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The role of maternal responsiveness and linguistic input in pre-academic skill development: A longitudinal analysis of pathways

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ABSTRACT

This prospective, longitudinal study examined the association between maternal responsiveness and linguistic input and children's pre-academic skill development. Further, we assessed the extent to which nascent cognitive and literacy abilities mediated the association between parenting dimensions and pre-academic skills. The sample consisted of 501 mother-child dyads recruited at birth. Maternal responsiveness and linguistic input were coded at 18 months during a shared picturebook reading task. Pre-academic skills were measured at age 4.5 using standardized tests of letter-word identification, reading comprehension, math applied problems, and receptive vocabulary. At age 3, cognitive and literacy mediators included inhibitory control, theory of mind, receptive language, and print recognition. Longitudinal path analyses revealed that both responsiveness and linguistic input made unique contributions to pre-academic outcomes, with linguistic input operating indirectly through cognitive and literacy abilities to a greater extent than responsiveness. Results suggest disparate mechanisms for these parenting dimensions in the facilitation of pre-academic skills.

1. Introduction

Academic achievement is a powerful predictor of psychosocial health and development across the lifespan. Underachievement in school not only has negative consequences for later economic and occupational attainment, but is also linked to a host of other problems such as higher rates of psychopathology, substance use, and teenage pregnancy (Fergusson, Woodward, & Horwood, 2000; Henry, Knight, & Thornberry, 2012; Masten et al., 2005). The roots of academic success are established early in life. Using six longitudinal data sets, Duncan et al. (2007) showed that academic skills at school entry (i.e., reading, verbal ability, and math) were stronger predictors of later academic outcomes compared to socio-emotional competence and attention skills. Thus, promoting early academic skill development is critical to foster positive outcomes and attenuate the risk of difficulties in many domains of functioning. The purpose of the current study was to examine the extent to which mothers' responsive behavior and linguistic input at 18 months independently predicted children's pre-academic skills in language (receptive vocabulary), reading (word reading and comprehension) and mathematics (problem solving) at age 4.5. Further, we investigated how emerging cognitive and literacy abilities at age 3—inhibitory control, theory of mind, print recognition, and receptive language – provided a mechanism linking mothers' responsiveness and linguistic input to children's pre-academic skills.

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1.1. Parenting and pre-academic skill development

From a Vygotskian perspective, children's progression toward autonomous and self-directed learning and problem-solving relies on early parental scaffolding that is both responsive and cognitively stimulating (Vygotsky, 1978). The cognitive dimension involves the provision of concrete strategies, alternative perspectives, suggestions for stepwise task completion, and basic information relevant to the given activity. This dimension is strongly linguistically-mediated, and has been shown to promote both verbal and non-verbal cognitive skills in the preschool period (Hubbs-Tait, Culp, Culp, & Miller, 2002; Landry, Smith, Swank, & Miller-Loncar, 2000; Smith, Landry, & Swank, 2000). The responsiveness dimension (frequently termed 'sensitivity' in the extant literature) involves cultivating a warm interactional style, offering praise and encouragement, promoting autonomy, and being attuned to the needs of the child. For instance, Pianta and Harbers (1996) showed that mothers who provide encouragement, warmth, emotional support, and respect for their child's autonomy at school entry have children with better academic achievement over the first few years of school. Similarly, Connell and Prinz (2002) showed that responsive parenting (goal-corrected behavior, parental control, and affective mutuality) predicts teacher-reported readiness skills, social skills, and receptive communication (also see Hirsh-Pasek & Burchinal, 2006; Molfese, Modglin, & Molfese, 2003; Poe, Burchinal, & Roberts, 2004; Tamis LeMonda, Bornstein, & Baumwell, 2001). Thus, while maternal responsiveness and linguistic input underscore distinct behaviors, both have been linked to pre-academic skill development.

Less is known about the relative influence of responsiveness and linguistic input on pre-academic skill development. Indeed, there is reason to suspect that these parental behaviors may act on child outcomes in different ways, or via disparate mechanisms. This is consistent with growing evidence which suggests that socialization is not a general process, but a collection of distinct processes that bear upon specific domains of functioning (Smetana, 2017). In this "domains" approach, parenting can be differentiated on the basis of discrete sets of behaviors that demonstrate specificity with respect to child outcomes (Davidov, 2013; Grusec & Davidov, 2010). For instance, while some studies have shown independent contributions of both cognitive stimulation and parental responsiveness to early academic functioning (Bradley, Corwyn, Burchinal, McAdoo, & Garcia Coll, 2001), others have shown stronger links for certain dimensions, such as parental nurturance (Merlo, Bowman, & Barnett, 2007). Leerkes, Blankson, O'Brien, Calkins, and Marcovitch (2011) showed that maternal emotional support (interest, encouragement, and praise), but not cognitive support, during problem-solving tasks predicted gains in pre-academic skills from age 3 to 4. The quality of the home learning environment, including availability and engagement with learning materials, also predicted pre-academic skill development.

More recently, Merz et al. (2015) demonstrated that parental responsiveness was positively associated with concurrent language ability at 2–4 years, as well as growth in literacy, math, and emotion knowledge over a one-year period. In addition, while the *quantity* of parental language input was not related to any child outcome, inferential language *quality* was positively associated with concurrent emotion knowledge, and marginally associated with concurrent language ability. Merz et al. (2015) suggested that, while literal discourse plays an important role in language and literacy development, inferential discourse may additionally encourage the development of higher-level reasoning skills, such as understanding hypotheticals, decontextualized knowledge, and abstract concepts (see Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010; Rowe, 2012; van Kleeck, 2008). To this end, complex linguistic input that entails both literal and inferential discourse may support both core literacy abilities and higher-level cognitive skills. However, given the lack of direct effect of parental inferential language on math and literacy skills observed by Merz and colleagues, it was suggested that such effects may operate indirectly through intermediary cognitive and linguistic abilities. In line with this proposal, the current study examined a subset of interceding cognitive and literacy skills that may be couriers of these maternal inputs.

In the current study, we assessed maternal responsiveness and linguistic input at 18 months. We focused on this period since the first two years of life are a period of rapid postnatal brain maturation – not only does the brain grow to approximately 80% of the adult size within the first two years of life (Lenroot & Giedd, 2006), but brain volume doubles in the first year, with 15% additional growth in the second year (Knickmeyer et al., 2008). During this period, the brain is particularly sensitive to environmental influence, including linguistic input from caregivers, maternal responsiveness, and other factors such as early adversity (see Bick & Nelson, 2016; Curley & Champagne, 2016; Werker & Hensch, 2015; Zeanah, Gunnar, McCall, Kreppner, & Fox, 2011). Moreover, we examined the relation between both maternal responsiveness and linguistic input on pre-academic skills *simultaneously*, statistically controlling for the covariance between these parenting dimensions. This enabled us to test the independent contribution of each dimension to children's pre-academic skills, as well as unique pathways through emerging cognitive and literacy abilities.

1.2. Cognitive and literacy abilities as predictors of pre-academic skill development

Developmental psychobiological models posit that children's cognitive abilities provide a proximal mechanism through which social-contextual influences support early learning, including the acquisition and maturation of specific academic skills (Blair & Raver, 2015). A host of cognitive abilities have been identified in the extant literature that may be relevant for children's achievement. In selecting abilities that link early maternal behaviors with later pre-academic functioning, we focused on four cognitive/literacy abilities that have garnered significant support as predictors of a wide range of learning outcomes. The first ability is *inhibitory control* (IC), which is a facet of executive functioning that reflects the ability to inhibit prepotent thoughts or actions in favor of less salient responses, usually during goal-directed activities. Theoretically, children with higher IC should be able to more effectively attend to relevant information and inhibit irrelevant information whilst undertaking academic tasks, especially those with superfluous or distracting details. IC may also aid in behavioral regulation that enables successful engagement with academic material. Consistent with this proposal, IC has repeatedly been found to predict early academic skills using an array of assessment methods (Allan & Lonigan, 2011; Bull & Scerif, 2001; Espy et al., 2004; Swanson, Jerman, & Zheng, 2008; Valiente, Lemery-Chalfant,

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