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Do Infant Temperament Characteristics Predict Core Academic Abilities in Preschool-Aged Children?

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ABSTRACT

Examined relationships between temperament, measured via parent report at 4 months and structured laboratory observations at 12 months of age, and a school readiness battery administered at about 4 years of age (N = 31). Scores on the School Readiness Assessment of the Bracken Basic Concept Scale (BBCS) were related to infant Positive Affectivity/Surgency (PAS), with infants described as demonstrating higher levels of PAS at 4 months of age later demonstrating greater school readiness in the domains of color, letter, and number skills. Regulatory Capacity/Orienting (RCO) at 4 months also predicted color skills, with more regulated infants demonstrating superior pre-academic functioning in this area. Analyses involving laboratory observations of temperament provided additional information concerning the importance of infant Positive Affectivity/Surgency, predictive of letter skills and overall school-readiness scores later in childhood. Results are discussed in the context of implications for theory and research, as well as early education settings.

The concept of school readiness has become a significant social and political concern because of its strong contribution to children's adjustment and overall wellbeing later in life (NICHD, 2003). In 2002, a nationally representative survey of over 3,000 teachers provided support for this concern, in so far as 30% of kindergarten teachers identified at least half of the children in their class as lacking necessary academic skills and showing difficulty following directions and working as part of a group (Raver, 2002). Importantly, early school readiness predicts later academic success, suggesting continuity for children's functioning in this domain (Duncan et al., 2007). Entwisle and Alexander (1993) argued that schooling-entry and the transition into full-time education in first grade represent a "critical period" for children's academic development, wherein students showing limited success at the start continue to struggle, with few opportunities to change the trajectory. In response to these troubling reports, there has been a call for early intervention services that can alter the trajectory of academic performance in a meaningful way (e.g., Shonkoff & Phillips, 2000), and many teachers, parents, and researchers have begun to appreciate the importance of identifying risk and protective factors influential with respect to early academic functioning.

The National Education Goals Panel (NEGP), an executive branch of the federal government responsible for monitoring progress toward nationally mandated educational goals, has formulated a definition of school readiness that places emphasis on cognition and general knowledge as the essential components of school readiness (Mehaffie & Fraser, 2007). Although multiple factors may be reflected in whether or not a particular child presents as "ready" or "not ready" for school, a teacher survey indicated that skills including the ability to make comparisons, recognize numbers, and problem-solve are particularly critical for school success (Pavelchek, 2005), and represent the aspects of school readiness assessed in the current study.

Studies of developmental precursors of school readiness have generally considered cognitive skills, such as executive functions (e.g., working memory) (Fitzpatrick & Pagani, 2012; Monette, Bigras, & Guay, 2011; Welsh, Nix, Blair, Bierman, & Nelson, 2010). It is important to recognize, however, that the social-emotional domain is not orthogonal to the academic realm, but rather provides crucial input with respect to the development of cognitive capacities, and uniquely contributes to academic success (Duncan et al., 2007). That is, academic success, or lack thereof, is shaped by the child's ability to adapt to the school setting, the demands and expectations of her teachers and peers, as well as the challenges inherent in mastering new skills. This adaptation is in part a function of child temperament, with different reactive and regulatory attributes serving to either facilitate adjustment, or hinder children in the educational setting. Temperament attributes represent a particularly important set of early predictors for pre-academic skills, as this domain of individual differences comes online shortly after birth (some would argue prenatally; e.g. DiPietro, Hodgson, Costigan, & Johnson, 1996), and can be reliably measured via parent-report and behavioral observations in the beginning of the first year of life (Gartstein, Bridgett, & Low, 2012).

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Rothbart and Bates (2006) define temperament as "constitutionally based individual differences in reactivity and self-regulation, in the domains of affect, activity, and attention" (p. 2). Structurally, temperament in childhood has been defined in terms of three major domains (Gartstein & Rothbart, 2003; Putnam, Ellis, & Rothbart, 2001). The first domain is labeled Negative Emotionality (NE), which is similar to the Neuroticism factor identified in adult personality research and is often described as a child's general proneness to distress. In infancy, this domain includes the sub-constructs of fear, sadness, anger, and slow recovery from distress. Another domain of temperament, Positive Affectivity/Surgency (PAS), represents early manifestations of Extraversion and broadly relates to a child's sociability and capacity to experience positive emotions. In infants, this domain includes the expression of pleasure, particularly during intense activities, rapid approach to objects, positive anticipation, high activity level and social engagement. In infancy, the third domain of temperament is labeled Regulatory Capacity/Orienting (RCO), and consists of attributes such as persistence of orienting attention, soothability, cuddliness and enjoyment of low-intensity activities. These three overarching domains of temperament are generally thought of as working in tandem to shape a variety of developmental outcomes (Rothbart & Bates, 2006).

Rothbart and Hwang (2005) provide a valuable theoretical framework for considering these temperament dimensions in relation to competence and motivation in school settings. These authors argue that the reactive temperament dimensions are directly linked to motivation, governing the child's approach, withdrawal, and interest to both novel and familiar stimuli, and shaping their emotional responses when goals are blocked. Regulatory attributes are seen as capacities that can work in the service of different motivations, enabling persistence in the pursuit of difficult goals and attention to goal-relevant stimuli.

Of the three domains of temperament, regulation-related attributes have been most thoroughly explored with respect to school readiness (Belsky, Friedman, & Hsieh, 2001; Howse, Lange, Farran, & Boyles, 2003; McClelland et al., 2007; Newman, Noel, Chen, & Matsopoulos, 1998; Schoen & Nagle, 1994). For instance, McClelland et al. (2007) investigated relationships between behavioral regulation abilities (including attention, working memory, and inhibitory control) and early academic skills of preschoolers, with assessments conducted in the fall and spring of the pre-kindergarten year. Children's attention abilities in the pre-kindergarten year were predictive of reading and math achievement, with children who demonstrated superior behavioral regulation performing at higher levels on emergent literacy, math and vocabulary scores (McClelland et al., 2007). Belsky et al. (2001) also provided support for the importance of early attentional skills, viewed as the foundation of the regulatory domain of temperament (Rothbart & Bates, 2006), in predicting school readiness. Importantly, attentional persistence assessed at 15 months through play observations (focused attention on a single object), was predictive of children's knowledge of basic academic concepts at 36 months of age. Although the Belsky et al. (2001) findings were based on analyses of the NICHD Study of Early Child Care (N = 1,038) dataset, with enrollment/screening initiated within 48 hours after birth, temperament related predictors of school readiness were not available until 15 months of age. Thus, to our knowledge, the current sample is the first enabling temperament dimensions (including attention-based regulation) assessed early in the first year of life to be considered as predictors of later school readiness.

Negative emotionality has also been connected, both longitudinally and concurrently, to school readiness (e.g., Denham et al., 2012), with preschool negative emotionality/behavioral reactivity predicting lower levels of concurrent and kindergarten school success. Importantly, aspects of negative emotion have been shown to predict variance in academic skills not accounted for by attention measures. For instance, Coplan, Barber, and Lagacé-Séguin (1999) examined links between temperament and preschoolers' language and numeracy skills, demonstrating that 45 to 58-month-old children described by mothers as exhibiting greater attention spans and lower negative emotionality exhibited superior literacy and numeracy skills seven months later. Similarly, negative emotionality evident in the context of other traits associated with impulsivity (e.g., low attentional persistence) negatively contributed to letter knowledge and print concept skills in a cross-sectional study of preschool children (42- to 68-months-old) attending Head Start (Fuhs, Wyant, & Day, 2011).

To date, few studies have linked the positive approach tendencies associated with Surgency to school readiness, perhaps because early perspectives on temperament failed to consider positive affectivity as separate from negative emotionality (see Goldsmith et al., 1987), and/or due to the salience of negative emotions as a detrimental influence on classroom behavior. Conceptually, Rothbart and Hwang (2005) proposed a model in which tendencies to engage with the environment reflected in surgency promote an eagerness to learn. Consistent with this notion, Rudasill, Gallagher, and White (2010) found activity level at 4 years to be predictive of high academic performance in middle childhood. Also suggestive of such a relationship are longitudinal findings in which PAS in infancy was predictive of toddlers' effortful control (regulation-related temperament factor linked with executive functions; Rothbart & Bates, 2006), over and above prediction from infant RCO (Putnam, Gartstein, & Rothbart, 2006), and a study wherein aspects of motivation were associated with reading achievement in 5 to 8 year-old children (Howse et al., 2003).

1. The Present Study: Goals and Hypotheses

Although connections between temperament characteristics and school readiness have been examined in previous investigations, a number of unanswered questions remain. Importantly, infancy predictors of school readiness have not been included in prior research, which has also been limited in the scope of temperament assessment. Although a number of large-scale projects have been conducted to address school readiness, starting as early as the first year of life (e.g., NICHD Study of Early Child Care), temperament has not been measured early in infancy, and larger samples have been limited with respect to methodology, often relying on a single operationalization (e.g., observation or caregiver report), and largely neglecting positive affectivity/surgency. Since early intervention is thought to be a necessary part of preventing future academic problems (Raver, 2002), it is important to identify the contributing temperament characteristics at the earliest age possible, so that we can better prepare any children facing additional risk in terms of academic functioning. In addition, findings conferring specificity for prediction of risk with respect to certain domains of school readiness/basic skills, but not others, could be helpful in this context.

The first goal of the present study was to identify mother-reported infant temperament characteristics most closely tied to the examined domains of basic knowledge/skills: Colors, Letters, Numbers/Counting, Sizes, Comparisons, and Shapes, as well as overall school readiness. We anticipated significant associations between early temperament attributes and core pre-academic skills, with the three over-arching temperament factors (NE, PAS, and RCO) expected to make significant contributions to subsequent school readiness. Based on recent theory and the results of previous research in older children, high RCO, high PAS, and low NE in infancy were expected to predict superior school readiness at preschool age. We additionally addressed associations between observed indicators of temperament obtained in the laboratory when the children were 12 months of age, to determine consistency with the results obtained at 4 months via parent-report. Thus, manifestations of temperament observed early in the first year of life, and those gleaned later in infancy, were considered as separate predictors of school readiness skills, as temperament undergoes considerable development during this time (e.g., Gartstein & Rothbart, 2003: Gartstein et al., 2010). It was hypothesized that laboratory-based indicators of temperament and those obtained via parent-report earlier in the first year of life would demonstrate parallel patterns of associations with the school readiness outcomes.