Routledge
Taylor & Francis Group

Early Education and Development

ISSN: 1040-9289 (Print) 1556-6935 (Online) Journal homepage: www.tandfonline.com/journals/heed20

Executive Functioning and School Readiness Among Preschoolers With Externalizing Problems: The Moderating Role of the Student–Teacher Relationship

Paulo A. Graziano, Leanna R. Garb, Rosmary Ros, Katie Hart & Alexis Garcia

To cite this article: Paulo A. Graziano, Leanna R. Garb, Rosmary Ros, Katie Hart & Alexis Garcia (2016) Executive Functioning and School Readiness Among Preschoolers With Externalizing Problems: The Moderating Role of the Student–Teacher Relationship, Early Education and Development, 27:5, 573-589, DOI: 10.1080/10409289.2016.1102019

To link to this article: https://doi.org/10.1080/10409289.2016.1102019

EARLY EDUCATION AND DEVELOPMENT
2016, VOL. 27, NO. 5, 573–589
http://dx.doi.org/10.1080/10409289.2016.1102019

Routledge
Taylor & Francis Group

Executive Functioning and School Readiness Among Preschoolers With Externalizing Problems: The Moderating Role of the Student–Teacher Relationship

Paulo A. Graziano, Leanna R. Garb, Rosmary Ros, Katie Hart, and Alexis Garcia

Department of Psychology, Florida International University

ABSTRACT

Research Findings: The objective of this study was to examine the student–teacher relationship as a potential moderator of the link between executive functioning (EF) and children's early school readiness among a clinical sample of preschoolers with externalizing behavior problems (EBP). Participants for the study included 139 preschool children (75.54% boys, *M* age = 5.01 years, 84.94% Hispanic/Latino) with at-risk or clinically elevated levels of EBP. The student–teacher relationship was assessed using the Student–Teacher Relationship Scale. School readiness data were composed of standardized achievement test scores and teacher reports of kindergarten readiness. EF was measured via parent and teacher reports along with standardized measures of EF, including the Head–Toes–Knees–Shoulders task and 4 standardized subtests from the Automated Working Memory Assessment. Poorer student–teacher relationship quality was predictive of lower teacher-reported kindergarten readiness and higher academic impairment. Main effects were qualified by an interaction between EF and student–teacher relationship quality such that worse EF (parent/teacher reports and standardized performance) was only associated with lower teacher-rated kindergarten readiness for children with poorer student–teacher relationship quality. *Practice or Policy*: EF appears to be an important predictor of school readiness for preschool children with EBP, particularly for children experiencing poorer student–teacher relationships.

Kindergarten marks an important transition period for children. As outlined by Rimm-Kaufman and Pianta's (2000) ecological and dynamic model of transition, the kindergarten environment is qualitatively different from previous school and home, with a greater emphasis on formal instructions and academic outcomes. Kindergartners must adapt to a more challenging ecological system that expects them to accomplish numerous goals such as literacy, numeracy, and socialization skills under decreased supervision. It is not surprising that a significant number of young children have difficulty meeting the novel demands of learning new academic and interpersonal skills in a more autonomous manner (Rimm-Kaufman & Pianta, 2000). In fact, a survey conducted by the National Center for Early Development and Learning indicated that 46% of kindergarten teachers reported that more than half of the children in their classes were not ready for school. That is, many children lacked the skills necessary to function productively and learn in kindergarten. Although some teachers identified poor academic skills at school entry as the primary source of children's difficulties, most attributed children's lack of school readiness to problems with following directions and controlling attention (Rimm-Kaufman, Pianta, & Cox, 2000).

CONTACT Paulo A. Graziano pgrazian@fiu.edu Center for Children and Families & Department of Psychology, Florida International University, 11200 SW 8th St., Miami, FL 33199.

School readiness and externalizing behavior problems (EBP)

The construct of *school readiness* has become one of the most frequently used labels for discussing early childhood education and school outcomes encompassing traditional academic domains as well as socioemotional, attentional, and behavioral domains (Blair, 2002; La Paro & Pianta, 2000). Socioemotional, attentional, and behavioral domains include problem behavior, attention problems, peer relations, and social competence, which are all typically examined through the use of teacher or parent rating scales (Janus & Offord, 2007; Snow, 2006). These characteristics are important predictors of general school adjustment and in some instances are considered as important as academic/cognitive skills (Blair, 2002). Ensuring competence across these domains should begin as early as possible, as children's readiness for kindergarten is a reliable predictor of their long-term social and academic outcomes (Duncan et al., 2007; Mashburn & Pianta, 2006; Snow, 2006).

Children with EBP, including those displaying aggression, impulsivity, hyperactivity, and inattention, often have poor school readiness and experience greater difficulty transitioning to the formal school environment than typically developing children (Rimm-Kaufman et al., 2000). For example, children with EBP are at greater risk for academic failure, school absences, school dropout, and delinquency (see McEvoy & Welker, 2000, for a review) as well as academic underachievement (Bub, McCartney, & Willett, 2007). Several longitudinal studies have identified negative associations between early behavior problems and academic skills across the transition to elementary school (Bierman et al., 2013; Grimm, Steele, Mashburn, Burchinal, & Pianta, 2010). Children with a preestablished set of negative behaviors are unlikely to attend to instruction, which is critical for attaining and advancing academic skills (Metcalfe, Harvey, & Laws, 2013). Following a contextual systems model (CSM) approach to school readiness (Pianta & Walsh, 1996), the current study focused on an individual child factor (executive functioning [EF] skills) along with a classroom-level factor (the student–teacher relationship) that in an interactive manner may explain why preschool children with EBP experience a difficult transition to kindergarten.

Executive functioning

EF is a construct that unites cognitive flexibility, working memory, and inhibitory control for the purposes of planning and executing goal-directed activity (Miyake et al., 2000; Pennington & Ozonoff, 1996). Children who experience a more successful transition to kindergarten effectively use each of the core executive functions to control their behavioral and attentional functioning in the classroom. *Cognitive flexibility* refers to the ability to intentionally disengage from a current behavior or way of thinking and reengage in a different manner. It allows the back-and-forth transfer of attention between multiple tasks and plays a role in filtering task-relevant stimuli from task-irrelevant stimuli (Anderson, 2002). In a classroom setting this may be illustrated as the ability to attend to teacher instructions despite a distracting classroom environment. *Working memory*, which refers to the holding and updating of information while performing operations (Baddeley, 1992), enables children to remember classroom rules while participating in activities (McClelland et al., 2007). Lastly, *inhibitory control* refers to the deliberate inhibition of an automatic response (Miyake et al., 2000), such as engaging in reflection prior to acting (e.g., raising a hand instead of shouting an answer).

Together, EF skills contribute to self-regulatory processes that are necessary for optimal behavioral and attentional functioning in the classroom (Blair, 2002). It is not surprising that individual differences in EF have been shown to be concurrently and longitudinally associated with children's math and literacy scores (Blair & Razza, 2007; Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; Mazzocco & Kover, 2007; McClelland et al., 2007; Nesbitt, Baker-Ward, & Willoughby, 2013; Neuenschwander, Röthlisberger, Cimeli, & Roebers, 2012). Children with EBP, such as those diagnosed with attention-deficit/hyperactivity disorder (ADHD), often experience EF deficits (see Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005, for a review) that are predictive of their

impairments in academic functioning (Barkley & Fischer, 2011). For example, children with both ADHD and EF deficits have significantly lower academic achievement and are more likely to be held back in school compared to children with ADHD alone, even after socioeconomic status and intelligence are accounted for (Biederman et al., 2004). EF deficits are also associated with other aspects of EBP, including aggression, conduct problems, and oppositionality (Morgan & Lilienfeld, 2000; Schoemaker, Mulder, Deković, & Matthys, 2013). However, there remains a gap in current knowledge regarding the extent to which EF deficits among preschool children with EBP relate to children's school readiness.

Quality of the student–teacher relationship

The quality of children's relationships with their teachers has become increasingly recognized as an important predictor of children's early school adjustment and academic success (Baker, 2006; Birch & Ladd, 1997; Curby, Rimm-Kaufman, & Ponitz, 2009; Hamre & Pianta, 2001; Lee & Bierman, 2015; Pianta, Steinberg, & Rollins, 1995; Pianta & Stuhlman, 2004; Roorda, Koomen, Spilt, & Oort, 2011). The effects of student–teacher relationship quality on children's school outcomes also appear to be long lasting, as Baker (2006) found that student–teacher relationship quality during kindergarten significantly predicted behavioral and academic indicators of school readiness through fifth grade. Furthermore, Hamre and Pianta (2001) found that student–teacher relationships in kindergarten predicted outcomes through eighth grade. In particular, student–teacher closeness is associated with better performance and more favorable attitudes toward school (Mashburn & Pianta, 2006). In contrast, a student–teacher relationship characterized by conflict is associated with negative academic (Spilt, Hughes, Wu, & Kwok, 2012) and behavioral (Hamre & Pianta, 2001; Skalická, Stenseng, & Wichstrøm, 2015) outcomes. Lastly, a more recent meta-analysis found that the effects of a positive or negative student–teacher relationship on children's academic functioning and engagement are particularly important for children who are academically at risk and from disadvantaged economic backgrounds (Roorda et al., 2011).

The moderating role of quality of the student–teacher relationship

Given these findings, it is not surprising that high-quality student–teacher relationships have been the target of numerous early intervention programs aimed at improving the socioemotional climate in the classroom and subsequently children's engagement in the classroom (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Birch & Ladd, 1997; Bodrova & Leong, 2007; Greenberg, Kusche, Cook, & Quamma, 1995). The moderating role of a positive student–teacher relationship is particularly relevant for children with EBP who are significantly more likely to have initial difficulties forming a positive relationship with their teacher (Silver, Measelle, Armstrong, & Essex, 2005; Skalická et al., 2015; Sutherland, Lewis-Palmer, Stichter, & Morgan, 2008). Teachers also have lower levels of tolerance for behavior problems in the classroom, expressing negative views in response to children's EBP (Coplan, Bullock, Archbell, & Bosacki, 2015). EBP in the classroom interferes with teachers' abilities to focus on teaching (Raver et al., 2008), as they end up engaging in more negative classroom management practices (Gunter & Coutinho, 1997).

From a CSM perspective (Pianta & Walsh, 1996), the quality of the student–teacher relationship is a key classroom-level factor that interacts with children's individual characteristics (e.g., EBP or EF) to influence their overall school readiness. Indeed, empirical work has provided some support for this CSM approach to child development, as a secure relationship with a teacher has been shown to offset preexisting EBP and serve as a protective factor against a poor home environment or insecure maternal attachment (Baker, 2006; Hughes, Cavell, & Wilson, 2001; Lynch & Cicchetti, 1997; O'Connor, Dearing, & Collins, 2011; Pianta et al., 1995; Resnick et al., 1997). However, no study to our knowledge has applied the CSM to examine whether the quality of the student–teacher relationship does indeed interact with a strong individual child-level predictor of school readiness

(i.e., EF) that is often impaired among preschool children with EBP. Such an empirical question has significant policy implications for early education given that interventions are often centered on improving the student–teacher relationship as a key mechanism of improving school outcomes for children with EBP. Alternatively, it may be the case that among children with EBP who have poor EF, simply improving the student–teacher relationship is not enough to improve children's school outcomes, which would then suggest the need for more intensive intervention approaches.

The current study

In summary, when school readiness is conceptualized from a CSM approach, both classroom factors (e.g., the student–teacher relationship) as well as individual child factors (e.g., EF) are critical for children's early school success. However, there are several gaps in the literature. In terms of the link between EF and academic achievement, the majority of studies have been conducted using middle school children or adolescents (Masten et al., 2005). In addition, almost all studies that have examined the link between EF and academic readiness have focused on nonclinical samples of preschoolers (Blair & Razza, 2007; Espy et al., 2004; Smith-Donald, Raver, Hayes, & Richardson, 2007), with only a couple studies focusing on preschoolers with EBP (Hughes, Dunn, & White, 1998; Mariani & Barkley, 1997). Most important and related to a CSM approach to school readiness is that no study to our knowledge has examined the student–teacher relationship as a potential moderator of the link between EF and school readiness. Distinguishing which conditions in school settings can alter the early trajectories of children's academic and social functioning has important implications for understanding pathways to children's successful transition (Hamre & Pianta, 2005). If students' interactions with their teachers can lower the risk of school failure for children with EF deficits, efforts could be focused toward improving teacher training and support, curriculum implementation, and assessments to counter potential poor outcomes for children with EBP who are more likely to have EF deficits.

Hence, the goals of the current study were to (a) examine the association between EF and academic readiness in a clinical sample of preschoolers with EBP and (b) examine whether the student–teacher relationship would moderate any link between EF and school readiness. Based on past work with nonclinical samples showing the importance of individual differences in EF for school readiness, we expected that children with EBP who displayed lower levels of EF would be less prepared for kindergarten across both objective and subjective measures of school readiness. More important, we predicted based on the CSM perspective (Pianta & Walsh, 1996) that a close student–teacher relationship would mitigate the effects of poor EF on school readiness.

Method

Participants and recruitment

The study took place in a large urban city in the southeastern United States with a large Hispanic population. The primary caregiver provided written consent prior to the start of the initial assessment. To qualify for the study participants were required (a) to have an externalizing problems composite *t* score of 60 or above on the teacher (M = 68.33, SD = 14.51) or parent (M = 65.52, SD = 13.78) Behavior Assessment System for Children–Second Edition (Reynolds & Kamphaus, 2004) collected as part of our initial assessment, (b) to have been enrolled in preschool during the previous year, (c) to have an estimated IQ of 70 or higher (M = 88.99, SD = 13.85) based on the Wechsler Preschool and Primary Scale of Intelligence–Fourth Edition (WPPSI-IV; Wechsler, 2012), (d) to have no confirmed history of autism spectrum disorder or psychotic disorder, and (e) to be able to attend the 8-week Summer Treatment Program for Prekindergartners (STP-PreK; see Graziano, Slavec, Hart, Garcia, & Pelham, 2014, for a full description).

The final participating sample consisted of 139 preschool children (75.54% boys) with at-risk or clinically elevated levels of EBP whose parents provided consent to participate in the study. The mean

age of the participating children was 5.01 years (range = 3.50–6.35 years, *SD* = 0.53) with Hollingshead socioeconomic status scores in the lower class to middle-class range (*M* = 42.11, *SD* = 13.07). Of the children, 59% were from an intact biological household, 34% from a single-parent household (separated, divorced, or single/never married), and 7% from a single-parent household living with a partner. According to the Diagnostic Interview Schedule for Children, computerized version IV (C-DISC; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000), which was conducted by mental health graduate students under the supervision of a licensed psychologist, 48% of children met *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*, criteria for both ADHD and oppositional defiant disorder/conduct disorder, whereas an additional 26% met criteria for ADHD only and 14% met criteria for oppositional defiant disorder/conduct disorder only. Only one child was taking a stimulant medication during the study.

Procedures

This study was approved by the university's institutional review board. Children recruited across 2 years participated in two randomized trials of the STP-PreK. Only children who met inclusionary criteria and were able to participate in the STP-PreK were included in the present study. The present study focused on our pretreatment assessment and the role of preschoolers' EF and the student–teacher relationship as it related to school readiness.

As part of the pretreatment assessment, consenting caregivers brought their children to the laboratory on two occasions in the spring prior to kindergarten. During the first visit, clinicians administered six subtests from the WPPSI-IV (Wechsler, 2012), the Bracken School Readiness Assessment (BSRA; Bracken, 2002), and six subtests from the Woodcock–Johnson III Tests of Achievement (WJ-III; Woodcock, McGrew, & Mather, 2001). While in the laboratory, the consenting caregiver completed various questionnaires and participated in a structured interview (C-DISC; Shaffer et al., 2000). Preschool teachers also completed several rating scales. Eligible participants were invited to attend the second laboratory visit, at which children were administered four subtests from the Automated Working Memory Assessment (AWMA; Alloway, Gathercole, & Pickering, 2004) followed by the Head–Toes–Knees–Shoulders (HTKS) task (Ponitz et al., 2008). Children were given small breaks at the end of each task (e.g., free play) to ensure that there were no carryover effects from one task to another.

All children involved in the present study were required to be fluent in English, as administration of standardized academic measures (e.g., the WPPSI, AWMA, BSRA, and WJ-III) could only be conducted in English. Thus, all child testing was conducted in English. In instances of parental bilingualism, parents were asked whether they were more comfortable reading in English or Spanish, and parent report forms/parent interviews were provided in the language of choice. There were no significant differences in any variables reported between English- and Spanish-speaking parents.

Measures of executive function

Parent and teacher reports

Parents and teachers filled out the Behavior Rating Inventory of Executive Function–Preschool Version (BRIEF-P; Gioia, Espy, & Isquith, 2003). The BRIEF-P contains 63 items rated on a 3-point Likert scale (never, sometimes, and often) that yield three overlapping indexes—Inhibitory Self-Control (Inhibit and Emotional Control), Flexibility (Shift and Emotional Control), and Emergent Metacognition (Working Memory and Plan/Organize)—along with an overall Global Executive composite. Higher scores indicate poorer EF. The BRIEF-P has well-established internal consistency, reliability, and validity (Isquith, Crawford, Espy, & Gioia, 2005; Mahone & Hoffman, 2007). For the purpose of the present study, the Global Executive composite raw score was used as a measure of overall EF (αs for parent and teacher reports = .95–.96.). Parent and teacher reports (r = .21, p = .02) were combined following the "or" rule by selecting the higher of the two scores for each child (Bird, Gould, & Staghezza, 1992; Piacentini, Cohen, & Cohen, 1992).

Standardized assessment

Children completed the HTKS task (Ponitz et al., 2008). The HTKS task is a direct brief measure used to assess multiple aspects of EF in preschoolers and kindergartners. During the first part of the task, children are instructed to follow paired behavioral commands (e.g., "Touch your toes"). Children are later instructed to do a behavior opposite of the verbal command (e.g., touching their head when told to touch their toes). Scores range from 0 to 40, with higher scores indicative of better EF. Good psychometric properties have been reported, including 3-month test–retest reliability above .90 (Ponitz et al., 2008) and high concurrent validity with teacher ratings of children's self-regulation in preschool and kindergarten (McClelland et al., 2007; Ponitz, McClelland, Matthews, & Morrison, 2009) and with parent ratings of attention and inhibitory control (Ponitz et al., 2009).

Children were also individually administered four subtests from the AWMA (Alloway et al., 2004), a computer-based assessment of working memory skills for children ages 4 and older. Four subtests were administered in the present battery: (a) Word Recall (auditory short-term memory): In Word Recall, children are asked to repeat back a progressively longer series of one- and two-syllable words. (b) Listening Recall (auditory working memory): In the Listening Recall task, children are first asked to determine the validity of a sentence (true/false) and then asked to recall the last word in the sentence. Additional sentences are progressively added to increase difficulty. (c) Dot Matrix (visuospatial short-term memory): In Dot Matrix, children are presented with a series of dots on a 4×5 grid and asked to recall in the same sequence the spatial location of each dot. (d) Mister X (visuospatial working memory): In Mister X, children are presented with two similar cartoon figures holding a ball in one hand, one of whom is rotated between 45 and 315 degrees. Children are first asked to make a judgment about the spatial orientation of the figures (i.e., "Are they holding a ball in the same or different hand?"). The figures disappear shortly afterward and then children are asked to recall the location of the ball. Raw scores are converted to standard scores compared to same-age peers. To reduce the number of analyses and given the high correlations among the four AWMA tests (rs = .66–.80, $p < .001$), we calculated an average standardized score and aggregated it with the HTKS task given their moderate correlation (r = .59, $p < .001$) to form an EF composite. The EF composite was used in subsequent analyses, with higher scores indicating better EF.

Measure of the student–teacher relationship

Teacher ratings

The Student–Teacher Relationship Scale (STRS; Pianta, 2001) contains 28 items rated on a 5-point Likert scale (definitely does not apply, not really, neutral, not sure, applies somewhat, and definitely applies) that yield three overlapping indexes. These three aspects refer to, respectively, the amount of warmth and open communication in the relationship (11 items), children's overdependence on the teacher (5 items), and the extent to which the relationship is characterized by anger and negativity (12 items). The STRS is a widely used research instrument with good psychometric properties and is predictive of school adjustment (Hamre & Pianta, 2001). For the purposes of this study, the total raw score for the STRS was utilized (α = .77).

Measures of school readiness

Academic school readiness

Teachers were asked to complete the Kindergarten Behavior and Academic Competency Scale (KBACS; Hart & Graziano, 2013). The KBACS is a 24-item questionnaire that requires teachers to rate the extent to which the target child is ready for kindergarten across various domains (e.g., following classroom rules, completing academic work) along a 5-point scale (poor, fair, average, above average, and excellent). For the present study, the overall kindergarten readiness item was used as a measure of kindergarten readiness. The overall kindergarten readiness item asks teachers to rate on a scale from 1 to 100 how ready they feel the target child is for meeting the academic and

behavioral demands of kindergarten. Higher scores indicate greater kindergarten readiness. Previous studies using the KBACS have documented that the overall readiness item is associated with objective measures of school readiness such as standardized academic scores on the WJ-III (Graziano et al., 2015), has excellent test–retest reliability (intraclass correlation coefficient = .82), and is sensitive to intervention effects (Graziano et al., 2014).

Academic functioning

Children were individually administered six subtests of the WJ-III (Woodcock et al., 2001), a widely used, norm-referenced measure of academic ability that has excellent psychometric properties (Mather & Woodcock, 2001). The six subtests administered were Applied Problems, Calculation, Writing Sample, Letter-Word Identification, Passage Comprehension, and Spelling. The current study examined the derived composite scores: Brief Reading (Letter-Word Identification, Passage Comprehension), Brief Math (Applied Problems + Calculation), and Brief Writing (Spelling + Writing Sample). However, given the high correlations among these composites (rs = .63–.69, $p < .001$), an overall achievement composite was used by averaging the standardized composites.

Children were also individually administered the BSRA (Bracken, 2002), a widely used kindergarten readiness test that consists of five subtests assessing children's receptive knowledge of colors, letters, numbers/counting, sizes/comparisons, and shapes. The BSRA has strong psychometric properties and has been validated as a strong predictor of children's academic outcomes (Bracken, 2002; Panter & Bracken, 2009). For the purposes of this study, the overall school readiness composite raw score was used.

Behavioral impairment of academic progress

Teachers completed the Impairment Rating Scale (IRS; Fabiano et al., 2006). The IRS measures the severity of children's impairment in multiple domains on a 7-point Likert scale ranging from *no impairment* to *extreme impairment*. Areas of impairment rated include academic functioning, classroom functioning, self-esteem, relationships with peers/teachers, and overall functioning. The IRS has well-established internal consistency, cross-informant reliability, and convergent and divergent validity with other measures of impairment (Fabiano et al., 2006). Consistent with the current study's focus on school readiness, the extent to which children's behavior problems were impairing their academic functioning in the classroom was examined.

Data analysis strategy

Analyses were conducted using the SPSS Version 21.0. Preliminary data screening revealed minimal missing data (2.60%). Initial correlation analyses were conducted to determine the main effects of EF and the student–teacher relationship on academic performance outcomes. Statistically significant correlations were then examined further using a hierarchical multiple regression model along with multiplicative interaction terms for executive function and student–teacher relationship. Significant interactions were probed following procedures outlined by Aiken, West, and Reno (1991) and the use of Hayes's macro (Hayes & Matthes, 2009).

Results

Preliminary analyses

Descriptive statistics

Descriptive statistics for all outcome variables are presented in Table 1. Preliminary data analyses indicated a significant association between child age at the time of assessment and the EF composite ($r = .54$, $p < .001$) and BSRA scores ($r = .35$, $p < .001$), indicating that older children performed better across the EF tasks and had higher school readiness scores. Children's age was controlled in all

Table 1. Descriptive Statistics for All Variables.

Variable	M	SD	Min	Max
Demographics				
Child age	5.01	0.53	3.50	6.35
Socioeconomic status (P)	42.11	13.07	11.00	62.00
Executive Functioning				
Global EF problems BRIEF (T)	122.17	24.17	68.00	181.00
Global EF problems BRIEF (P)	125.53	21.90	80.00	176.00
Global EF problems BRIEF (PT)	134.76	20.20	97.00	181.00
Automated Working Memory Assessment (L)	87.31	19.24	0.00	127.50
Head–Toes–Knees–Shoulders task (L)	10.25	11.59	0.00	38.00
EF *z*-score composite (L)	0.01	0.84	−2.71	2.03
Quality of student–teacher relationship				
STRS total (T)	108.33	14.83	72.00	167.00
School readiness/academic functioning				
Academic impairment: IRS (T)	3.94	1.88	0.00	6.00
Overall kindergarten readiness: KBACS (T)	44.86	24.11	0.00	100.00
School readiness composite: BSRA (L)	53.86	15.95	10.00	79.00
Academic achievement: WJ SS (L)	97.43	15.58	62.50	155.33

Note. P = parent-report measure; Global EF problems BRIEF = global executive functioning (Behavior Rating Inventory of Executive Function); T = teacher-report measure; PT = combined parent/teacher report; L = laboratory/standardized measure; EF composite = executive functioning composite score from Automated Working Memory Assessment and Head–Toes–Knees–Shoulders assessments; STRS = Student–Teacher Relationship Scale; IRS = Impairment Rating Scale; KBACS = Kindergarten Behavior and Academic Competency Scale; BSRA = Bracken School Readiness Assessment; WJ SS = Woodcock–Johnson III Tests of Achievement standard scores.

subsequent analyses. Preliminary analyses did not yield any other significant associations between demographic variables (e.g., socioeconomic status) and school readiness outcomes.

Interrelations among study variables

Correlations were calculated for the study variables while controlling for child age. As seen in Table 2, there was a negative association between parent/teacher global EF problems, as measured by the BRIEF, and the STRS (r = –.39, p < .01) and the KBACS (r = –.24, p < .01) as well as a positive association with teacher IRS academic impairment (r = .27, p < .01). These correlations suggested that children reported by teachers as having higher levels of executive dysfunction were more likely to have poorer student–teacher relationships, were less ready for kindergarten, and experienced greater levels of academic impairment. A positive correlation was reported between the STRS and KBACS (r = .19, p < .05), indicating that children with a more positive relationship with their teachers were more ready for kindergarten. A negative correlation was reported between the STRS and teacher IRS academic impairment (r = –.29, p < .01), suggesting that children with a more positive relationship with their teachers were less likely to have academic impairment. Finally, there were significant correlations between the EF composite and the WJ (r = .46, p < .01), KBACS (r = .32, p < .01), and the BSRA (r = .42, p < .01), indicating that better EF skills were associated with

Table 2. Correlations Between Variables.

Variable	1	2	3	4	5	6	7
1. Global EF problems (PT)	—	−.394**	.039	−.244**	.019	−.110	.274**
2. Student–teacher relationship (T)		—	−.137	.194*	−.089	−.108	−.287**
3. EF composite (L)			—	.316**	.424**	.459**	−.107
4. Overall school readiness (T)				—	.399**	.467**	−.469**
5. School readiness composite (L)					—	.653***	−.249**
6. Academic achievement (L)						—	−.322**
7. Academic impairment (T)							—

Note. All analyses controlled for child age. EF = executive functioning; PT = combined parent/teacher report; T = teacher-report measure; EF composite = executive functioning tasks composite score from Automated Working Memory Assessment and Head–Toes–Knees–Shoulders assessments; L = laboratory/standardized measure.
*p < .05. **p < .01.***p < .001.

higher academic achievement, better school readiness, and less academic impairment. All other correlations between study variables are presented in Table 2.

Hierarchical multiple regression analyses

Teacher-reported outcomes

A series of hierarchical multiple regressions were conducted to evaluate the unique effects of EF and the student–teacher relationship on outcome variables (e.g., academics) while accounting for initial levels of age (controlled for in Step 1). In addition, Step 3 of all regressions examined two-way interactions between student–teacher relationship and the EF variables. As seen in Table 3, parent/teacher reports of global EF problems, as measured via the BRIEF, were associated with the KBACS overall readiness score (β = –.20, $p < .05$) and IRS academic impairment (β = .19, $p < .05$), suggesting that higher rates of EF problems were associated with lower levels of teacher-rated school readiness and higher rates of academic impairment. In addition, EF, as measured via standardized laboratory assessments, was associated with the KBACS school readiness score (β = .48, $p < .001$), suggesting that higher EF was associated with higher teacher-rated school readiness. Finally, higher levels of overall student–teacher relationship quality were associated with higher teacher-rated school readiness (β = .18, $p < .05$) and lower rated academic impairment (β = –.23, $p < .05$).

STRS as a moderator. However, these main effects were qualified by significant interactions. Results revealed a significant interaction between parent/teacher-reported global EF problems and student–teacher relationship quality in predicting the KBACS overall readiness score (β = .16, $p < .05$). As seen in Figure 1, the student–teacher relationship moderated the association between global EF problems and the KBACS, such that more EF problems were only predictive of lower teacher-rated school readiness for students experiencing a poor student–teacher relationship ($t = -2.95$, $b = -.41$, $p < .01$), whereas EF problems were unrelated to school readiness for children with high student–teacher relationship quality ($t = -0.47$, $b = -.06$, $p > .05$). Similarly, an additional interaction emerged between the EF composite and student–teacher relationship quality in predicting the KBACS overall readiness score (β = –.18, $p < .05$). As seen in Figure 2, the student–teacher relationship moderated the association between EF on standardized assessments and the KBACS such that lower EF was only

Table 3. Hierarchical Regression Analyses: Teacher-Reported Outcomes.

Outcome	β	T	Adjusted R^2	Adjusted R^2 Change	F Change
School readiness: KBACS					
Step 1. Child age	.00	0.00	.00	.00	0.00
Step 2. Global EF problems (PT)	–.20*	–2.26	.18	.18	10.10***
Student–teacher relationship (STRS; T)	.18*	1.98			
EF composite (L)	.48***	4.32			
Step 3. Global EF Problems (PT) × STRS (T)	.16*	1.95	.22	.04	4.34**
EF Composite (L) × STRS (T)	–.18*	–2.20			
Academic impairment: IRS					
Step 1. Child age	.15†	1.69	.02	.02	2.85†
Step 2. Global EF problems (PT)	.19*	2.01	.13	.11	5.87**
Student–teacher relationship (STRS; T)	–.23*	–2.45			
EF composite (L)	–.15	–1.66			
Step 3. Global EF Problems (PT) × STRS (T)	–.12	–1.30	.13	.00	1.20
EF Composite (L) × STRS (T)	–.07	–0.79			

Note. KBACS = Kindergarten Behavior and Academic Competency Scale; Global EF problems = global executive functioning (Behavior Rating Inventory of Executive Function); PT = combined parent/teacher report; STRS = Student–Teacher Relationship Scale; T = teacher-report measure; EF composite = executive functioning tasks composite score from Automated Working Memory Assessment and Head–Toes–Knees–Shoulders assessments; L = laboratory/standardized measure; IRS Academic = Impairment Rating Scale Academic Subscale.
†$p < .10$. *$p < .05$. **$p < .01$.***$p < .001$.

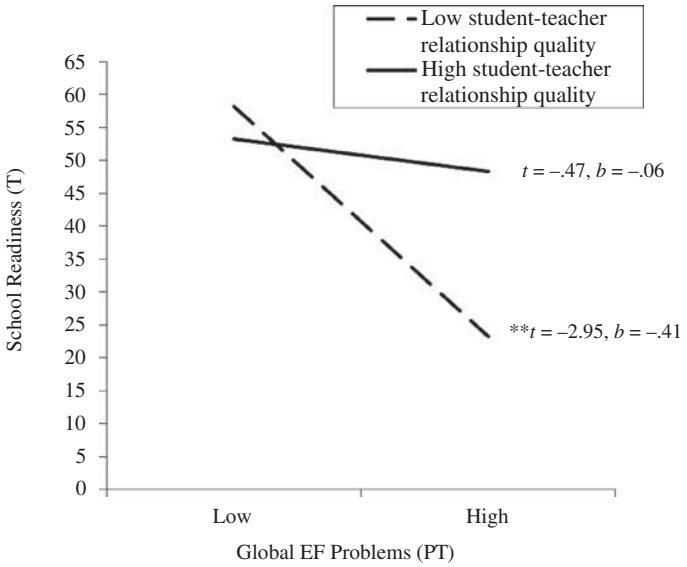

Figure 1. Quality of the student–teacher relationship moderating the association between global EF problems and school readiness. T = teacher-report measure; EF = executive functioning; PT = combined parent/teacher report. $^{**}p < .01$.

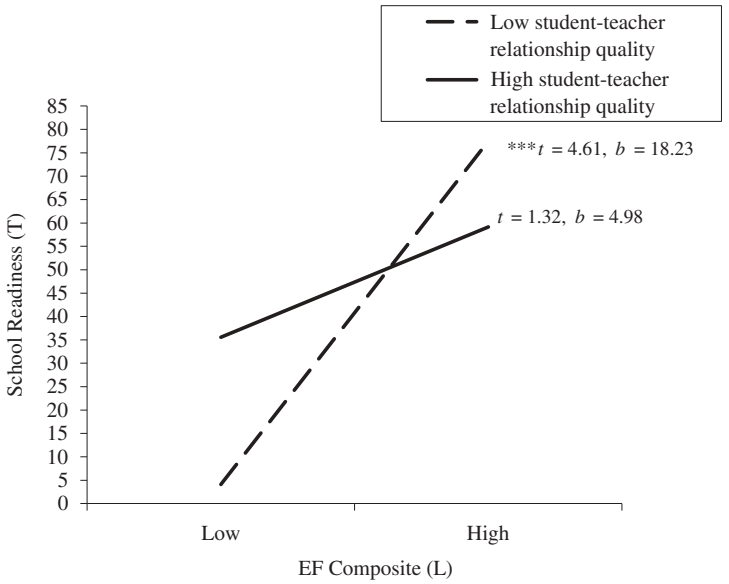

Figure 2. Quality of the student–teacher relationship moderating the association between EF composite and school readiness. T = teacher-report measure; EF composite = executive functioning tasks composite score from Automated Working Memory Assessment and Head–Toes–Knees–Shoulders assessments; L = laboratory measure. $^{***}p < .001$.

predictive of lower teacher-rated school readiness outcomes for students experiencing a poor student–teacher relationship ($t = 4.61$, $b = 18.23$, $p < .001$), whereas standardized EF performance was unrelated to school readiness for children with high student–teacher relationship quality ($t = 1.32$, $b = 4.98$).

Table 4. Hierarchical Regression Analyses: Standardized Achievement Outcomes.

Outcome	β	T	Adjusted R^2	Adjusted R^2 Change	F Change
Academic achievement: WJ SS					
Step 1. Child age	−.15†	−1.70	.02	.02	2.89†
Step 2. Global EF problems (PT)	−.19*	−2.32	.27	.25	15.22***
Student–teacher relationship (STRS; T)	−.13	−1.52			
EF composite (L)	.50***	6.09			
Step 3. Global EF Problems (PT) × STRS (T)	−.09	−1.17	.28	.01	1.37
EF Composite (L) × STRS (T)	.09	1.17			
School readiness composite: BSRA					
Step 1. Child age	.17	1.86	.02	.02	31.14**
Step 2. Global EF problems (PT)	.05	0.47	.18	.16	1.88
Student–teacher relationship (STRS; T)	−.03	−0.30			
EF composite (L)	.45***	5.15			
Step 3. Global EF Problems (PT) × STRS (T)	.12	−1.47	.19	.01	0.72
EF Composite (L) × STRS (T)	−.09	1.47			

Note. WJ SS = Woodcock–Johnson III Tests of Achievement standard scores; Global EF problems = global executive functioning (Behavior Rating Inventory of Executive Function); PT = combined parent/teacher report; STRS = Student–Teacher Relationship Scale; T = teacher-report measure; EF composite = executive functioning tasks composite score from Automated Working Memory Assessment and Head–Toes–Knees–Shoulders assessments; L = laboratory/standardized measure; BSRA = Bracken School Readiness Assessment.
†$p < .10$. *$p < .05$. **$p < .01$.

Standardized achievement outcomes

As seen in Table 4, parent/teacher reports of global EF problems, as measured via the BRIEF, were associated with the WJ standard score (β = –.19, $p < .05$), suggesting that higher rates of global EF problems were associated with lower academic achievement scores. In addition, EF, as measured via standardized laboratory assessments, was associated with the WJ standard score (β = .50, $p < .001$) and the BSRA school readiness score (β = .45, $p < .001$), such that higher EF was predictive of higher academic achievement and school readiness scores. Finally, there were no significant two-way interactions between the student–teacher relationship and the EF variables in predicting standardized achievement outcomes.

Discussion

The present study sought to examine the effect of EF on early school readiness for preschool children with EBP. Specifically, and informed by the CSM perspective, we examined whether the association between children's EF skills and school readiness was moderated by the student–teacher relationship. Although a small number of studies have previously established the link between preschoolers' EF and school readiness (Blair & Razza, 2007; Cameron et al., 2012), this study is the first to (a) confirm this link in a clinical sample of preschoolers exhibiting EBP who were also predominantly Hispanic/Latino and (b) partially demonstrate that a positive student–teacher relationship can mitigate some of the negative effects of poor EF on school readiness. The implications of our findings are discussed in further detail here.

As expected and hypothesized, EF as reported by a combination of teacher and parent ratings as well as assessed objectively via a neuropsychological battery positively predicted school readiness as measured by both teacher ratings and standardized achievement tests. Consistent with Rimm-Kaufmann and Pianta's (2000) ecological model regarding the change in environment from preschool to kindergarten, EF skills indirectly facilitate learning in classrooms by promoting relevant, facilitative behaviors (Blair & Diamond, 2008). Children whose EF skills are better developed may be more likely to understand teacher directions and transition more easily into classroom activities while simultaneously attending to academic exercises (Fuhs, Nesbitt, Farran, & Dong, 2014). Our finding is consistent with previous work showing that children with EF deficits struggle academically

and are less ready for kindergarten (Blair & Razza, 2007; St Clair-Thompson & Gathercole, 2006) while extending the literature by showing that the link between individual differences in EF and school readiness is also relevant for preschool children displaying EBP. Most important, our robust findings across both a combination of parent and teacher ratings as well as a comprehensive neuropsychological battery (AWMA) and a more ecologically based EF task (HTKS) indicate that it is not just a shared reporter bias in terms of teachers rating a child with EBP poorly on EF and then also reporting that the child is not ready academically for kindergarten. Rather, the actual EF skills of children with EBP do in fact strongly relate to children's early academic performance prior to the start of kindergarten while at the same time impacting teacher perceptions of their school readiness.

In addition, our study is the first to demonstrate the link between EF and school readiness within a predominantly Hispanic/Latino sample. Establishing the link between EF and school readiness in such a sample is important given that Hispanics/Latinos are the fastest growing minority in the United States, representing 14% of the general population in 2004 (Kohler & Lazarin, 2007) and 22% of children younger than the age of 5. Despite this rapid growth, the participation of Hispanics/Latinos in early childhood education programs is low. Because Hispanic/Latino children are more susceptible to academic difficulties (Toppelberg & Collins, 2010), validating links between EF and school readiness is critical for this population.

Another question addressed in this study was whether the quality of the student–teacher relationship could alleviate the effects of poor EF on school readiness. Our results provided partial evidence for such a hypothesis, as we did find significant interactions between children's EF (measured both via a combination of parent and teacher ratings as well as via the standardized neuropsychological assessment battery) and student–teacher relationship quality in predicting teacher-reported school readiness. Indeed, a closer student–teacher relationship appeared to buffer the negative effects of poor EF on teacher-rated school readiness. However, no such interactions emerged for objective measures of school readiness (e.g., the WJ-III or BSRA). Taken together, and considering the policy/practice implications, it appears that although developing a close student–teacher relationship for children with EBP and poor EF (measured both objectively and subjectively) may make the teacher have a more positive impression of that child's school readiness, it unfortunately does not translate to better objective measures of school readiness (e.g., standardized achievement scores). Given the levels of cognitive and behavioral impairment among children with EBP, it may be the case that teachers need more resources and support systems to make a more meaningful impact in the academic development of these children. However, it is important to acknowledge that the student–teacher relationship has been shown to be important for children's nonacademic functioning, including attentional functioning (Swearer, Espelage, Vaillancourt, & Hymel, 2010), social functioning, motivation, and self-esteem (see Davis, 2003, for a review). Hence, such an improved subjective impression of a child with EBP and poor EF may still be valuable for such nonacademic outcomes. In addition, given the cross-sectional nature of the current study, it may still be possible that a positive student–teacher relationship can buffer longer term negative academic outcomes for a child with EBP and poor EF.

There are several limitations to the current study that must be noted. Of course because the study was cross-sectional, the causality of the relation between children's EF skills and school readiness cannot be inferred. Although EF deficits likely contribute to worse school readiness, it is also possible that lower school performance may make EF skills worse. Future studies should incorporate a longitudinal design to better understand the association between children's EF and school readiness, as such associations may be reciprocal. In addition, teachers rated children's school readiness, children's EF, and student–teacher relationship quality, which raises concerns regarding shared reporter bias. Although we combined parent and teacher ratings of EF, the link between student–teacher relationship and school readiness ratings may still be a function of reporter bias, as there is a well-documented negative halo effect for teachers reporting on related constructs and functioning of children with EBP (Abikoff, Courtney, Pelham, & Koplewicz, 1993; Stevens & Quittner, 1998). It will

be important for future work to measure the student–teacher relationship more objectively, perhaps via the use of classroom observation systems that rate teachers' frequency of praising and responsiveness to the targeted student of interest.

Lastly, our teacher-rated school readiness measure (the KBACS) relied on a single overall item that asked teachers to rate from 0 to 100 how ready they felt the child was for kindergarten. Although there can be some psychometric limitations (e.g., measurement error) that come with relying on a single item (Bowling, 1997), single-item measures are gaining interest across academic disciplines given the practical and cost-effective implications. For example, a large-scale study found that a single-item measure of stress within the workplace was psychometrically sound and valid (Elo, Leppänen, & Jahkola, 2003). More closely related to the current study is that an overall single item of the IRS (Fabiano et al., 2006) has also been used across intervention trials with excellent success. Past work using the KBACS has shown this overall item to be psychometrically sound in terms of its test–retest reliability, construct validity, and sensitivity to intervention effects (Graziano et al., 2014, 2015). Similarly, the current study found that the overall item of the KBACS was moderately correlated with both of the standardized academic measures (r = .40, p < .01, for BSRA; and r = .47, p < .01, for WJ-III), indicating that such a quick and practical measure can provide important information regarding a child's school readiness abilities.

Despite these limitations, our study provides important information on the relation between children's EF and early school readiness. It is the first study to our knowledge to empirically examine this association in a predominantly Hispanic/Latino sample. The study also examined EF using a multimethod approach (e.g., parent/teacher ratings and standardized tasks), providing a more thorough assessment of the role of children's EF as it relates to school readiness. Within the student–teacher relationship domain, past work highlights that positive student–teacher interactions can provide children with a positive, supportive, and stimulating early childhood experience that is associated with positive gains in school readiness skills (Curby et al., 2009; Mashburn et al., 2008). In addition, such positive student–teacher interactions can mitigate some of the negative effects of lower child engagement in the classroom on school readiness outcomes (Williford, Maier, Downer, Pianta, & Howes, 2013). Our study extends this literature by being the first study to our knowledge to document that a close student–teacher relationship can also mitigate the negative effects of poor EF on school readiness (as rated by teachers).

Related to policy or intervention implications, the current study did not find that the student–teacher relationship buffered effects extended to objective measures of school readiness, suggesting that for children with EBP and poor EF simply improving the student–teacher relationship will not be sufficient to address their academic impairment as measured via standardized achievement tests. It will be important for future work to determine the required level of intervention in terms of the resources and intensity needed to help children with EBP, particularly those with poor EF skills. The robust main effects of EF on school readiness found in the current study further reinforce the importance of improving the preschool classroom environment and curriculums to better promote children's EF (Nayfeld, Fuccillo, & Greenfield, 2013). Because EF skills are rapidly developing around the time children transition to the formal school environment (Riggs, Jahromi, Razza, Dillworth-Bart, & Mueller, 2006), a greater emphasis on the development of EF may improve outcomes across subjects (Nayfeld et al., 2013). Indeed, a significant number of early intervention programs, such as the Research-Based Developmentally Informed Head Start innovation (Bierman et al., 2008), Tools of the Mind (Bodrova & Leong, 2007), and Promoting Alternative Thinking Skills (Greenberg et al., 1995), have recently been developed to target children's EF, with STP-PreK (Graziano et al., 2014) being specifically designed for children with EBP. It will be important for future studies to continue to examine how to best target children's EF, especially among children with EBP who are more prone to EF deficits compared to typically developing children. Lastly, with increasing national interest in providing universal preschool, it will be critical for research to examine how to optimally train and provide resources so that preschool teachers can effectively manage and help promote school readiness among children with EBP.

Funding

The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant No. R324A120136 (PI Graziano). The opinions expressed are our own and do not represent views of the Institute or the U.S. Department of Education.

References

Abikoff, H., Courtney, M., Pelham, W. E. Jr., & Koplewicz, H. S. (1993). Teachers' ratings of disruptive behaviors: The influence of halo effects. *Journal of Abnormal Child Psychology*, *21*(5), 519–533. doi:10.1007/BF00916317

Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA: Sage.

Alloway, T. P., Gathercole, S. E., & Pickering, S. J. (2004). *The Automated Working Memory Assessment*. London, England: Pearson Assessment.

Anderson, P. (2002). Assessment and development of executive function (EF) during childhood. *Child Neuropsychology*, *8*, 71–82. doi:10.1076/chin.8.2.71.8724

Baddeley, A. (1992, January 31). Working memory. *Science*, *255*(5044), 556–559. doi:10.1126/science.1736359

Baker, J. A. (2006). Contributions of teacher–child relationships to positive school adjustment during elementary school. *Journal of School Psychology*, *44*, 211–229. doi:10.1016/j.jsp.2006.02.002

Barkley, R. A., & Fischer, M. (2011). Predicting impairment in major life activities and occupational functioning in hyperactive children as adults: Self-reported executive function (EF) deficits versus EF tests. *Developmental Neuropsychology*, *36*, 137–161. doi:10.1080/87565641.2010.549877

Biederman, J., Monuteaux, M., Doyle, A., Seidman, L., Wilens, T., Ferrero, F., … Faraone, S. (2004). Impact of executive function deficits and attention deficit/hyperactivity disorder (ADHD) on academic outcomes in children. *Journal of Consulting and Clinical Psychology*, *72*, 757–766. doi:10.1037/0022-006X.72.5.757

Bierman, K. L., Coie, J., Dodge, K., Greenberg, M., Lochman, J., McMohan, R., & Pinderhughes, E. (2013). School outcomes of aggressive-disruptive children: Prediction from kindergarten risk factors and impact of the fast track prevention program. *Aggressive Behavior*, *39*(2), 114–130. doi:10.1002/ab.21467

Bierman, K. L., Nix, R. L., Greenberg, M. T., Blair, C., & Domitrovich, C. E. (2008). Executive functions and school readiness intervention: Impact, moderation, and mediation in the Head Start REDI program. *Development and Psychopathology*, *20*, 821–843. doi:10.1017/S0954579408000394

Birch, S., & Ladd, G. (1997). The teacher-child relationship and children's early school adjustment. *Journal of School Psychology*, *35*, 61–79. doi:10.1016/S0022-4405(96)00029-5

Bird, H. R., Gould, M. S., & Staghezza, B. (1992). Aggregating data from multiple informants in child psychiatry epidemiological research. *Journal of the American Academy of Child & Adolescent Psychiatry*, *31*(1), 78–85. doi:10.1097/00004583-199201000-00012

Blair, C. (2002). School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *American Psychologist*, *57*, 111–127. doi:10.1037/0003-066X.57.2.111

Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: The promotion of self-regulation as a means of preventing school failure. *Development and Psychopathology*, *20*, 899–911. doi:10.1017/S0954579408000436

Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development*, *78*, 647–663. doi:10.1111/cdev.2007.78.issue-2

Bodrova, E., & Leong, D. J. (2007). *Tools of the mind: The Vygotskian approach to early childhood education* (2nd ed.). New York, NY: Merrill/Prentice Hall.

Bowling, A. (1997). *Research methods in health*. Buckingham, England: Open University Press.

Bracken, B. A. (2002). *Bracken School Readiness Assessment*. San Antonio, TX: The Psychological Corporation.

Brock, L., Rimm-Kaufman, S., Nathanson, L., & Grimm, K. (2009). The contributions of "hot" and "cool" executive function to children's academic achievement, learning-related behaviors, and engagement in kindergarten. *Early Childhood Research Quarterly*, *24*, 337–349. doi:10.1016/j.ecresq.2009.06.001

Bub, K. L., McCartney, K., & Willett, J. B. (2007). Behavior problem trajectories and first-grade cognitive ability and achievement skills: A latent growth curve analysis. *Journal of Educational Psychology*, *99*, 653–670. doi:10.1037/0022-0663.99.3.653

Cameron, C. E., Brock, L. L., Murrah, W. M., Bell, L. H., Worzalla, S. L., Grissmer, D., & Morrison, F. J. (2012). Fine motor skills and executive function both contribute to kindergarten achievement. *Child Development*, *83*, 1229–1244. doi:10.1111/cdev.2012.83.issue-4

Coplan, R. J., Bullock, A., Archbell, K. A., & Bosacki, S. (2015). Preschool teachers' attitudes, beliefs, and emotional reactions to young children's peer group behaviors. *Early Childhood Research Quarterly*, *30*, 117–127. doi:10.1016/j.ecresq.2014.09.005

Curby, T. W., Rimm-Kaufman, S. E., & Ponitz, C. C. (2009). Teacher–child interactions and children's achievement trajectories across kindergarten and first grade. *Journal of Educational Psychology*, *101*(4), 912–925. doi:10.1037/a0016647

Davis, H. A. (2003). Conceptualizing the role and influence of student-teacher relationships on children's social and cognitive development. *Educational Psychologist*, *38*, 207–234. doi:10.1207/S15326985EP3804_2

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., … Japel, C. (2007). School readiness and later achievement. *Developmental Psychology*, *43*, 1428–1446. doi:10.1037/0012-1649.43.6.1428

Elo, A.-L., Leppänen, A., & Jahkola, A. (2003). Validity of a single-item measure of stress symptoms. *Scandinavian Journal of Work, Environment & Health*, *29*, 444–451. doi:10.5271/sjweh.752

Espy, K. A., McDiarmid, M. M., Cwik, M. F., Stalets, M. M., Hamby, A., & Senn, T. E. (2004). The contribution of executive functions to emergent mathematic skills in preschool children. *Developmental Neuropsychology*, *26*(1), 465–486. doi:10.1207/s15326942dn2601_6

Fabiano, G. A., Pelham, W. E. Jr., Waschbusch, D. A., Gnagy, E. M., Lahey, B. B., Chronis, A. M., … Burrows-MacLean, L. (2006). A practical measure of impairment: Psychometric properties of the Impairment Rating Scale in samples of children with attention deficit hyperactivity disorder and two school-based samples. *Journal of Clinical Child & Adolescent Psychology*, *35*, 369–385. doi:10.1207/s15374424jccp3503_3

Fuhs, M. W., Nesbitt, K. T., Farran, D. C., & Dong, N. (2014). Longitudinal associations between executive functioning and academic skills across content areas. *Developmental Psychology*, *50*, 1698–1709. doi:10.1037/a0036633

Gioia, G. A., Espy, K. A., & Isquith, P. K. (2003). *Behavior Rating Inventory of Executive Function, Preschool Version (BRIEF-P)*. Lutz, FL: Psychological Assessment Resources.

Graziano, P. A., Slavec, J., Hart, K., Garcia, A., & Pelham, W. E. Jr., (2014). Improving school readiness in preschoolers with behavior problems: Results from a summer treatment program. *Journal of Psychopathology and Behavioral Assessment*, *36*(4), 555–569. doi:10.1007/s10862-014-9418-1

Graziano, P. A., Slavec, J., Ros, R., Garb, L., Hart, K., & Garcia, A. (2015). Self-regulation assessment among preschoolers with externalizing behavior problems. *Psychological Assessment*. Advance online publication. doi:10.1037/pas0000113

Greenberg, M. T., Kusche, C. A., Cook, E. T., & Quamma, J. P. (1995). Promoting emotional competence in school-aged children: The effects of the PATHS curriculum. *Development and Psychopathology*, *7*, 117–136. doi:10.1017/S0954579400006374

Grimm, K. J., Steele, J. S., Mashburn, A. J., Burchinal, M., & Pianta, R. C. (2010). Early behavioral associations of achievement trajectories. *Developmental Psychology*, *46*, 976–983. doi:10.1037/a0018878

Gunter, P. L., & Coutinho, M. J. (1997). Negative reinforcement in classrooms: What we're beginning to learn. *Teacher Education and Special Education*, *20*, 249–264. doi:10.1177/088840649702000306

Hamre, B. K., & Pianta, R. C. (2001). Early teacher–child relationships and the trajectory of children's school outcomes through eighth grade. *Child Development*, *72*, 625–638. doi:10.1111/cdev.2001.72.issue-2

Hamre, B. K., & Pianta, R. C. (2005). Can instructional and emotional support in the first-grade classroom make a difference for children at risk of school failure? *Child Development*, *76*, 949–967. doi:10.1111/cdev.2005.76.issue-5

Hart, K., & Graziano, P. (2013, November). *Assessing kindergarten readiness: The development of a new tool to assess preschoolers' behavioral, social-emotional, and academic functioning in the transition to kindergarten*. Paper presented at the meeting of Association for Behavioral and Cognitive Therapies, Nashville, TN.

Hayes, A. F., & Matthes, J. (2009). Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behavior Research Methods*, *41*, 924–936. doi:10.3758/BRM.41.3.924

Hughes, C., Dunn, J., & White, A. (1998). Trick or treat? Uneven understanding of mind and emotion and executive dysfunction in "hard-to-manage" preschoolers. *Journal of Child Psychology and Psychiatry*, *39*, 981–994. doi:10.1111/jcpp.1998.39.issue-7

Hughes, J. N., Cavell, T. A., & Wilson, V. (2001). Further support for the significance of the quality of teacher–child relationships. *Journal of School Psychology*, *29*, 281–301.

Isquith, P. K., Crawford, J. S., Espy, K. A., & Gioia, G. A. (2005). Assessment of executive function in preschool-aged children. *Mental Retardation and Developmental Disabilities Research Reviews*, *11*, 209–215. doi:10.1002/(ISSN)1098-2779

Janus, M., & Offord, D. R. (2007). Development and psychometric properties of the Early Development Instrument (EDI): A measure of children's school readiness. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement*, *39*(1), 1–22. doi:10.1037/cjbs2007001

Kohler, A. D., & Lazarin, J. (2007). *Hispanic education in the United States* (Statistical Brief No. 8). Washington, DC: National Council of La Raza.

La Paro, K., & Pianta, R. (2000). Predicting children's competence in the early school years: A meta-analytic review. *Review of Educational Research*, *70*, 443–484. doi:10.3102/00346543070004443

Lee, P., & Bierman, K. L. (2015). Classroom and teacher support in kindergarten: Associations with the behavioral and academic adjustment of low-income students. *Merrill-Palmer Quarterly*, *61*(3), 383–411. doi:10.13110/merrpalmquar1982.61.3.0383

Lynch, M., & Cicchetti, D. (1997). Children's relationships with adults and peers: An examination of elementary and junior high school students. *Journal of School Psychology*, *35*, 81–99. doi:10.1016/S0022-4405(96)00031-3

Mahone, E. M., & Hoffman, J. (2007). Behavior ratings of executive function among preschoolers with ADHD. *The Clinical Neuropsychologist*, *21*, 569–586. doi:10.1080/13854040600762724

Mariani, M. A., & Barkley, R. A. (1997). Neuropsychological and academic functioning in preschool boys with attention deficit hyperactivity disorder. *Developmental Neuropsychology*, *13*, 111–129. doi:10.1080/87565649709540671

Mashburn, A., & Pianta, R. (2006). Social relationships and school readiness. *Early Education & Development*, *17*, 151–176. doi:10.1207/s15566935eed1701_7

Mashburn, A. J., Pianta, R. C., Hamre, B. K., Downer, J. T., Barbarin, O., Bryant, D., … Howes, C. (2008). Measures of classroom quality in pre-kindergarten and children's development of academic, language, and social skills. *Child Development*, *79*(3), 732–749. doi:10.1111/j.1467-8624.2008.01154.x

Masten, A., Roisman, G., Long, J., Burt, K., Obradović, J., Riley, J., … Tellegen, A. (2005). Developmental cascades: Linking academic achievement and externalizing and internalizing symptoms over 20 years. *Developmental Psychology*, *41*, 733–746. doi:10.1037/0012-1649.41.5.733

Mather, N., & Woodcock, R. W. (2001). *Woodcock-Johnson III Tests of Cognitive Abilities*. Itasca, IL: Riverside.

Mazzocco, M., & Kover, S. (2007). A longitudinal assessment of executive function skills and their association with math performance. *Child Neuropsychology*, *13*, 18–45. doi:10.1080/09297040600611346

McClelland, M., Cameron, C., Connor, C., Farris, C., Jewkes, A., & Morrison, F. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology*, *43*, 947–959. doi:10.1037/0012-1649.43.4.947

McEvoy, A., & Welker, R. (2000). Antisocial behavior, academic failure, and school climate: A critical review. *Journal of Emotional and Behavioral Disorders*, *8*(3), 130–140. doi:10.1177/106342660000800301

Metcalfe, L. A., Harvey, E. A., & Laws, H. B. (2013). The longitudinal relation between academic/cognitive skills and externalizing behavior problems in preschool children. *Journal of Educational Psychology*, *105*, 881–894. doi:10.1037/a0032624

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology*, *41*, 49–100. doi:10.1006/cogp.1999.0734

Morgan, A. B., & Lilienfeld, S. O. (2000). A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. *Clinical Psychology Review*, *20*, 113–136. doi:10.1016/S0272-7358(98)00096-8

Nayfeld, I., Fuccillo, J., & Greenfield, D. B. (2013). Executive functions in early learning: Extending the relationship between executive functions and school readiness to science. *Learning and Individual Differences*, *26*, 81–88. doi:10.1016/j.lindif.2013.04.011

Nesbitt, K., Baker-Ward, L., & Willoughby, M. (2013). Executive function mediates socio-economic and racial differences in early academic achievement. *Early Childhood Research Quarterly*, *28*, 774–783. doi:10.1016/j.ecresq.2013.07.005

Neuenschwander, R., Röthlisberger, M., Cimeli, P., & Roebers, C. (2012). How do different aspects of self-regulation predict successful adaptation to school? *Journal of Experimental Child Psychology*, *113*, 353–371. doi:10.1016/j.jecp.2012.07.004

O'Connor, E. E., Dearing, E., & Collins, B. A. (2011). Teacher-child relationship and behavior problem trajectories in elementary school. *American Educational Research Journal*, *48*(1), 120–162. doi:10.3102/0002831210365008

Panter, J. E., & Bracken, B. A. (2009). Validity of the Bracken School Readiness Assessment for predicting first grade readiness. *Psychology in the Schools*, *46*, 397–409. doi:10.1002/pits.v46:5

Pennington, B., & Ozonoff, S. (1996). Executive functions and developmental psychopathology. *Journal of Child Psychology and Psychiatry*, *37*, 51–87. doi:10.1111/jcpp.1996.37.issue-1

Piacentini, J. C., Cohen, P., & Cohen, J. (1992). Combining discrepant diagnostic information from multiple sources: Are complex algorithms better than simple ones? *Journal of Abnormal Child Psychology*, *20*(1), 51–63. doi:10.1007/BF00927116

Pianta, R. C. (2001). *STRS: Student-Teacher Relationship Scale: Professional manual*. Odessa, FL: Psychological Assessment Resources.

Pianta, R. C., Steinberg, M. S., & Rollins, K. (1995). The first two years of school: Teacher-child relationships and deflections in children's classroom adjustment. *Development and Psychopathology*, *7*, 295–312. doi:10.1017/S0954579400006519

Pianta, R. C., & Stuhlman, M. W. (2004). Teacher-child relationships and children's success in the first years of school. *School Psychology Review*, *33*, 444–458.

Pianta, R., & Walsh, D. (1996). *High-risk children in schools: Constructing sustaining relationships*. New York, NY: Routledge.

Ponitz, C. E. C., McClelland, M. M., Jewkes, A. M., Connor, C. M., Farris, C. L., & Morrison, F. J. (2008). Touch your toes! Developing a direct measure of behavioral regulation in early childhood. *Early Childhood Research Quarterly*, *23*(2), 141–158. doi:10.1016/j.ecresq.2007.01.004

Ponitz, C. C., McClelland, M. M., Matthews, J. S., & Morrison, F. J. (2009). A structured observation of behavioral self-regulation and its contribution to kindergarten outcomes. *Developmental Psychology*, *45*, 605–619. doi:10.1037/a0015365

Raver, C. C., Jones, S. M., Li-Grining, C. P., Metzger, M., Champion, K. M., & Sardin, L. (2008). Improving preschool classroom processes: Preliminary findings from a randomized trial implemented in Head Start settings. *Early Childhood Research Quarterly*, *23*, 10–26. doi:10.1016/j.ecresq.2007.09.001

Resnick, M., Bearman, P., Blum, R., Bauman, K., Harris, K., Jones, J., … Udry, J. (1997). Protecting adolescents from harm: Findings from the National Longitudinal Study on Adolescent Health. *Journal of the American Medical Association*, *278*, 823–832. doi:10.1001/jama.1997.03550100049038

Reynolds, C. R., & Kamphaus, R. W. (2004). *Behavior Assessment System for Children-Second Edition (BASC-2)*. Circle Pines, MN: American Guidance Service.

Riggs, N. R., Jahromi, L. B., Razza, R. P., Dillworth-Bart, J. E., & Mueller, U. (2006). Executive function and the promotion of social–emotional competence. *Journal of Applied Developmental Psychology*, *27*, 300–309. doi:10.1016/j.appdev.2006.04.002

Rimm-Kaufman, S. E., & Pianta, R. C. (2000). An ecological perspective on the transition to kindergarten. *Journal of Applied Developmental Psychology*, *21*, 491–511. doi:10.1016/S0193-3973(00)00051-4

Rimm-Kaufman, S. E., Pianta, R. C., & Cox, M. J. (2000). Teachers' judgments of problems in the transition to kindergarten. *Early Childhood Research Quarterly*, *15*, 147–166. doi:10.1016/S0885-2006(00)00049-1

Roorda, D. L., Koomen, H. M., Spilt, J. L., & Oort, F. J. (2011). The influence of affective teacher–student relationships on students' school engagement and achievement a meta-analytic approach. *Review of Educational Research*, *81*(4), 493–529.

Schoemaker, K., Mulder, H., Deković, M., & Matthys, W. (2013). Executive functions in preschool children with externalizing behavior problems: A meta-analysis. *Journal of Abnormal Child Psychology*, *41*(3), 457–471. doi:10.1007/s10802-012-9684-x

Shaffer, D., Fisher, P., Lucas, C. P., Dulcan, M. K., & Schwab-Stone, M. E. (2000). NIMH Diagnostic Interview Schedule for Children, Version IV (NIMH DISCIV): Description, differences from previous versions, and reliability of some common diagnoses. *Journal of the American Academy of Child & Adolescent Psychiatry*, *39*, 28–38. doi:10.1097/00004583-200001000-00014

Silver, R. B., Measelle, J. R., Armstrong, J. M., & Essex, M. J. (2005). Trajectories of classroom externalizing behavior: Contributions of child characteristics, family characteristics, and the teacher-child relationship during the school transition. *Journal of School Psychology*, *43*, 39–60. doi:10.1016/j.jsp.2004.11.003

Skalická, V., Stenseng, F., & Wichstrøm, L. (2015). Reciprocal relations between student–teacher conflict, children's social skills and externalizing behavior. A three-wave longitudinal study from preschool to third grade. *International Journal of Behavioral Development*. Advance online publication. doi:10.1177/0165025415584187

Smith-Donald, R., Raver, C. C., Hayes, T., & Richardson, B. (2007). Preliminary construct and concurrent validity of the Preschool Self-Regulation Assessment (PSRA) for field-based research. *Early Childhood Research Quarterly*, *22*(2), 173–187. doi:10.1016/j.ecresq.2007.01.002

Snow, K. L. (2006). Measuring school readiness: Conceptual and practical considerations. *Early Education & Development*, *17*, 7–41. doi:10.1207/s15566935eed1701_2

Spilt, J. L., Hughes, J. N., Wu, J.-Y., & Kwok, O.-M. (2012). Dynamics of teacher–student relationships: Stability and change across elementary school and the influence on children's academic success. *Child Development*, *83*(4), 1180–1195. doi:10.1111/cdev.2012.83.issue-4

St Clair-Thompson, H. L., & Gathercole, S. E. (2006). Executive functions and achievements in school: Shifting, updating, inhibition, and working memory. *Quarterly Journal of Experimental Psychology*, *59*, 745–759. doi:10.1080/17470210500162854

Stevens, J., & Quittner, A. L. (1998). Factors influencing elementary school teachers' ratings of ADHD and ODD behaviors. *Journal of Clinical Child Psychology*, *27*(4), 406–414. doi:10.1207/s15374424jccp2704_4

Sutherland, K. S., Lewis-Palmer, T., Stichter, J., & Morgan, P. L. (2008). Examining the influence of teacher behavior and classroom context on the behavioral and academic outcomes for students with emotional or behavioral disorders. *Journal of Special Education*, *41*, 223–233. doi:10.1177/0022466907310372

Swearer, S. M., Espelage, D. L., Vaillancourt, T., & Hymel, S. (2010). What can be done about school bullying? Linking research to educational practice. *Educational Researcher*, *39*, 38–47. doi:10.3102/0013189X09357622

Toppelberg, C. O., & Collins, B. A. (2010). Language, culture, and adaptation in immigrant children. *Child and Adolescent Psychiatric Clinics of North America*, *19*, 697–717. doi:10.1016/j.chc.2010.07.003

Wechsler, D. (2012). *Wechsler Preschool and Primary Scale of Intelligence–Fourth Edition (WPPSI-IV) technical manual*. San Antonio, TX: The Psychological Corporation.

Willcutt, E. G., Doyle, A. E., Nigg, J. T., Faraone, S. V., & Pennington, B. F. (2005). Validity of the executive function theory of attention-deficit/hyperactivity disorder: A meta-analytic review. *Biological Psychiatry*, *57*(11), 1336–1346. doi:10.1016/j.biopsych.2005.02.006

Williford, A. P., Maier, M. F., Downer, J. T., Pianta, R. C., & Howes, C. (2013). Understanding how children's engagement and teachers' interactions combine to predict school readiness. *Journal of Applied Developmental Psychology*, *34*(6), 299–309. doi:10.1016/j.appdev.2013.05.002

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III Tests of Achievement*. Itasca,IL: Riverside.