especially boys. On the other hand, the findings also raise questions about whether the high behavioral expectations for co-operative compliance in preschool and early elementary school settings may disadvantage boys who might benefit cognitively from more active, individual learning opportunities. Clearly, more research is needed attending to these gender differences.

Limitations and Future Directions

This was a cross-sectional study, thereby limiting any conclusions one can make regarding the direction of causality, or the nature of cross-domain influences over time. One might as easily postulate that cognitive skill acquisition will promote behavioral school readiness as the reverse. In addition, in this study, only teacher ratings were available to assess behavioral readiness. Follow-up studies using multiple measurement methods are needed to evaluate the nature of cross-domain influence over time. At the same time, the results suggest several directions for preschool practice and research.

The results validate the importance of attending to behavioral dimensions of school readiness, particularly in preschool programs serving socioeconomically disadvantaged children, in combination with focused attention to cognitive skill development. Although cognitive skills (block design and vocabulary) accounted for substantial variance in academic and EF skill development (41 and 24 percent, respectively), social–emotional skills that foster positive classroom participation and peer relations

accounted for an additional 7–8 percent of the variance. Programs designed to enrich peer play learning opportunities and social–emotional learning in the preschool setting may enhance behavioral and cognitive school readiness (Diamond, Barnett, Thomas, & Munro, 2007; Domitrovich, Cortes, & Greenberg, 2007; Zins, Weissberg, Wang, & Walberg, 2004). Additional longitudinal research on these topics is needed to further clarify the transactional processes that link different facets of behavioral and cognitive school readiness and promote long-term school adjustment and attainment, and to inform preventive interventions and preschool program design.

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