



Does social–behavioral adjustment mediate the relation between executive function and academic readiness?



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ABSTRACT

Research shows that executive function and social–behavioral adjustment during the preschool years are both associated with the successful acquisition of academic readiness abilities. However, studies bringing these constructs together in one investigation are lacking. This study addresses this gap by testing the extent to which social and behavioral adjustment mediated the association between executive function and academic readiness. Sixty-nine 63–76 month old children, enrolled in the last semester of the preschool year, participated in the present study. Tasks were administered to measure executive function and preacademic abilities, and teachers rated preschoolers' social–behavioral adjustment. Hierarchical regression analyses revealed that social–behavioral adjustment was a significant mediator of the effect of executive function on academic readiness, even after controlling for maternal education and child verbal ability. These findings extend prior research and suggest that executive function contributes to early academic achievement by influencing preschoolers' opportunities to be engaged in optimal social learning activities.

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A large body of empirical literature emphasizes the importance of early academic readiness—namely the ability to perform basic academic tasks, such as counting and recognizing letters—for school achievement and adjustment during elementary years (Duncan et al., 2007; Hindman, Skibbe, Miller, & Zimmerman, 2010; Lonigan, 2006; Romano, Babchishin, Pagani, & Kohen, 2010). Indeed, in a meta-analytic study, involving 70 longitudinal studies, La Paro and Pianta (2000) concluded that academic and cognitive abilities in preschoolers predicted about 25% of the variance in academic and cognitive skills measured during the first and second grades. Thereby, identifying the contributors for early academic school readiness seems crucial for promoting future academic success.

Recently, research on school readiness has emphasized the importance of executive function for early math and literacy performance before school entry (Blair & Razza, 2007; Espy et al., 2004; Fitzpatrick, McKinnon, Blair, & Willoughby, 2014). However, less attention has been given to the processes by which executive capacities relate to academic school readiness. Interestingly, executive function has also been observed to predict early social and behavioral adjustment (Brophy, Taylor, & Hughes, 2002; Diamantopoulou, Rydell, Thorell, & Bohlin,

2007). Research has demonstrated that children who do not have appropriate executive function capacities are less able to control their impulsive behaviors and to regulate their emotions (Jahromi & Stifter, 2008), which compromises their engagement with the classroom activities and thereby their readiness to school (Raver, 2002). In fact, substantial research has documented that young children exhibiting challenging behaviors and peer problems within the classroom are more likely to be at risk for early academic difficulties (Arnold, 1997; Ladd, Birch, & Buhs, 1999; Ladd & Burgess, 2001; McWayne, Fantuzzo, & McDermott, 2004). Nevertheless, much of the research investigating academic readiness in preschoolers has been focused either on executive function or on social and behavioral development, and studies that bring these constructs together in one investigation are lacking. Furthermore, what is yet to be examined is whether social–behavioral adjustment is a potential mediator of the association between executive function and academic school readiness in preschoolers. The present study explored this issue, as it seems to hold promise for understanding processes underlying the contribution of executive function for early academic abilities.

1. Executive function and academic school readiness

Executive function is a collection of top-down processes that allow for conscious, goal-directed control of thoughts and actions (Diamond,

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2013; Zelazo & Carlson, 2012), including *working memory*, defined as the ability to maintain and manipulate information for short time periods; *set-shifting* or the ability to shift flexibly the focus of cognitive set and to adjust behavior accordingly; and *inhibitory control*, defined as the ability to inhibit an automatic, but non-optimal, response (Blair & Ursache, 2013). Recently, executive function has been observed to be associated with early academic abilities. Bull, Espy, Wiebe, Sheffield, and Nelson (2011) found significant predictive relationships between executive functioning capabilities and math readiness in preschoolers, even after controlling for child IQ, age, and maternal education. Nayfeld, Fuccillo, and Greenfield (2013) similarly concluded that greater executive function abilities were related to math skills, letter and word identification, and knowledge of story-and-print concepts, in 54–66-month old children. Moreover, Dilworth-Bart (2012) revealed that executive function mediated the association between home-environment quality and academic readiness in preschoolers, even after accounting for child verbal abilities, while other researchers (Clark, Pritchard, & Woodward, 2010) observed significant associations between executive function scores obtained at age 4 years and later academic achievements at 6 years. These findings suggest that executive function is central to academic readiness. Nevertheless, there has been little research integrating the study of executive function in preschoolers with the examination of other constructs also related to academic school readiness, with the exception of socioeconomic status and maternal education, children's verbal abilities and general intelligence (e.g., Dilworth-Bart, 2012; Espy et al., 2004; Fitzpatrick et al., 2014).

2. Social-behavioral adjustment as a meditational mechanism

Empirical findings suggest that children's social and behavioral development may be of particular interest for understanding individual differences in readiness to school. Indeed, in addition to executive function, mounting evidence has also documented the relationship between social-behavioral development and academic achievement and success during elementary years (e.g., Nigg, Quamma, Greenberg, & Kusche, 1999; Riggs, Blair, & Greenberg, 2003). Fewer studies, however, have examined this association during the preschool years. This is quite surprising given evidence of the constructive role of social competence and behavioral functioning, including internalizing and externalizing behaviors, in shaping adjustment. Indeed, both social and behavioral abilities are considered to be core developmental milestones of the preschool period (e.g., Bornstein, Hahn, & Haynes, 2010). This developmental phase is a time when children are becoming more able in regulating their emotions and behavior, as well as more competent in solving social problems, in cooperating with others, and in making friends (Denham et al., 2003; Sroufe, 1997). Although still scarce, the existing research has demonstrated a link between those social and behavioral skills and early academic achievement and success (Ladd et al., 1999; Ladd & Burgess, 2001; McWayne et al., 2004). For example, Palermo, Hanish, Martin, Fabes, and Reiser (2007) found that preschoolers' prosocial behaviors including the ability to manage conflicts and to cooperate with peers were positively correlated with academic readiness and with peer acceptance. In addition to the importance of social functioning for academic readiness, the authors have also reported that children's behavioral functioning, including their aggressive behaviors, was related to lower academic readiness and higher rates of peer rejection. Indeed, externalizing behavior problems—including symptoms of inattention, overactivity and oppositional behavior—have also been found to correlate with academic difficulties in literacy, language and mathematics in preschoolers (Arnold, 1997; Campbell, Shaw, & Gilliom, 2000; Friedman-Weieneth, Harvey, Youngwirth, & Goldstein, 2007; Lonigan et al., 1999). Moreover, research has documented the negative influence of internalizing behavior problems on pre-academic abilities (Bulotsky-Shearer, Fantuzzo, & McDermott, 2008). Indeed, in a recent study of Head Start children, Bulotsky-Shearer, Dominguez, and Bell

(2012) found that social withdrawal behaviors were associated with lower school readiness skills, in the areas of emergent literacy, language, and mathematics. In a longitudinal study, Bub, McCartney, and Willett (2007) concluded that young children with both internalizing and externalizing behavior problems, exhibited lower cognitive abilities and achievement scores in first grade.

Interestingly, a growing number of studies have also revealed that social-behavioral dysfunction—including symptoms of inattention, impulsivity, physical aggression, and peer problems—is similarly related to impairments in executive abilities (Diamantopoulou et al., 2007). Executive functioning, revealed in the capacity to suppress an inappropriate response in a given situation and to flexibly choose alternative responses, enables children to better regulate their emotions and behaviors, which are core abilities needed to form and maintain positive social relationships (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009), and thus to foster academic success and adjustment. In fact, it has been established that greater executive abilities are associated with fewer internalizing and externalizing problems, and overall social competence in young children (Cole, Usher, & Cargo, 1993; Eisenberg et al., 2000). For example, Jahromi and Stifter (2008) have documented that preschoolers with lower executive function capabilities showed poorer emotion regulation and were less able to control their impulsive behaviors. Similarly, Bierbman, Nix, Greenberg, Blair, and Domitrovich (2008) found that executive abilities—namely working memory, inhibitory control and attention shifting or flexibility—predicted socio-emotional competencies during the course of prekindergarten year. Brophy et al. (2002) compared “hard-to-manage” 4-year-old children with typically developing peers. The authors found that, compared to controls, the ‘hard-to-manage’ group showed marked deficits in inhibitory control and planning, more errors on executive function tasks, and difficulties following rules. A study by Valiente, Lemery-Chalfant, Swanson, and Reiser (2008) is also noteworthy. These investigators examined cognitive and social contributors of academic achievement in a sample of 7-to-12-year-old students. They found that the quality of teacher-child relationship, social competence and classroom participation partially mediated the concurrent relation between children's regulatory abilities—assessed in terms of effortful control or the ability to inhibited a dominant response, to plan, and detect errors—and changes in grade point averages from the beginning to the end of the school year. In another study from the same research team, the authors have found that social functioning—i.e., a composite variable consisting of the social competence and the behavior functioning scores—fully mediated the relation between effortful control at 73 months and academic achievement at 12 years (Valiente et al., 2011). Oberle and Reichl (2013), in a study with 4th and 5th grade early adolescents, also added to the literature, by showing that both executive function, assessed in terms of inhibitory control, and peer acceptance were significantly and positively related to math achievement. Furthermore, the authors also found that peer acceptance was significantly linked to inhibitory control, and acted as a mediator in the relation between inhibitory control and math achievement. These findings suggest that both cognitive and social and behavioral functioning are relevant for academic success, and that social and behavioral competencies might mediate the link between executive function and academic readiness.

Notwithstanding the aforementioned research, very few reports have examined the relations between *both* executive function and social-behavioral adjustment and academic achievement before school entry, and thus the question remains whether social-behavioral adjustment accounts for the relation between executive function and academic school readiness. It is possible that impairments in executive function, revealed in inadequate attentional and behavioral regulatory skills, may affect preschoolers' social and behavioral adaptation in the classroom, and thus the degree to which they benefit from their structured academic experiences with teachers and peers (Denham, 2006; Raver, 2002). Furthermore, there has been

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