

Parenting, Attachment and Child Outcomes: Self-Regulation as a Developmental Mechanism

by

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Abstract

Using data from *The National Institute of Child Health and Human Development (NICHD), Study of Early Child Care and Youth Development (SECCYD)*, I conducted two distinct but related studies. In the first study, the associations between maternal sensitivity and enrichment behaviors in infancy and two domains of self-regulation, executive functioning (EF) and effortful control (EC) in preschool were examined for children who were securely and insecurely attached. Maternal sensitivity and enrichment were measured at 15 months using a combination of observation and maternal report. Attachment behavior was also coded when children were 15 months during a laboratory observation session. Executive functioning, indexed by attention focusing and memory, was measured at 54 months using a combination of observation and maternal report. Finally, effortful control, indexed by two indicators of impulse control, was measured at 54 months using maternal report. Structural Equation modeling and multi-group analyses indicated that enrichment behaviors were predictive of EF and EC for secure children while sensitivity was predictive of EC for insecure children. Findings illustrate differences in the influences of early parenting on the development of self-regulation skills for children based on attachment security.

The second study examined EF and EC in preschool as potential mediators of the effects of maternal sensitivity and enrichment in infancy on academic achievement and behavior problems in 3rd grade. Attachment security at 15 months was again examined as a moderator of the mediated or indirect pathways from early parenting to later child outcomes. Academic

achievement in the 3rd grade was measured using direct assessments of verbal and mathematics skills and total behavior problems were measured using mother report. Findings illustrate that EF and EC serve as mechanisms through which early parenting predicts later developmental outcomes and that these indirect or mediated pathways differ based on attachment security. Specifically, while both secure and insecure children benefit from sensitivity through EF, effects of enrichment differ across groups. That is, for secure children enrichment predicted academic achievement through EF skills and behavior problems through EF and EC skills. Only one pathway, enrichment to behavior problems through EF, emerged for insecure children.

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List of Abbreviations

SR	Self Regulation
EF	Executive Functioning
EC	Effortful Control

Parenting, Attachment, and Self-Regulation: An investigation of differential pathways of development.

Self-regulation (SR) has been identified as one of the single most important factors in understanding child development (Posner & Rothbart, 2000). In fact, Fonagy and Target (2008) describe the ability to self-regulate as “the key mediator between genetic predisposition, early experience and adult functioning” (p. 307). These skills typically develop rapidly between ages two and five (Karreman, van Tuijl, Aken, & Dekovic, 2006), with environmental and caregiving experiences being especially critical influences (Volling, Blandon, & Kolak, 2006). SR becomes particularly important as children enter preschool, because for the first time they are expected to monitor and control their attention and behaviors without direct adult guidance (Sroufe, Egeland, Carlson, & Collins, 2005). Given the role of SR in later child well-being, interest in this topic has grown substantially in recent years. However, the majority of studies have focused on a single construct of SR, overlooking the potentially unique nature of cognitive and behavioral components. Further, few studies have examined developmental pathways linking early experiences with a primary caregiver to specific aspects of SR (Lan, Legare, Pointz, Li, & Morrison, 2011). By examining the influences of early parenting and the attachment bond in infancy on the development of cognitive (executive functioning (EF)) and behavioral (effortful control (EC)) domains of SR, the current study contributes to our understanding of two potentially distinct early developmental pathways to self-regulation in preschool.

Parenting has been identified as a powerful predictor of child self-regulation (Karraman et al., 2006; Landry, Smith, & Swank, 2003; Oxford & Lee, 2011). Further, different domains of parenting may have a unique influences on child developmental outcomes (Carlo, McGinley, Hayes, Batenhorst, & Wilkenson, 2007; George, Cummings, & Davies, 2010; Karraman et al.,

2006; Mize & Pettit, 1997). However, few studies have examined multiple domains of parenting simultaneously, instead focusing on global constructs of “quality” (Carlo et al., 2007; Mize & Pettit, 1997). The attachment relationship has also been shown to influence the development of SR skills (Bauminger & Kimhi-Kind, 2012; Grossman et al., 1999; Meins, 1997; Kochanska & Kim, 2013; Sroufe et al., 2005). Although a fair amount of research suggests different developmental outcomes for secure and insecure children (McElwain, Cox, Burchinal, & Macfie, 2003), relatively few studies have explored whether the pathways from early maternal sensitivity and enrichment to EF and EC differ between these groups. To address these gaps and to expand our understanding of how EF and EC might develop, we examined whether maternal sensitivity and parenting enrichment at 15 months differentially predict EF and EC at 54 months. The second major goal of this study was to identify potential differences in the influences of each domain of parenting on EF and EC for securely versus insecurely attached children.

Theoretical Frameworks

The current study was guided by Developmental Psychopathology and Attachment Theory. Developmental Psychopathology focuses on potential mechanisms and pathways to understand how children develop. This framework is particularly useful for this study because it allows for the examination of behaviors and skills along on a continuum ranging from normal to pathological (Cicchetti & Cohen, 2006; Cicchetti & Dawson, 2002). Importantly, Developmental Psychopathology takes into consideration a range of contextual factors and processes, including proximal or child-centered (e.g., attachment behaviors) and distal or contextual (i.e., maternal sensitivity and enrichment). Finally, Developmental Psychopathology recognizes that there can be multiple pathways to a single outcome, a principal referred to as equifinality (Cicchetti & Blender, 2004). This principal is a central tenant of the current study and provides an essential

framework for understanding developmental mechanisms that may come into play for a given outcome.

The second framework used in this study was Attachment Theory. Theorists argue that infants engage in organized patterns of proximity-seeking behaviors to promote safety and development (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969; 1973). These patterns are directly associated with early experience of caregiver sensitivity and responsiveness and serve as the “blueprint” for emerging mental representations of the world, the caregiver and the self, commonly referred to as the internal working model (Ainsworth et al., 1978; Raikes & Thompson, 2008). Children who are classified as securely attached possess confidence that the attachment figure will be available if needed (Ainsworth et al., 1978; Bowlby, 1973) and are more likely to use their caregiver as a secure base to explore and learn from their environments (Bowlby, 1973; Sroufe, 2005; van der Lippe, Eilersten, Hartman, & Killen, 2010; Vaughn et al., 2007). Through this exploration, infants and children gain experiences and skills that will advance self-regulatory abilities (Shaver & Mikulincer, 2010). On the other hand, children who are insecurely attached appear to be preoccupied with ensuring caregiver availability and often organize their behaviors in ways that inhibit exploration (Ainsworth et al., 1978; Goldberg, 2000; Mains, 1997; Sroufe et al., 2005). These behaviors include fixating on the caregiver, suppressing affect to increase the likelihood of responsivity, or some combination of both (van der Lippe et al., 2010). Because children who are not able or willing to explore miss out on the opportunity to learn from their environments, it stands to reason that their SR skill development may suffer. Thus, a consideration of SR in the context of Attachment Theory provides a valuable lens through which we can understand how early parenting and the attachment relationship may be related to the emergence of these essential skills in secure and insecure children.

Self-Regulation

Self-regulation has been defined broadly as the ability to monitor and control cognitions and behaviors (Bernier et al., 2012; Jahromi & Stifter, 2008; Raffaelli, Crockett & Shen, 2005; Robson, 2010; 2012). Mary Rothbart, one of the predominant scholars in the field, considers SR as the ability to inhibit a dominant response in favor of some subdominant response and engage in planning (Kochanska & Kim, 2013; Rothbart & Bates, 1998; 2006). Others have described SR as the ability to manage behaviors, cognitions, and emotions in an adaptive manner across social and physical contexts (Volling, McElwain, Notaro, & Herrera, 2002). Still others conceptualize SR as the ability to comply with requests, begin and end activities based on situational demands, modulate verbal and motor acts, and act in a socially appropriate manner without external monitoring (Boyer, 2009; Kopp, 1982). The inclusion of emotion-regulation, or the ability to regulate affective states, is also common in global definitions of self-regulation (Jahromi & Stifer, 2008; Raffaelli et al., 2005).

Although many studies utilize Rothbart's conceptualization of SR, commonly termed effortful control (Fox & Calkins, 2003; Kochanska, Philbert, & Barry, 2009; Posner & Rothbart, 1998), others have taken the stance that cognitive functions and behavioral control are highly related but separate domains of a greater self-regulatory process (McClelland & Morrison, 2003). For example, Raver and colleagues (2011) differentiate cognitive tasks associated with self-regulation (e.g., attention focusing, concentration, planning, and working memory), referred to as executive functioning (EF), from behavioral tasks (e.g., impulse-control, resisting temptation), referred to as self-control or effortful control (EC). Studies have shown that with the maturation of attention skills, the ability to control behavioral responses across contexts improves as well (Rothbart & Bates, 1998; Rothbart & Posner, 2005), further supporting the notion that these are

distinct but related domains of development. In an attempt to gain a better understanding of the nature of SR and to identify whether distinct developmental pathways from early experience (i.e., maternal sensitivity and enrichment) to different domains of SR exist, we examined EF and EC as separate but related latent constructs each comprised of multiple indicators.

Executive functioning. Executive functioning describes a specific set of self-regulatory skills that include the ability to direct and sustain attention, to plan, to focus, to work towards goals and successfully achieve them, and to engage in activities that require working towards a common social goal (Duckworth, 2009; Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). Others have defined EF as a set of “interrelated cognitive abilities that are required when one must intentionally or deliberately hold information in mind, manage and integrate information, and resolve conflict or competition between stimulus representations and response options” (Raver et al., 2011, p. 363). EF is said to be rooted in the frontal lobe and involves a top-down process in which a child organizes knowledge and higher-order cognitions, including planning, problem solving and other goal-directed processes (Carlson; 2005; Miyake et al., 2000; Raver et al., 2011; Willoughby et al., 2011). Other terms that have been used to describe EF include mastery skills, executive attention, learning-related regulation, and self-regulated learning skills (Hole & Crozier, 2007; Jahromi & Stifer, 2008; Lipsey, Wilson, & Farran, 2010; McClelland & Morrison, 2003). Studies have shown that EF typically emerges and advances rapidly between the ages 3 and 6 (Raffaelli, Crockett, & Shen, 2005) and is related to a wide-range of developmental outcomes (Miyake et al., 2000; Raver et al., 2011; Volling et al., 2006).

Effortful control. Effortful control is defined as the ability to control impulses or to suppress a desired response in favor of an acceptable response in accordance with social expectations (Blair & Razza, 2007; Kochanska et al., 2009; Kopp, 1982; Raver et al., 2011;

Rothbart & Ahandi, 1994; Rothbart & Bates, 1998). Others have conceptualized EC as the ability to modulate reactions to social stimuli (Calkins, 2004; McClelland & Cameron, 2011). These skills are commonly used as an indicator of the internalization of social norms and expectations in small children. Whereas EF is thought of as a top-down process that involves the pre-frontal cortex, EC is often viewed as a bottom-up system involving the limbic system wherein the child regulates behaviors through inhibition and management of responses (Calkins & Hill, 2007; Raver et al., 2011; Rothbart & Bates, 1998; Willoughby et al., 2011). Because EC often involves frustrating situations, it has been described as “hot regulation,” as children must control impulses in emotionally arousing or demanding situations (Metcalf & Mischel, 1999; Willoughby et al., 2011).

Although there is evidence to support that both EF and EC matter for social and behavioral outcomes in early childhood (Raver et al., 2011; Willoughby et al., 2011), few studies have examined the etiology of these skills concurrently. Therefore, our understanding of the developmental processes associated with the emergence of multiple aspects of self-regulation in early childhood is limited. With separate neurological pathways indicated for EF and EC, examining them independently but simultaneously may provide useful insight into how these regulatory skills develop. Therefore, the first major purpose of the current study was to examine how maternal sensitivity, parenting enrichment, and child attachment behaviors may differentially influence the development of EF and EC in preschool.

Parenting

Because parents often provide the first source of socialization and are largely responsible for young children’s environments, parenting styles and behaviors have a considerable influence on the outcomes of children across infancy, toddlerhood, and preschool (Carr & Pike, 2012;

Crossley & Buckner, 2012; Hustedt & Raver, 2002; Mills-Koonce et al., 2008). Despite widely established evidence that parenting is multifaceted, encompassing an array of styles and behaviors, it is common for scholars to use a single construct described as “quality” or to focus on only one aspect of parenting at a time (e.g., sensitivity or cognitive stimulation) when examining influences on child development (Mize & Pettit, 1997; Whipple, Bernier, & Mageau, 2010). However, not all parenting is created equally and little is known about how specific aspects of parenting, including maternal sensitivity and parenting enrichment, may differentially predict children’s EF and EC skill development.

Maternal sensitivity. Sensitivity is generally defined as the level with which a parent is in tune with the needs of his/her child. Others have defined sensitivity in terms of the level of warmth, reinforcement (physical or verbal), or openness to a child’s requests and feelings (Hirsh-Pasek & Burchinal, 2006). For the current study, maternal sensitivity was defined by high levels of responsiveness and positive regard, as well as low levels of intrusiveness. In general, a sensitive parent can gauge what the child needs in a timely manner and will respond accordingly (Combs-Orme et al., 2003). Unlike other behaviors that are usually domain specific, sensitivity often transcends contexts, applying to many things that parents do, including feeding, clothing, monitoring, protecting, and providing physical stimulation (Combs-Orme et al., 2003). Studies have shown that children who experience positive caregiving during early childhood have improved self-regulation skills (Keller, 2008; Volling et al., 2002), compared to children from less supportive homes. Using a sample of 106 mothers and six-year-old children, von der Lippe and colleagues (2010) found that maternal sensitivity (along with attachment and enrichment) were related to SR skills (specifically a single composite of working memory and inhibitory control). Further, exposure to intrusive, harsh, and inconsistent parenting predisposes children to

poorer attention focusing and impulse control, interfering with the development of autonomous self-regulation and increasing their reliance on external regulators (Colman, Hardy, Albert, Rafaelli, & Crockett, 2006; Gustafson, Cox, & Blair, 2012; Karreman et al., 2006; Volling, Bandon, & Kolak, 2006).

Enrichment. Whereas maternal sensitivity applies to an overarching, trait-like descriptor of mother-child relationships, enrichment behaviors (also referred to as cognitive stimulation) are far less general and have the express purpose of stimulating cognitive growth and development by scaffolding the child to acquire an advanced skill set (Carr & Pike, 2012). In the current study, parenting enrichment was defined as the level of cognitive stimulation provided to the child. Examples of enrichment behaviors include providing a child with a developmentally appropriate and stimulating toy or reading with a child. These behaviors are argued to be especially impactful during infancy when the brain is rapidly developing (Landry, Smith, & Swank, 2003). Studies have shown that parents who engage in behaviors such as encouraging focus on certain objects, providing positive feedback for children when focusing on tasks, or waiting to provide assistance until a child absolutely needs it, are more likely to have children with higher cognitive functioning in toddlerhood and preschool (Carr & Pike; 2012; Kiernan & Mensah, 2011). For example, a recent longitudinal study that followed 10,000 children from birth to preschool in the UK found that stimulating parenting activities (e.g., reading to child, talking to child often) during infancy were associated with advanced motor skills and better social skills at age 3 (Gutman & Feinstein, 2010). Others have found that infants whose parents use entertaining strategies to engage them are more likely to learn and explore and will initiate social interactions later in childhood (Karreman et al., 2006), increasing opportunities for EF and EC skill development. For example, laboratory observations of mother and child interactions

during a complex task revealed that children whose parents offered more manual help, modeled behaviors, and provided verbal cues were able to focus attention for longer periods of time and were more likely to persist in the task compared to other children (Hustedt & Raver, 2002).

Importantly, children whose parents are active in providing assistance when necessary are more likely to internalize regulatory processes and social expectations (Karreman et al., 2006; Lorber & Egeland, 2011), a key process for both executive functioning and effortful control.

Overall, there is ample evidence to the claim that parenting matters for positive child developmental outcomes. Despite research suggesting that both maternal sensitivity and enrichment influence SR, studies that concurrently examine the role of these parenting domains on EF and EC are lacking. One study that examined sensitivity and enrichment on SR skills in general using a sample of 40 middle-class mother-infant dyads identified differential associations of these parenting domains on child outcomes at age six (von der Lippe et al., 2010). However, the authors cite a need for further research using a larger sample. Further, they did not separate cognitive skills from impulse-control skills (von der Lippe et al., 2010). Therefore, the current study built upon the work von der Lippe et al. (2010) by simultaneously examining the associations between these parenting domains and EF and EC in order to gain a better understanding of the role that these aspects of parenting may play in emergence of cognitive and behavioral regulatory skills.

Attachment

Although there is no question that parenting is a powerful early environmental influence on children's development, children also develop as a function of their early dyadic interactions, including the attachment relationship. The attachment relationship captures the child's organization of behaviors in response to early parenting, environmental context, and expectations

of caregiver availability (Ainsworth et al., 1978; Bowlby, 1973; Sroufe, Waters, & Matas, 1974; Sroufe, 2005). Bowlby (1969) suggested that early caregiver experiences directly influence both proximity-seeking and exploratory behavior in infancy and early childhood in a dynamic transactional manner. When infants experience caregiving that is timely, appropriate, and reliable, they will grow to expect that their caregiver will be available when needed. Secure children use their attachment figure as a base from which to explore their surroundings and as a source of comfort and support when stressful or threatening situations arise (Bowlby, 1973; Kochanska, et al., 2009). Infants who experience care that is less responsive, harsh, inconsistent or fear-provoking, organize their behaviors in a manner that focuses on the attachment figure and maximizes the potential that the caregiver will be available. Insecurely attached children are more preoccupied with caregiver availability and less able to engage in high-quality exploration compared to their secure peers (Goldberg, 2000; Sroufe et al., 2005). Scholars argue that it is through the balance of attachment and exploratory behaviors that children learn to navigate their environments, become more skilled, and expand their cognitive and behavioral capacities (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969; Sroufe, Egeland, & Kreutzer, 1990; Sroufe, 2005).

Securely attached children are more likely to actively engage with and learn from their environments (Ainsworth et al., 1978; Bowlby, 1973; Shaver & Mikulincer, 2010; Vaughn et al. 2007). Therefore, it is no surprise that secure attachment has been linked to more advanced emotion regulation, higher empathy skills, more advanced self-control skills, more positive peer relationships, fewer behavior problems, and better school outcomes (Ainsworth et al., 1978; Bowlby, 1973; Bauminger & Kimhi-Kind, 2012; Goldberg, 2000; McElwain, Cox, Burchinal & Macfie, 2003; O'Connor & McCartney, 2007; Sroufe et al., 2005; West, Mathews, & Kern,

2013). In contrast, children who have histories of insecure attachment are often believed to be at a developmental disadvantage. Indeed, insecure children tend to have more negative developmental outcomes including poor self-regulatory capacities, peer rejection and loneliness, and higher levels of externalizing and internalizing behavior problems compared to their securely attached peers (Bauminger & Kimhi-Kind, 2012; Boris & Zenah, 1999; Card & Hodges, 2003; Cohen & Shaver, 2004; Granot & Mayseless, 2001; Kochanska & Kim, 2013; Sroufe, 2005).

Although there is considerable evidence directly linking attachment behavior to a range of positive and negative outcomes, there is a small body of work suggesting that attachment behavior may intensify (or diminish) the effects of some experiences on children's outcomes (Kochanska & Kim, 2012; Milan, Snow, & Belay, 2009; Sroufe, Carlson, Levy, & Egeland, 1999). For example, children who are exposed to high levels of stress during prenatal development and early in infancy appear to be at greater risk for negative outcomes if they are also insecurely attached; in contrast, a secure attachment relationship seems to buffer children from the negative effects of these early risk factors (Bergman, Sarkar, Glover, & O'Connor, 2008). Similar patterns of findings have emerged for children exposed to maternal depression, with secure children demonstrating fewer negative outcomes than insecure children (Graham & Easterbrooks, 2000; Milan et al., 2009). Thus, there is some evidence to suggest that attachment behavior may moderate the effects of early environmental experiences on later outcomes. Despite evidence of the complex and interactive nature of parenting and attachment, little is known about whether the associations between maternal sensitivity or parenting enrichment and Ef and EC may differ by attachment behavior. It is possible that secure attachment may buffer children against the negative effects of insensitive parenting or low enrichment behaviors while insecure attachment may exacerbate the negative consequences of these experiences. To explore

this possibility, we investigated whether attachment behavior (i.e., secure vs. insecure) moderated the associations between early maternal sensitivity and enrichment with later EF and EC skills.

Control Variables

Several additional child and family factors were included in the current study as control variables. Numerous studies have found that child temperament and self-regulatory capabilities are highly related constructs (Fox, Schmidt, Calkins, Rubin & Colpan, 1996; Rothbart & Bates, 1998; Rothbart, 1987). In fact, some studies suggest early temperament characteristics influence later self-regulation abilities (Blair et al., 2004), whereas others have found no such relationship. There is also research suggesting that child temperament may influence parenting behaviors, which, in turn, are related to child attachment behavior (Sroufe et al., 2005). As such, an index of child temperament was included in an attempt to account for some of the influences that child temperament may have on both SR and the environment. Child sex was also included as a control. Although studies of child gender and SR have yielded somewhat mixed results, there is a general consensus that girls demonstrate more advanced regulation skills than boys (Matthews, Pointz, & Morrison, 2009). For example, studies of impulse control frequently find that girls have more advanced abilities to suppress dominant responses and delay gratification compared to boys (Li-Grining, 2007). Finally, there is a great deal of evidence to suggest that developmental outcomes for children may differ by ethnicity and thus we controlled for children's ethnicity (Dotterer, Iruka, & Pungello, 2012; Friend, Hunter, & Fletcher, 2011).

In addition, two indicators of family socioeconomic status were included as controls, including income-to-needs, maternal education, and partner status. There is strong evidence to suggest that children who live in poverty are at heightened risk for negative developmental

outcomes, including inattention and poor SR (Dilworth-Bart, Khurshid, & Vandell, 2007; Oxford & Lee, 2011; Raver, 2009). Beyond the impacts of poverty, studies have shown that mothers who have lower levels of education have poorer parenting skills, including lower levels of sensitivity (Burrous, Crockenberg, & Leerkes, 2009; Carr & Pike, 2012) and engage their infants in less developmentally appropriate cognitive stimulation (Lowe, Erickson, MacLean, Schrader, & Fuller, 2013). Thus, maternal education was controlled for.

The Current Study

Given the importance of SR in the acquisition of skills necessary for psychosocial development and later success (Blair et al., 2004; Raver et al., 2011; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009), more research is needed to understand the antecedents of these skills. Although some findings are expected to replicate existing work, the current study offers important insight into how multiple early experiences influence the development of EF and EC for secure and insecure children. First, we have investigated developmental antecedents of two distinct but related domains of SR – EF and EC – that have been shown to differentially predict critical cognitive and behavioral outcomes later in life (Bernier et al., 2010; Birmingham & Bub, under review). In doing so, our study provides useful insight concerning potential developmental pathways to these skills.

Second, rather than examining a broad index of parenting quality or a single domain of parenting, we investigated simultaneously the association between two domains of parenting – maternal sensitivity and parenting enrichment – that we hypothesized might differentially predict EF (a cognitive domain) and EC (a behavioral domain). A common critique in the parenting literature is that single global constructs are often used to predict child outcomes and less is known about the differential effects of parenting styles versus parenting behaviors (Mize &

Pettit, 1997). Although global conceptualizations of parenting do offer insight into how early caregiving is associated with later outcomes, failing to acknowledge the possibility that different domains of parenting may have unique effects on child development ignores potentially critical variability in the early experiences that may explain differences in SR. By examining simultaneously the unique effects of maternal sensitivity and parenting enrichment on the development of child EF and EC, this study provides unique insight into the role of early caregiving on child developmental outcomes. Having such an understanding may allow us to target specific parenting approaches or behaviors in order to promote optimal self-regulation skill development in early childhood.

Third, there is ample evidence to suggest that attachment style is related to a range of child outcomes including self-regulation, with securely attached children demonstrating better attention, planning, and self-control skills than insecurely attached children (Goldberg, 2000; Kochanska et al., 2009; Sroufe et al., 2005). What is less well understood is whether attachment moderates the effects of maternal sensitivity and enrichment on EF and EC in preschool. This knowledge has significant implications for targeting specific behaviors and regulatory skills in order to promote positive developmental outcomes for all children, but especially for insecure children. To address some of these gaps in the literature, we addressed the following research questions: 1) Do maternal sensitivity and enrichment at 15 months predict executive functioning and/or effortful control at 54 months?; and 2) Do the effects of maternal sensitivity and enrichment on EF and EC differ for secure and insecure children?

We hypothesized that there would be differential pathways from maternal sensitivity and enrichment at 15 months to EF and EC in preschool. Specifically, maternal sensitivity was expected to be more strongly associated with EC than EF in preschool, as children learn to

regulate behaviors through early parental responsiveness and soothing behaviors. On the other hand, high levels of enrichment at 15 months were expected to be more strongly associated with EF than EC skills due to the increased provision of cognitive stimulation. Second, we hypothesized that the pathways from maternal sensitivity and enrichment at 15 months to EF and EC at 54 months would differ for children who were classified as secure versus insecure at 15 months. That is, we predicted that secure children would display better EF and EC skills when they experienced higher levels of both sensitivity and enrichment at 15 months. On the other hand, we expected that insecurely attached children would not benefit from parenting enrichment due to preoccupation with caregiver availability and reduced likelihood to explore and take advantage of environment.

Methods

Sample

Data from phases I and II of *The National Institute of Child Health and Human Development (NICHD), Study of Early Child Care and Youth Development (SECCYD)*, a comprehensive, longitudinal study on various aspects of child development, was used for this study. The dataset included a sample of 1,364 children and their families. Information was gathered from 10 locations across the United States: Little Rock, Arkansas; Irvine, California; Lawrence, Kansas; Boston, Massachusetts; Philadelphia, Pennsylvania; Pittsburgh, Pennsylvania; Charlottesville, Virginia; Morganton, North Carolina; Seattle, Washington and Madison, Wisconsin. A total of 8,986 women gave birth during the sampling period and 60% (5,416) of those women agreed to be contacted for a telephone interview (NICHD ECCRN, 2004). Of the women who agreed to participate, 56% (3,015) were selected on the basis of a conditional random sampling plan. A total of one thousand, five hundred and twenty-five families were selected as eligible, but only 1,364 completed the home interview when the infant

was 1 month old, making up the final sample of the study (NICHD ECCRN, 2004). Of these, 53% were male, 24% were ethnic minorities, 11% of mothers had not completed high school, 14% were single mothers, and the average family had an income of over three times the poverty threshold (NICHD ECCRN, 2004).

It is important to note that there were numerous exclusion criteria for the study, including families that intended to move, mothers under the age of 18, infants from multiple births, infants who were born with disabilities, mothers who did not speak English, mothers with medical problems/substance abuse problems, and families that lived in dangerous neighborhoods. As a result of these exclusion factors, the current sample is comprised of relatively low risk individuals and is not nationally representative. Nevertheless, participating families were similar to other families in the catchment areas on typical demographic variables with two exceptions; mothers in the sample were slightly more educated and families had slightly higher income levels.

Procedures

Data collection methods included home and laboratory observations, direct assessments, maternal-report questionnaires, home interviews, and phone interviews conducted when children were 1, 15 and 54 months old. Parenting sensitivity was observed in the home during a structured play interaction when children were 15 months old. Parenting enrichment was also observed by research assistants during the home visit at 15 months; in cases where an item was not observed, mothers were asked directly about the presence and/quantity of the item. Child attachment was measured when children were 15 months old via a laboratory assessment. Executive functioning and effortful control were reported by mothers via questionnaire and by researchers through

laboratory observations when children were 54 months old. Finally, family and child demographics were collected at all major assessment points via maternal report.

Measures

Executive functioning. Executive functioning was measured at 54 months using three indices of attention-related behaviors: the Attention Problems subscale of the *Child Behavior Checklist 2/3*, the Memory for Sentences subscale of the *Woodcock-Johnson Revised (WJ-R)*, and the *Continuous Performance Task*. The Attention Problems subscale consists of 7 items describing attention focusing problems. Mothers were asked to report on how well specific statements described their child's behavior within the past 2 months using a three-point Likert scale ($0 = \textit{not true}$, $1 = \textit{sometimes true}$, $2 = \textit{very true}$; Achenbach, 1992). This subscale consists of items such as *can't concentrate*, *daydreams*, *confused*, *nervous*, *twitches*, *poor school work*, *clumsy* and *stares*. T-scores (or standardized scores) were used for the current analyses and range from a possible 50 to 100, with higher scores indicating more behavior problems. The CBCL has well-established concurrent and predictive validity and is the most widely used screening instrument for tracking the emergence of behavior problems in children (Achenbach, 1991; Bub, McCartney, & Willet, 2007), with a reliability coefficient of $\alpha=0.94$.

The Memory for Sentences subscale from the WJ-R (McGrew, Werder, & Woodcock, 1991; Woodcock, 1990) was designed to examine a child's ability to remember and repeat simple words and phrases. Sentences were presented using a tape player or by the examiner. This subscale is a test of short-term memory. Possible standardized scores for this task range from 17 to 142, with scores above 100 indicating higher than average abilities. The Memory for Sentences task is a valid measure of short-term memory (Woodcock & Johnson, 1989; 1990; NICHD SECCYD, 2003), with a reliability coefficient of $\alpha=0.82$.

The *Continuous Performance Task* is a laboratory procedure that involves showing the child a series of familiar pictures (e.g., butterfly, fish, flower) along with a critical stimulus picture (a chair). The number of times the child's attention waivered and needed to be refocused on the task while remaining seated and the number of times the child completely walked away were calculated. These two indicators were averaged to create a single measure a child's ability to focus attention, concentrate, and stay on task in a laboratory setting. *The Continuous Performance Task* has been widely used to measure child cognitive executive functioning/attention skills (Barkley, 1994; Halperin, Sharma, Greenblatt, & Schwartz, 1991; Jahromi & Stifer, 2008; Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991). Observed scores from the CBCL attention problems subscale, the WJ-R memory for sentences subscale and *The Continuous Performance Task* will be used to create a single latent construct of executive functioning.

Effortful control. Effortful control was measured using at 54 months using two measures: the Inhibitory Control subscale from the *Child Behavior Questionnaire* (CBQ; Rothbart, Ahadi & Hershey, 1994; Rothbart, Ahadir, Hershey & Fisher, 2001) and the Self-Control subscale from the *Social Skills Rating System* (Gresham & Elliot, 1990; NICHD ECCRN, 2003). The Inhibitory Control subscale reflects how well a child can delay impulses. Mothers were asked to report on characteristics of their child in the past 6 months using a seven-point likert scale (1= *extremely untrue* to 7= *extremely true*). This subscale includes items such as: *child can't wait before entering into new activity*, *child easily stops activity when told to*, and *child is able to resist temptation*. Responses to items were summed (with several items reverse scored) and higher scores indicate more advanced EC skills. This subscale has been used to measure impulse control in preschool-aged children in previous studies (Cohen, MacWhinney,

Flatt, & Provost, 1993; Clark et al., 2002; Langua, 2002; Raver et al., 2011) and demonstrates good reliability in this sample ($\alpha=0.75$).

The Self Control subscale of the SSRS was measured when children were 54 months old and reflects how well a child can control their impulses, specifically in social situations. Mothers were asked to report how often items represented their child using a three-point likert scale (0=*never*, 1=*sometimes*, 2=*very often*). This subscale includes items such as: *controls temper when arguing, follows instructions and responds appropriately when hit or pushed*. Responses to items were summed (with several items reverse scored) and higher scores indicate more advanced self-control skills. This subscale has been used to measure impulse control in preschool-aged children in previous studies (Gresham & Elliot, 1990; NICHD ECCRN, 2003) and demonstrates good reliability in this sample ($\alpha=0.78$).

Key Predictor Variables

Maternal sensitivity. Maternal sensitivity was assessed at 15 months using the *Mother-Child Structured Play Observation Procedure* (Ainsworth, Blehar, Waters, & Wall, 1978; Egeland & Farber, 1984; Fish, 1990). In this procedure mothers and infants were video-recorded in a laboratory setting in 15 minute segments. Mothers were instructed to play with their infants using a series of toys. In the first segment mothers presented their infants with a story book. The second segment involved a toy stove and various props and the third and final segment involved a toy house with figures (McElwain & Booth-LaForce; 2006; NICHD ECCRN, 1999). Observers coded interactions with a focus on how mothers engaged infants in play, as well as the nature of mothers' responses to child's gestures, expressions, and signals (Ainsworth et al., 1978; Egeland & Farber, 1984). Observations were recorded on a four-point scale (1= *not at all characteristic* to 4= *highly characteristic*) and a composite was then created by combining the

following scales: Sensitivity to non-distress, positive regard for the child, and intrusiveness (reverse-scored). Higher scores indicate more sensitive mothers. This measure has been used to measure parenting sensitivity in many studies (Bradley, 1994; NICHD SECCYD, 2003; Potharst et al., 2012) and has been deemed reliable in this sample ($\alpha = 0.70$).

Parenting enrichment. Parenting enrichment was measured using the *Stimulation of Development Subscale* of the *Home Observation for Measurement of the Environment (HOME) Inventory* (Caldwell & Bradley, 1984). Information on the opportunity for cognitive stimulation in the environment was collected during a home visit when the infant was 15 months old. Items were scored on a scale from zero to four (higher indicating more enrichment) and were averaged to create a composite score of parenting enrichment. Sample items include: *mother provides toys, consciously encourages development, structures play, and reads to child*. This measure has been validated (NICHD SECCYD, 2003; Bradley & Caldwell, 1988) and has a reliability of $\alpha = 0.72$.

Child attachment. Child attachment style was measured using a modified version of Ainsworth's *Strange Situation Paradigm* (Ainsworth et al., 1978; Cassidy et al., 1992) at 15 months. Child behavior was observed in a playroom setting during a sequence of events. For the first three minutes of the session the mother played with the child. Following a knock at the door, she would leave the child alone for 3 minutes. The child's behavior while alone, as well as when reunited with his/her mother was observed. The reunion lasted for three more minutes when another knock at the door prompted the mother to leave again, for 5 more minutes. The mother then returned to the child for a final reunion, lasting 3 minutes. The child's behavior during the mother-child interaction, as well as the reaction to absence of the mother and reunification with their mother was observed and coded. Children were classified as avoidant (category A), secure (category B), resistant (category C) or disorganized (Category D). The Strange Situation is a

widely used measure of child attachment (Cassidy, Berlin, & Belsky, 1991; Cicchetti & Barnett, 1991; MacArthur; Cassidy & Marvin and the MacArthur Working Group on Attachment, 1992; Sroufe et al., 2005). Inter-rater reliabilities for this categorical variable were 84%. For a complete description of the Strange Situation procedure see Appendix B.

Control Variables

Child temperament. Child temperament was measured using the *Early Infant Temperament Questionnaire* when the child was 1 month old (Medoff-Cooper, Carey & McDevitt, 1993). Mothers completed the questionnaire consisting of 57 items that tapped into different domains of child behavior including activity, approach, adaptability, mood and intensity. Items were rated on a 6 point scale ranging from “almost never” to “almost always” in describing their children. A total composite score that measured infant temperament on a continuous scale with higher scores indicating more difficult temperaments, mid-range scores average, and lower scores more easy temperaments (Carey & McDevitt, 1978; McDonnell & Beck, 2001; Sakamura, Dang, Ballard & Hansen, 2008). This scale has shown adequate reliability ($\alpha=0.744$), (NICHD, Phase I instrumentation) and has good internal consistency (Goyal, Gay & Lee, 2009; Hall, Wilson & Frankenfield, 2003; Medoff-Cooper, 1995).

Child gender. Information on child gender was collected when children were one month old. A dummy variable was created that assigned a value of 0 to females and 1 to males.

Race/ethnicity. Information on child race/ethnicity was collected when children were one month old. A series of dummy variables was created, reflecting White/Non-Hispanic, African American, Hispanic, and Other.

Socioeconomic status. Socioeconomic Status was measured using the family income-to-needs ratio when children were 15-months of age. The income-to-needs ratio is computed by

taking family income, not including federal aid, and dividing this by the federal poverty threshold for the appropriate family size (US Bureau of the Census, 1999). Families in this sample had highly stable income-to-needs ratios across time ($r=0.74$) and thus only the 15-month value was used this study.

Maternal education. Maternal reports of the number of years of education were collected when the child was one month of age.

Site. A set of nine dummy variables representing the ten data collection sites will also be included in all analyses.

Data Analysis

Descriptive analysis. Means and standard deviations on all outcome and predictor variables were obtained using SAS version 9.3. Each variable was examined for skewness and kurtosis. Inter-correlations were also examined to identify the strength and direction of the association between all predictor and outcome variables. To determine whether observed indicators of EF and EC captured their intended latent constructs, a measurement model that included both constructs was fitted using Mplus version 5. Missing data on all predictors was handled using full information maximum likelihood.

Predictive analysis. To investigate whether there were associations between maternal sensitivity and parenting enrichment at 15 months and EF and/or EC at 54 months (RQ1), a taxonomy of structural equation models (SEM) was fitted. First, a model that regressed the latent constructs of EF and EC on maternal sensitivity was fitted followed by a model that regressed EF and EC on parenting enrichment. These models allowed for the examination of the unique effects of each parenting construct on either EF or EC. To address limitations in existing research and to account for one parenting domain while examining the other, we fit a model that regressed EF

and EC on both parenting domains (i.e., maternal sensitivity and enrichment) simultaneously. This model allowed us to identify all concurrent effects and compare strength and direction of associations between variables and constructs of interest. Model fit was evaluated using the Chi-Square (with non-significant values indicating good fit), Comparative Fit Index (*CFI*; with values greater than .90 indicating good fit), and Root Mean Square Error of Approximation (*RMSEA*; with values less than .10 indicating good fit) indices.

Finally, to determine whether the associations between parenting and self-regulation differed by child attachment classification at 15 months (RQ2), a multi-group analysis was conducted. First, we fit a model in which all of the pathways across the dichotomous attachment groups (i.e., secure and insecure) were freely estimated. Next, we constrained all pathways to be equal across attachment groups. Finally, pathways of interest were systematically freed to test whether the pathways of influence for secure children differed from those for insecure children. Model fit was compared using the chi-square statistic (ΔX^2).

Results

Sample means and standard deviations for all outcome, predictor, and control variables can be found in Table 1. Correlations between outcome and predictor variables can be found in Table 2. Model fit statistics for the measurement model containing executive functioning and effortful control latent constructs can be found in Appendix C. Descriptive statistics for indicators of were fairly high. That is, mean scores for working memory ($M = 91.94$ out of a possible 142) and continuous performance ($M = 32.83$ out of a possible 44) were high. Similarly, the mean for attention problems was low, with children scoring a 2.7 out of a possible range of 14. Both indicators of effortful control were also high, with inhibitory control scores 4.66 out of 7 and self-control 12.96 out of 20. Average maternal sensitivity and enrichment scores at 15

months were also high (see Table 1). Finally, of the final analytic sample, 562 (62%) children were classified securely attached and 340 (38%) were classified as insecure at 15 months. All observed indicators of EF and EC were moderately correlated in the expected direction with both domains of parenting. Interestingly, attachment status (secure/insecure) was not significantly correlated with maternal sensitivity or parenting enrichment and was only significantly correlated with the Continuous Performance Task, an indicator of executive functioning (0.1, $p < 0.05$). No other statistically significant correlations were found.

Do maternal sensitivity and parenting enrichment at 15 months differentially predict child executive functioning and effortful control at 54 months?

Parameter estimates and goodness of fit statistics for the direct effects models predicting EF and EC from maternal sensitivity and enrichment behaviors are presented in Table 3. Controlling for child and family demographics (i.e., child temperament, child gender, child race, SES, maternal education), maternal sensitivity and enrichment were positively and significantly associated with EF at 54 months (see Table 3). Controlling for parenting enrichment, children who experienced higher levels of maternal sensitivity at 15 months exhibited more EF skills at 54 months compared to children who experienced less sensitive parenting. Children also exhibited higher EF skills when they were exposed to more enrichment behaviors at 15 months, even after taking into account maternal sensitivity. The association was stronger for parenting enrichment ($\beta = 0.23, p < 0.001$) than for maternal sensitivity ($\beta = 0.11, p = 0.05$). Nevertheless, both domains of parenting significantly predicted child EF at 54 months, suggesting that the pathways from maternal sensitivity and enrichment at 15 months to executive functioning and effortful control at 54 months are not different.

The pattern of findings for EC was similar. Children who experienced higher levels of maternal sensitivity at 15 months exhibited higher EC skills at 54 months compared to children who experienced less sensitive parenting, even after taking into account parenting enrichment behaviors. Additionally, higher parenting enrichment was associated with better EC, controlling for maternal sensitivity. Although both domains of parenting significantly predicted child effortful control at 54 months, parental enrichment ($\beta=0.15, p=0.001$) was a slightly stronger predictor than sensitivity ($\beta = 0.10, p<0.05$). Nevertheless, both domains of parenting significantly predicted child EC at 54 months. Therefore, it does not appear that the effects of parenting sensitivity and enrichment on child EF and EC differ on average as was predicted. It is worth noting that together maternal sensitivity and parenting enrichment explained a considerable amount of variance in child EF (45%) and a moderate amount of variance in EC (18%). Model fit statistics examining these associations simultaneously indicate that the fit is adequate: $X^2=129.9^{***}$ ($df=49$), $CFI=0.89$, $RMSEA=0.05$.

Do these associations differ by the child's attachment classification at 15 months?

To address this question, a series of multi-group structural equation models were fitted to determine whether paths to EF and EC from maternal sensitivity and enrichment for secure and insecure children. First, we fit a model in which all means, factor loadings and pathways were freely estimated across groups. This model allowed the factor loadings for the indicators of EF and EC as well as the pathways from the parenting domains (i.e., sensitivity and enrichment) to the self-regulatory skills (i.e., EF and EC) to be different for secure and insecure children. We then fit a model in which we constrained all factor loadings and pathways to be equal across groups. In other words, we tested the hypothesis that there were no group differences in these associations. The X^2 statistic from the fully unconstrained model ($X^2=218.43$) was compared to

that of the fully constrained model ($X^2=261.27$). The significantly poorer fit ($\Delta X^2=43, p<0.05$) of the fully constrained model suggested that there were, in fact, differences in the associations between parenting domains and self-regulatory skills across attachment groups. To identify, where, exactly, those differences were, the maternal sensitivity and enrichment pathways were freely estimated while all else, including control variables remained constrained. Comparison of model fit from the parenting paths model ($X^2=250.23$) to the fully constrained model ($X^2=261.27$) indicated that allowing sensitivity and enrichment to differ across attachment groups offered a statistically significant improvement to model fit ($\Delta X^2=11.04, p<0.05$). Finally, to ensure that significant control variables were accounted for in these relationships, child temperament, child gender, and maternal education were freely estimated across groups. However, the fit of this model did not improve significantly compared to the model that only allowed parenting sensitivity and enrichment pathways to be freely estimated, indicating that control variables had similar influence on outcomes for securely and insecurely attached children but that parenting domains did not. Therefore, the freely estimated parenting pathways only model was selected as the final model.

An examination of the pathway coefficients from the final model indicated that parenting enrichment significantly predicted both EF and EC for securely attached children. That is, securely attached children who experienced higher levels of parenting enrichment at 15 months demonstrated more EF and EC skills at 54 months compared to children who experienced less enrichment. The association between parenting enrichment and EF is stronger ($\beta = 0.49, p<0.001$) than the pathway from parenting enrichment to EC ($\beta = 0.29, p<0.001$). Nevertheless, parenting enrichment is a significant predictor of both EF and EC for securely attached children. Maternal sensitivity did not predict EF or EC for this group (see Figure 1).

Interestingly, a different pattern of findings emerged for children who were insecurely attached at 15 months. More specifically, parenting sensitivity predicted EC only. That is, insecure children demonstrated higher EC skills in preschool if they experienced higher levels of parenting sensitivity at 15 months ($\beta = 0.26, p < 0.001$). Neither parenting domain predicted EF for insecurely attached children, nor did this group appear to benefit from enrichment activities (see Figure 1). Therefore, it appears that parenting sensitivity and enrichment do indeed have differential effects on EF and EC depending on the child's attachment status at 15 months. Namely, secure children benefit from higher levels of enrichment while insecure children only benefit if their mothers display higher levels of sensitivity. Additionally, early parenting appears to be unassociated with EF skills for insecurely attached children. These findings support the second hypothesis that different pathways would emerge for children who were classified as secure versus insecure at 15 months.

Discussion

Early childhood is a developmental period characterized by growth that is unparalleled at any other point during the lifespan. Children's capacity to self-regulate expands rapidly during the first several years of life and early experiences are highly influential in this process (Goldberg, 2000; Raver et al., 2011; Sroufe et al., 2005). As such, the purpose of the current study was twofold. First, we examined the relationship between two domains of parenting in infancy, specifically maternal sensitivity and parenting enrichment, and two domains of self-regulation in preschool, specifically executive functioning and effortful control. By investigating the developmental pathways from maternal sensitivity and enrichment to EF and EC, this study advances our understanding of how different domains of parenting simultaneously influence the development of two distinct but related self-regulatory skills in young children. Further, driven

by a small body of work suggesting that attachment security may moderate the relations between early experiences and child outcomes, we moved beyond a simple main effects model of parenting to understand the role of attachment in these relationships. That is, we explored whether the developmental pathways from parenting to self-regulation may differ for children who are classified as secure versus insecure.

Early Experience and Self-Regulatory Skills

The first goal of this study was to examine the differential effects of maternal sensitivity and enrichment on the development of EF and EC in preschool. We found that sensitivity predicted both EF and EC and that the associations were nearly identical for both skills. In other words, children whose mothers demonstrated more sensitivity at 15 months developed superior EF and EC skills compared to their peers who experienced less sensitive maternal care. This finding is in line with previous studies that have demonstrated that sensitivity promotes positive developmental outcomes in children (Hirsh-Pasek & Burchinal, 2006; Mills-Koonce et al., 2008; Raikes & Thompson, 2008; van Ijzendoorn, 1997; Volling et al., 2002). Parental enrichment also significantly predicted EF and EC, although the pathway from enrichment to EF was twice the size as the pathway from enrichment to EC. That is, although enrichment behaviors did enhance children's EC in preschool, these activities appeared to be more beneficial for their EF capacities. This finding is also consistent with an abundance of research that demonstrates early cognitive stimulation promotes later executive capacities (Lowe, Erickson, MacLean, Schrader, & Fuller, 2013). For example, in a recent study that examined the effects of maternal enrichment behaviors on a sample of 84 at-risk infants who had been born pre-maturely, the authors found that children who experienced higher rates of scaffolding (evidenced by sophisticated verbal guidance and problem-solving during play) demonstrated more advanced cognitive abilities in

toddlerhood compared to premature children who experienced fewer enrichment behaviors (Lowe et al., 2013).

Although the hypothesis that enrichment would be a stronger predictor of EF skills was supported, the prediction that maternal sensitivity would be a stronger predictor of EC skills was not. This was surprising, as a substantial body of literature highlights the importance of sensitive caregiving for the emergence of impulse control skills, particularly as self-regulation shifts from external, in which an infant is reliant on the caregiver to help regulate emotions, arousal and behaviors, to mutual or dyadic, and finally to autonomous (Crossley & Buckner, 2012; Davies, 2005; Sroufe, 1996; Sroufe et al., 1999; 2005). Nevertheless, there is some evidence to support this finding. In a 2010 study that examined concurrent influences of sensitivity and enrichment behaviors on self-regulation (a global construct termed EF), mothers who engaged in scaffolding behaviors and ensured that their infant played an active role in successful completion of tasks promoted more advanced impulse control skills even after accounting for sensitivity (Bernier et al., 2010). In fact, once the influences of enrichment were accounted for, the influences of sensitivity in their sample became non-significant. The authors argued that enrichment behaviors may be of particular salience because in addition to the cognitive stimulation provided, scaffolding interactions may encompass sensitivity as well, serving as a possible mediator from maternal sensitivity to self-regulation (Bernier et al., 2010). This is an intriguing possibility and one that warrants further exploration in future studies.

Differences by Attachment Classification at 15 months

A second goal of this study was to investigate the possibility that attachment at 15 months moderated the associations between parenting and self-regulation. We found support for our hypothesis that very different developmental pathways would emerge for secure and insecure

children. Specifically, parenting enrichment was particularly salient for secure children as it predicted both EF and EC. Children who were securely attached and who were exposed to more enrichment behaviors had better self-regulatory skills than other children. In contrast, maternal sensitivity emerged as a critical pathway for children classified as insecure, although it only predicted EC. That is, children who were insecurely attached at 15 months experienced significantly higher EC skills if they were exposed to sensitive caregiving. No other significant pathways were identified.

The potential importance of enrichment behaviors for secure children has been described in earlier work. Specifically, Aber and Allen (1987) used the phrase *Secure Readiness to Learn* to describe the fact that children who are securely attached tend to gain more social and cognitive skills because of their ability to use a secure base to explore. This notion has been repeatedly supported in the literature, as securely attached children are better able to focus attention, persist in goal-directed activities, participate in higher quality play, engage others in their environment, all activities that promote cognitive capacities (Aviezar, Sagi, Resnick, & Gini, 2002; Goldberg, 2000; Meins, 1997). The child's behavior might also explain this finding. Hustedt and Raver (2002) argued that when children are highly attentive and engaging in exploration, as children who have a secure base tend to be (Ainsworth et al., 1978), they are likely draw positive attention and assistance from their caretakers (Hustedt & Raver, 2002). This explanation is in line with Bowlby's (1973) description of the attachment relationship as transactional, as it underpins not only the importance of early caregiver experience and the organization of behaviors, but the role of child behavioral responses and influence of those behaviors on future parent-child interaction (Bowlby, 1973; Eisenberg et al., 2005; Sroufe & Waters, 1977; Sroufe et al., 1999; 2005).

Contrary to expectation, however, was the fact that maternal sensitivity was not related to either EF or EC for secure children. This may be explained, in part, by the fact that securely attached children are more likely to have a history of sensitive caregiving (Ainsworth et al., 1978; Bowlby, 1973; Goldberg, 2000; Fearon & Belsky, 2002; Sroufe et al., 1999; 2005) and as such the enrichment behaviors they experience tend to be more developmentally appropriate and facilitated in a sensitive manner. For example, in a study that compared the scaffolding behaviors of mothers in securely versus insecurely attached children, Meins reported that mothers of securely attached children used more positive feedback, less negative feedback, and tended to intervene only when their children needed it, demonstrating a level of sensitivity in their enrichment behaviors (Meins, 1997). Other studies have supported the notion that when cognitive stimulation is facilitated in a developmentally appropriate and non-intrusive manner, children thrive (Hustedt & Raver, 2002; Mains, 1997; Volling et al., 2006). Thus, it is possible that infants who were classified as securely attached benefited indirectly from a more sensitive parenting approach to enrichment, as Bernier and colleagues (2010) speculated. This is a pathway worth exploring in future studies.

There is considerable research linking early sensitivity and later EC skills, demonstrating that warm and positive parenting is associated with increased EC skills later in childhood (Eisenberg et al., 2005; Spinrad et al., 2012). What was surprising, however, was the fact that this association emerged only for the insecure children. One possible explanation for this is that there is greater variability in sensitive caregiving for the insecurely attached group because of different maternal reactions to insecure behavioral organization. For example, an insecurely attached child who demonstrates behaviors such as clinginess, high levels of distress, and other resistant patterns upon separation and reunion may elicit more sensitive caregiving (Ainsworth et

al., 1978). On the other hand, an insecure child who demonstrates avoidant, distancing behavior, and suppression of affect may reduce the likelihood of sensitive interactions (Ainsworth et al., 1978; Sroufe et al., 2005). Given that differences in developmental outcomes have been established for children who have a history of secure versus insecure attachments (McElwain et al., 2003), future studies could benefit from examining child EC as a mechanism to explain how early experiences may influence developmental outcomes across insecurely attached children. In other words, might deficits in EC skills explain why insecurely attached children often have poorer social, academic and behavior outcomes compared to their securely attached peers? Questions such as this are in line with a recent call to examine self-regulation as a developmental mechanism in the developmental pathways to later outcomes (Raver et al., 2011) and should be explored further in the future.

It is also intriguing that insecurely attached children did not appear to benefit from enrichment behaviors at all. Because children who are insecure are significantly less likely to explore their environments due to preoccupation with caregiver availability compared to secure children, perhaps this finding is not all that surprising (Ainsworth et al., 1978; Bowlby, 1969; Goldberg, 2000; Main, 1983; Sroufe, 2005). When insecure children do engage in exploratory behaviors, they tend to be superficial and of poorer quality than those of secure children (Cassidy, 1986; Dozier, Stovall & Albus, 1999; Goldberg, 2000; Hazen & Durett, 1982. For example, in studies comparing physiology during play, researchers have demonstrated that insecurely attached children often experience altered physiological arousal (some reporting over-arousal and others under-arousal) that may inhibit exploration and development (Burgess, Marshall, Rubin, & Fox, 2003; Spangler & Grossman, 1993). Thus, it is not necessarily

surprising that insecurely attached children are not as likely to benefit from a cognitively stimulating environment as are their secure peers.

Returning to the concept of multifinality in Developmental Psychopathology, the non-significant pathways from early enrichment to both EF and EC skills in preschool, as well as the non-significant pathway from sensitivity to EF for insecurely attached children may help us to understand why those with insecure histories often experience lowered executive capacities compared to those who were securely attached (Goldberg, 2000; Kohn, Rholes, & Schmeichel, 2012; Raikes & Thompson, 2008; Volling et al., 2002). Overall, the identification of differential pathways for children who were classified as secure versus insecure in infancy provides powerful insight into how self-regulation development differs depending on early experiences. It also demonstrates the importance of considering not only parenting styles and behaviors, but also the dynamic relationship (as evidenced here by the attachment bond) that exists between parent and child.

Limitations

Although this study contributes to our knowledge about early parenting and later self-regulation, there are still several limitations. The greatest limitation is our reliance on maternal report for many of the measures. When the same reporter is used on multiple indicators there is a risk that the associations we identified are a function of the reporter (in this case the mother) rather than an actual association. Although this is a possibility, there are several factors in the current study that reduce the likelihood of this. First, even though several of the indicators of self-regulation are maternal report, we also use direct assessments of attention focusing and working memory. Thus, at least one of our latent factors is comprised of indicators that are not reported by the mother. Second, maternal sensitivity was rated by observers and reflects, to some

extent, a dyadic process. Although her behaviors in a play situation may be a response to the child's self-regulatory skills, it is unlikely that the observer rated mothers as more sensitive when a child had higher EF or EC skills. Third, the temporal nature of the data helps reduce mono-reporter bias. That is, it is unlikely that findings emerging from contextually-related reporter biases (e.g., emotional state, having a bad day), will persist across the months and years that separate our assessments. Nevertheless, mono-reporter bias can be seen as a considerable limitation of this study and future studies should focus on obtaining measures using a variety of reporters (mother, teacher, observer, and direct assessments) as well as multiple indices of each domain.

A second potential limitation has to do with our measurement of EF and EC. That is, although EF was measured using some objective ratings (The Continuous Performance Task and performance on the WJ-R memory task), it also utilized mother-reported scales and measures that were not originally designed to capture self-regulation. Similarly, our measure of EC relied on maternal report as well. This is a drawback of utilizing secondary data, as we must rely on closely related domains (e.g. temperament, cognition and behaviors), as opposed to measures that were designed for the explicit purpose of gathering information on SR skills. Although other studies have used these instruments for similar purposes with success (cite; cite), future studies will benefit from using more objective measures that were designed specifically for the purpose of assessing EF and EC skills.

Another limitation was our use of a normative sample to compare self-regulation outcomes in children who were secure and insecurely attached. That is, the exclusion criteria for the NICHD SECCYD reduced many of the contextual risk factors that have been identified as predictors of insecure attachment (such as less education/awareness of developmental

expectations, lower parental support, maltreatment). Thus, our ability to detect differences in parenting behaviors, and especially in sensitivity, may have been somewhat limited. The fact that 38% of the sample was classified as insecure despite the limited risk factors is worth a noting. Nevertheless, the generalizability of the study is limited. Therefore, additional studies using both clinical and normative samples, as well as nationally representative samples, are needed to better understand the role of parenting sensitivity and enrichment on the development of EF and EC for children from all backgrounds.

Conclusions

Although this study is an important first step in identifying differential pathways from maternal sensitivity and enrichment to child EF and EC for secure and insecure children, this is only part of a much larger picture. Given that insecure children often experience substantially poorer developmental outcomes, an important next step will be to identify whether these domains of self-regulation act as mechanisms by which parenting may differentially relate to other developmental outcomes later in life for children with secure versus insecure attachment histories. Further, because sensitivity was strongly associated with EC for insecurely attached children and because there are marked differences in the nature and quality of parenting for avoidant, resistant and disorganized children, one future direction would be to examine whether differences in self-regulation emerge for subtypes of insecure attachment as well as for disorganized children. This would require using a sample with adequate variability across attachment classifications. Finally, we, like many other scholars, have focused on parenting and attachment behavior measured at one point in time. Future studies should consider not only the role of the child in these pathways but also the possibility that attachment behavior may evolve over time.

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	Mean	SD	Range
<i>Observed indicators EC</i>			
Inhibitory Control	4.66	0.78	0-7
Self-Control	12.96	3.10	0-20
<i>Observed indicators EF</i>			
Attention Problems	2.71	2.39	0-14
Memory	91.94	18.34	0-142
Continuous Performance	32.83	8.36	0-44
<i>Predictor Variables</i>			
Parenting Sensitivity	9.46	1.58	0-12
Parenting Enrichment	6.96	1.41	0-8
<i>Control Variables</i>			
Child Sex	0.49	0.5	0-1
Child Temperament	2.47	0.43	1-3
White	0.81	0.38	0-1
Black	0.02	0.32	0-1
Hispanic	0.06	0.23	0-1
Income to Needs Ratio	3.70	3.14	0-36
Maternal Education	14.46	2.41	7-21

Table 1.

Descriptive Statistics for all Outcome, Predictor and Control Variables.

	1	2	3	4	5	6	7	8
1. Sensitivity	1							
2. Enrichment	.322**	1						
3. Attachment	0.045	0.023	1					
4. Self-Control	.164**	.230**	0.042	1				
5. Inhibitory Control	.158**	.177**	0.005	.626**	1			
6. Att. Problems	-.136**	-.180**	0.024	-.380**	-.467**	1		
7. Memory	.216**	.281**	0.056	.205**	.241**	-.181**	1	
8. CPT	.096**	.144**	.075*	.124**	.136**	-.111**	.240**	1

*** $p < .001$, ** $p < .01$; * $p < .05$

Table 2.

Intercorrelations among Outcome and Key Predictor Variables.

	Executive Functioning	Effortful Control
Parenting Sensitivity	0.11* (.06)	0.10* (.04)
Parenting Enrichment	0.23*** (.06)	0.15*** (.04)
Child Gender	0.15** (.05)	0.17*** (.03)
Maternal Education	0.28*** (.06)	0.06 (.04)
Child Temperament	0.14** (.05)	0.13*** (.04)
Black	-0.13* (0.06)	0.09 (.04)
Hispanic	0.13 (0.05)	-0.23 (.05)
SES	0.02 (.06)	0.05 (.04)
X^2	129.9*** (49)	
<i>CFI</i>	0.89	
<i>RMSEA</i>	0.05	

*** $p < .001$, ** $p < .01$; * $p < .05$; R^2 (EF) = 43%; R^2 (EC) = 13%

Table 3.

Parameter Estimates from a Fitted Regression Model Simultaneously Predicting Executive Functioning and Effortful Control. Note. Estimates are derived from a single path model that included both EF & EC. Thus, only one set of model fit statistics is produced.

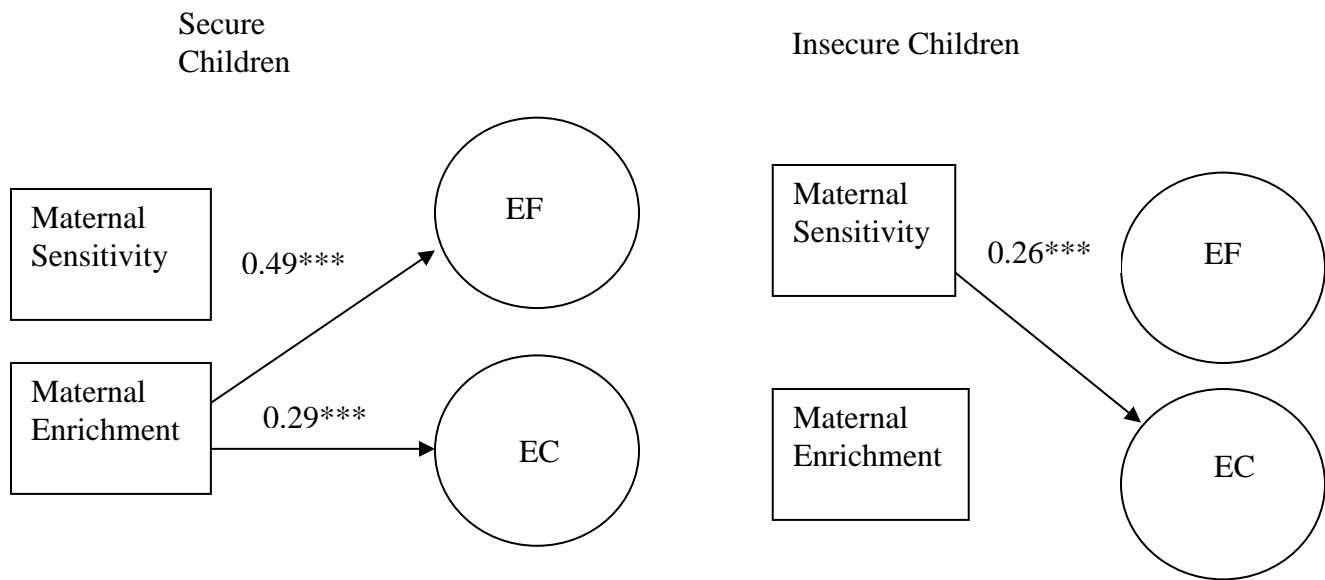


Figure 1.
The effects of maternal sensitivity and enrichment on EF and EC across attachment groups.

Note. $X^2= 250.43***$; $CFI=0.89$; $RMSEA= 0.04$

Parenting, Attachment, and Child Outcomes in the 3rd Grade: Self-Regulation as a Developmental Mechanism

Early childhood is a dynamic developmental period characterized by rapid advances in cognitive and behavioral functioning that have considerable implications for later social and academic outcomes. Scholars argue that by the 3rd grade a child's learning identity (i.e., whether they see themselves as a capable learner) is formed, setting most children on an educational trajectory where they will remain for the rest of their schooling (Pianta & Cox, 2002; Stacks & Oshio, 2009). Importantly, children who exhibit behavior problems are at a considerably higher risk of negative experiences in school that can interfere with learning, harm social relationships, and hinder future development in general (Hill, Degnan, Calkins, & Keane, 2006; Thijs, Koomen, De Jong, Van Der Leij, & Van Leeuwen, 2004). Therefore, efforts to reduce the risk of developing behavior problems, enhance the likelihood of school success, and improve the overall wellbeing of children have been extensive. In this spirit, scholars have sought to more clearly understand the role of early caregiving and the parent-child relationship in the development of later academic and behavior problem outcomes.

Despite a general consensus that both parenting behaviors and attachment in infancy are important predictors of later social and cognitive outcomes (Carr & Pike, 2012; Erikson, Sroufe, & Egeland, 1985; West, Matthews, & Kern, 2013), recent studies have called for a move beyond examining these direct influences to take a closer look at potential developmental mechanisms that may explain how early caregiving experiences influence later development (Kochanska & Kim, 2013; Posner & Rothbart, 2000; Raver et al., 2011; West et al., 2013). One such mechanism that has received increased attention is self-regulation (SR). SR has been shown to be a stronger predictor of school readiness than either academic skills or intelligence (Blair, 2002; Crossley & Buckner, 2012) and the ability to self-regulate is associated with fewer externalizing and internalizing behavior problems (Birmingham & Bub, under review; Volling et al., 2006) across early childhood.

Although we know that self-regulation (SR) matters, less is known about how distinct domains of SR, including cognitive (e.g., executive functioning) and behavioral aspects (e.g., effortful control), may differentially influence developmental outcomes. Further, our knowledge concerning the developmental role that these skills may play in linking early caregiving experiences to later outcomes is lacking. This may be due, in part, to the fact that studies tend to focus on one aspect of parenting, overlooking the potentially unique contributions of different styles and behaviors (Bernier & Carlson, 2010; Mize & Pettit, 1997). Finally, much remains unknown about the interplay between early attachment, self-regulation, and later outcomes. Therefore, guided by Developmental Psychopathology and Attachment Theory, the first major goal of the current study was to examine executive functioning and effortful control as potential mechanisms to explain how maternal sensitivity and enrichment in infancy influence academic and behavior problems in the 3rd grade. Additionally, given that securely attached children often demonstrate superior developmental outcomes compared to their insecurely attached peers (Kochanska & Kim, 2013; Sroufe et al., 2005), the second major goal of the current study was to examine whether the mediated or indirect pathways from early parenting to later academic and behavioral outcomes through SR differed for children who had been classified as secure versus insecure in infancy.

Theoretical Background

The current study was guided by Developmental Psychopathology and Attachment Theory. Developmental Psychopathology is a useful framework for considering antecedents of child outcomes, as it offers a lens to examine differential trajectories or pathways on a continuum from normative to problematic or even pathological. One of the most salient and applicable aspects of this framework is Cicchetti's assertion that any single contextual factor or relational process can generate multiple outcomes, a phenomenon he referred to as multi-finality (Cicchetti & Rogosch, 1996). For example,

early parenting styles and practices may lead to a variety of child outcomes, depending on the influences of additional contextual factors such as the ongoing and dynamic nature of parent-child interaction (Cicchetti & Blender, 2004). One child may learn to control impulses, and demonstrate school success, but experience high levels of fearfulness and anxiety due to early caregiving experiences, whereas another child with a similar background may experience trouble focusing and exhibit hyperactive and aggressive behavior. These multiple outcomes may arise from a variety of pathways, each potentially resulting from any single predictor, depending on the proximal and distal factors involved (Cicchetti & Rogosch, 1996). Thus, Developmental Psychopathology offers a useful framework for examining differential developmental pathways across early childhood.

The second framework we used was Attachment Theory. Bowlby (1969; 1973) asserted that early experiences with caregivers “teach” an individual what to expect from their environment, prompting the organization of behaviors in order to best elicit a response when needed. From this perspective, infants organize behaviors to ensure proximity to their caregivers (ensuring the evolutionary purpose of safety and survival), and ideally use them as a secure base for interacting with their environment (fulfilling the developmental purpose of exploration) (Bowlby, 1973). Based on early experience, subsequent organization of behaviors, ongoing dynamic interactions between the child and caregiver, exploration and growth, children develop in the context of their attachment relationships. Therefore, the attachment framework provides insight concerning how early experiences with caregivers may enhance or interrupt a child’s ability to explore and gain the SR skills necessary for the future development of positive academic and behavioral outcomes.

Academic Achievement and Behavior Problems

Scholars argue that the 3rd grade is a turning point in educational curriculum for children (Liew, McTigue, & Hughes, 2008). Many have conceptualized the transition that occurs during this year as a

movement away from “learning to read”, or obtaining basic language and vocabulary skills, to “reading to learn”, or a dependence on those early skills for continued learning (Bub, 2009). In other words, by the end of the 3rd grade children are expected to possess a basic skill level in order to be successful in later grades. In fact, studies have shown that a child’s performance in early grades, along with their levels of early aggression, are among the strongest predictors of whether or not that child will go on to graduate from high school (Alexander, Entwisle, & Kabbani, 2001; Ensminger & Slusarcick, 1992). Because children’s school success is strongly associated with performance in previous grades (McClelland & Hanson, 2001), identifying early environmental factors that can set them up for success is critical. Studies show that across the board, children who exhibit behavior problems are less likely to do well in school, as both externalizing and internalizing behaviors have been shown to inhibit the capacity to learn (Bradley & Corwyn, 2007) and harm the quality student-teacher relationships and hinder academic achievement (Birch & Ladd, 1998; Bub, McCartney, & Willett, 2007). Further, for a select group of children, behavior problems increase in severity as they age, placing them at risk for even greater negative developmental outcomes (Tremblay et al., 2004). In fact, when young children exhibit high levels of behavior problems (e.g., conduct disorder, hyperactivity, aggression), they are more likely to experience persistent conduct problems and poor mental health later in life, and they are at greater risk of having a criminal record (Kratzer & Hodges, 1997). Further, children become increasingly resistant to treatment and intervention as they age (Campbell, Shaw, & Gilliom, 2000). As such, it is critical to identify early predictors of these negative outcomes and intervene to prevent further problems and ensure positive developmental outcomes. A common place for scholars to look in order to better understand early factors that influence the development of child academic and behavior outcomes are parenting behaviors and the parent-child relationship, with specific focus given to distinct domains including maternal sensitivity and enrichment.

Parenting and Attachment

The impact of early parenting on child development is well-documented (Bradley & Corwyn, 2007; Burchinal, Roberts, Ziesel, Hennon, & Hooper, 2006; Hustedt & Raver, 2002; Lorber & Egeland, 2011). Overall, children who experience positive parenting in infancy, such as high levels of sensitivity and responsiveness, low levels of intrusiveness, and high levels of cognitive stimulation perform better in the classroom (Carr & Pike, 2012; Raikes & Thompson, 2008), have more positive relationships with their teachers (McClelland & Cameron, 2011; Pelco & Reed-Victor, 2007), have advanced social skills (Carlo, McGinley, Hayes, Batenhorst, & Wilkinson, 2007), and exhibit fewer behavior problems later in childhood. In a 2006 study, Hirsh-Pasek and Burchinal used longitudinal data from 1,097 infants and their parents and found that high levels of maternal sensitivity at 15 months were associated with improved language and cognitive outcomes in preschool and first grade. Maternal sensitivity is associated with behavioral outcomes as well. For example, children who are exposed to sensitive caregiving have more advanced social skills and fewer problem behaviors compared to children exposed to less ideal care (Crossley & Buckner, 2012). Further, in a recent study using a sample of 1,016 children, Raikes and Thompson (2008) found that maternal sensitivity at 15 and 24 months was positively associated with social problem solving skills, lower levels of negative attribution, less aggression, and fewer internalizing behaviors in preschool (Velderman et al., 2006).

Regular provision of enrichment activities and cognitive stimulation is also associated with positive child outcomes. For example, children whose parents provided regular cognitive stimulation and scaffolding during infancy demonstrated more advanced reading and mathematics scores (Bradley & Corwyn, 2002; Hirsh-Pasek & Burchinal, 2006), as well as fewer externalizing and internalizing behaviors in preschool compared to children who received less stimulation (Hoffman, Crnic, & Baker, 2006). Landry and colleagues (2003) suggest that children who experience more stimulating parenting

are more actively engaged in the learning process. Using a sample of 206 preterm infants, they found that children whose mothers regularly engaged them in developmentally appropriate activities had more advanced language skills at age 8 compared to children with less engaging mothers. This finding held even after accounting for concurrent stimulation (Landry, Smith, & Swank, 2003). Links between parental enrichment and social/behavioral outcomes have also been found. For example, using a sample of 208 preschool-aged children of depressed mothers, Hoffman and colleagues (2006) determined that children who received developmentally appropriate maternal scaffolding (e.g., ensure activity is appropriate for child, encourage child to finish task, make task a positive experience) had significantly fewer externalizing and internalizing behavior problems compared to children whose mothers could not provide such enrichment (Hoffman, Crnic, & Baker, 2006). Finally, there is ample evidence suggesting that children's outcomes are a function not only of direct parenting experiences but also of dyadic interactions between parents and children. In particular, the attachment relationship has been linked to a range of developmental outcomes, including social, behavioral, and academic skills (Goldberg, 2000; Egeland, Sroufe, & Farber, 1985; Sroufe et al., 2005). A central premise of attachment theory is that early relationships provide the foundation for later development (Bowlby, 1969; 1973; Erikson & Sroufe, 1985). Based on caregiver availability and responsiveness, infants organize their behaviors in a proximity-seeking manner to ensure safety and survival and ideally use the caregiver as a secure base to explore their environments (Sroufe & Waters, 1977; Vaughn et al., 2007). These early patterns give rise to later mental representations, or internal working models, of the caregiver, the self, the environment, and relationships (Ainsworth et al., 1978; Bowlby, 1973; Wolfe et al., 2011). Ainsworth and colleagues (1978) identified two major categories of behavioral organization: secure and insecure.

Children who experience sensitive and timely responses in infancy are more likely to become securely attached (Bowlby, 1973; Ainsworth et al., 1978), promoting exploration, growth and

development across social, cognitive, emotional and behavioral domains (Granot & Mayseless, 2001; Raikes & Thompson, 2008; Sroufe et al., 2005). As a result, secure children tend to have more opportunities for SR skill development and are reported to have superior academic, social, and behavioral outcomes later in life (Dotterer & Pungello, 2012; Granot & Mayseless, 2001; Goldberg, 2000; Lyons-Ruth, Easterbrooks, & Davidson, 1997; Raikes & Thompson, 2008; Sroufe et al., 2005). On the other hand, insecurely attached children commonly have a history of inconsistent, harsh, or unresponsive care and explore less due to a preoccupation with caregiver availability (Ainsworth et al., 1978; Kochanska & Kim, 2013; von der Lippe et al., 2010). They often organize behaviors in ways that ensure caregiver availability (e.g., fixating on the caregiver, heightened clinginess or suppressing affect) but this strategy interferes with their ability to explore and learn. Consequently, children with insecure attachment histories often exhibit poorer developmental outcomes. For example, insecurely attached children often have fewer executive capacities and less developed impulse control skills than securely attached children (Goldberg, 2000). Insecurely attached children also demonstrate higher levels of internalizing and externalizing behavior problems (Erickson, Sroufe, & Egeland, 1985; Lyons-Ruth, et al., 1997), and poorer school outcomes (Aviezer, Sagi, Resnick, & Gini, 2002).

Although a great deal is understood regarding the importance of maternal sensitivity, parenting enrichment, and attachment in early childhood, much remains unknown about the developmental pathways through which these early experiences impact later academic achievement and behavior problems. In recent years, scholars have suggested that self-regulation may be a key component in understanding how early experiences influence later outcomes (McClelland & Cameron, 2011; Posner & Rothbart, 2000) In fact, SR has been referred as the “black box” of development (Raver et al., 2011) and experts have called for a closer look at these skills in order to better understand the developmental pathways to later academic and behavioral outcomes. Thus, one goal of the current study is to

investigate the role that self-regulation may play in the relationship between early parenting, attachment, and later academic and behavioral outcomes. For more on attachment see Appendix A.

Self-Regulation

Across the board, studies have shown that more advanced self-regulation skills are associated with more positive social and academic outcomes for children (Birmingham & Bub, under review; Blair, Denham, Kochanoff & Whipple, 2004; Raver et al., 2009; Raver et al., 2011; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). In fact, the ability to self-regulate has been identified as a critical task in the preschool years (Sroufe, 2005). Indeed, children who can plan, self-monitor, and control impulses perform better in the classroom (Miyake et al., 2000; Raver et al., 2011) and exhibit fewer behavior problems (Best, Miller & Naglieri, 2011; Campbell, Shaw, & Gilliom, 2000). These skills become essential during the entrance into formal schooling when children are for the first time expected to monitor and control their own behaviors in the classroom setting, often without constant supervision and assistance (Rueda, Posner, & Rothbart, 2004; Volling et al., 2006). It is not surprising then that children who do not possess adequate SR skills are at higher risk of expulsion, social rejection, and poor academic performance in later grades (McClelland & Cameron, 2007). Despite the undisputed importance of SR skills in child development, the majority of existing studies have focused on regulation as a global construct, overlooking the potentially unique contributions of different domains of self-regulatory capacity including executive functioning (EF) and effortful control (EC; Lan, Legare, Pointz, Li, & Morrison, 2011). For more on self-regulation see Appendix B.

Executive functioning. EF is commonly used to describe cognitive self-regulatory capacities including attention focusing and shifting, planning, problem solving and engaging in goal-directed activities (Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). These skills highlight the cognitive or learning-related processes that children must activate when faced with complex social situations.

Children who have more advanced EF skills have better academic outcomes, in part because they can concentrate, plan, understand, and follow rules associated with learning activities (Raver et al., 2011). In fact, attention focusing and working memory have been linked to better academic outcomes, even after controlling for intelligence (McClelland & Cameron, 2011). Children who performed one standard deviation above average on attention focusing at four years of age were 44% more likely to complete college by the age of 25 (McClelland, Piccanin & Stallings, 2011). Children with high EF skills tend to be motivated to succeed, have a higher level of learning self-efficacy, and greater school engagement in general (Crossley & Buckner, 2012; Pintrich & De Groot, 1990). Scholars argue that the long-term implications of poor EF skills result in an achievement gap that grows as children progress through elementary school (McClelland & Hanson, 2001).

Although the link has not been explored to the degree that academic outcomes have, there is evidence to suggest that EF matters when it comes to behavior problems (Volling et al., 2006). For example, in a recent study that examined various developmental outcomes for a sample of 72 preschool-aged children who were pre-term infants, EF (i.e., planning, working memory, and organization) was significantly associated with higher levels of social competence (assessed with the *Child Behavior Checklist*) (Espy, Sheffield, Wiebe, Clark, & Moehr, 2011). In contrast, children who are unable focus attention and persist in goal-directed activities tend to have higher levels of externalizing and internalizing behaviors (Cosi et al., 2011) and poorer relationships with their teachers and classmates (McClelland & Cameron, 2011; Pelco & Reed-Victor, 2007).

Effortful control. EC has been described as the ability to suppress dominant responses in favor of less salient and more socially appropriate responses (Blair & Razza, 2007; Raver et al., 2011; Rothbart & Ahandi, 1994). In other words, EC reflects one's ability to act in accordance with social expectations. Children who can control impulses are more able to comply with expectations and persist

at difficult tasks, two skills that are essential for learning and performance (McClelland & Cameron, 2011). In fact, in a 2007 study of 310 preschool children, McClelland and colleagues found that behavioral regulation in the fall significantly predicted vocabulary, mathematics, and literacy scores in the spring. Additionally, more rapid increases in behavioral regulation predicted more rapid increases in academic skills (McClelland et al., 2007). In contrast, children who suffer from Attention Deficit Hyperactivity Disorder (ADHD) and other impulse control disorders often experience poor academic outcomes (August & Garfinkel, 1990; Spira & Fischel, 2005) and more negative relationships with teachers (Blair, Denham, Kochanoff, & Whipple, 2004; Raver et al., 2011). Inadequate impulse control is one of the major reasons cited for the high expulsion rate of preschool-aged children (McClelland & Cameron, 2011).

The ability to control impulses is directly related to behavior problems such as hyperactivity, non-compliance, aggression, and disruptive behaviors (Birmingham & Bub, under review; Epsy et al., 2011; Gusdorf, Karreman, van Aiken, Dekovic, & van Tuijl, 2011). In fact, impulsivity is among the most commonly diagnosed disorders in the DSM-IV (American Psychiatric Association, 2000) and often emerges in childhood (Cosi et al., 2011). Although studies have shown a link between impulse control and behavior problems, they tend to focus on older children. Thus, few studies have identified effects of impulse control on behavior problems in younger children (with the exception of ADHD literature). One such study used a sample of children from the National Institute of Child Health and Development (NICHD) Study of Early Child Care and Youth Development (SECCYD) and found that EC skills in preschool significantly predicted both externalizing and internalizing behavior problems in kindergarten (Birmingham & Bub, under review). Clearly EF and EC skills are essential for school success but few studies have examined the potentially unique pathways from EF and EC in preschool to academic and behavior problems later in childhood. Further, although we know that maternal sensitivity

and enrichment both influence the development of these SR skills as well as future academic and behavior outcomes, knowledge about the developmental pathways through which the parenting domains influence later outcomes is limited.

Finally, despite evidence linking early parenting behaviors and later developmental outcomes, less is known about the role that the attachment relationship plays in these associations. Recent evidence suggests that the quality of the attachment relationship accounts for the same amount of variance as parenting in explaining child SR outcomes, and highlights a need for considering the attachment relationship in addition to the effects of parenting on the development of self-regulation (Bernier et al., 2012). Further, recent studies point to a potentially moderating effect of the attachment relationship on child developmental outcomes. For instance, in a sample of 92 kindergartens, Kochanska and colleagues (2009) found that parental power assertion at 15 months predicted antisocial behaviors at age 5 through child oppositional resentment, but that this pathway was only significant for insecurely attached children. Given that a small body of research suggests that attachment security may moderate associations between early experiences and later outcomes (Bergman, Sarkar, Glover, & O'Connor, 2008; Birmingham & Bub, in preparation; Graham & Easterbrooks, 2000; Milan, Snow, & Belay, 2009), it stands to reason that children who are securely attached may gain more from their parenting experiences and subsequently develop better outcomes than do insecurely attached children. Yet, only a handful of studies have examined attachment as a moderator of the relationship between early experiences and self-regulation (e.g., Birmingham & Bub, in preparation; Kochanska, Philbert, & Barry, 2009) and to our knowledge, no one has studied attachment as a moderator of the mediated pathways from early experiences to later academic and behavioral outcomes through EF and EC. Therefore, the second goal of this study was to compare the mediated and indirect pathways from early sensitivity and

enrichment to later academic and behavior problem outcomes through EF and EC for secure versus insecure children to identify whether differences exist across groups.

Control Variables

Several additional variables were controlled for in this study including child sex, race/ethnicity, temperament, family SES, and maternal education. In general, boys experience a more difficult transition into formal schooling, are less able to comply with expectations and adjust to the classroom setting (Pointz, Rimm-Kaufman, Brock, & Nathanson, 2009) and exhibit more externalizing behaviors than girls (Paulussen-Hoogboom et al., 2008; Stacks & Goff, 2004; Tremblay et al., 2004). Additionally, temperament has been linked with multiple developmental outcomes with difficult temperament predicting more negative social, emotional, behavioral, and academic outcomes (Goldsmith, Buss, Plomin, Thomas, Chess & Rothbart, 1987; Thomas & Chess, 1977). Therefore, child temperament will be controlled. Finally, there is evidence to support that ethnicity, socioeconomic status and maternal education are all associated with differential child academic and behavior outcomes (Dotterer, et al., 2012; Friend, Hunter & Fletcher, 2011; Raver et al., 2009). Therefore, these demographic factors were included as controls.

The Current Study

Given the importance of SR in the acquisition of critical academic and behavioral outcomes, more research is needed to understand the role that different domains of SR, specifically EF and EC, play in the development of these skills. Therefore, the first major goal of the current study was to examine separately but simultaneously EF and EC skills in preschool as potential mechanisms through which maternal sensitivity and enrichment in infancy may influence academic and behavior problem outcomes in 3rd grade. Additionally, although ample evidence exists to suggest that attachment in infancy influences the development of academic and behavior outcomes, and that secure and insecure

children have differential SR skills, few studies have examined and compared the direct and indirect links between early parenting, self-regulation, and later developmental outcomes across secure and insecure children. In other words, few studies have considered the possibility that the potentially mediated pathways from early parenting to later developmental outcomes through self-regulation may be moderated by attachment status in infancy. To address these gaps, the following research questions were addressed: (1.) Are the effects of maternal sensitivity and enrichment at 15 months on academic achievement and behavior outcomes in the 3rd grade mediated by child EF and EC skills at 54 months? (2.) Do these pathways differ for children who were classified as secure versus insecure at 15 months?

We hypothesized that the impacts of early maternal sensitivity and enrichment on later academic achievement and behavior problems would be mediated by EF and EC skills in preschool. Specifically, we predicted that children who experience greater levels of cognitive stimulation would develop more advanced EF skills, and these skills would in turn promote better academic outcomes. Similarly, we predicted that sensitivity would be associated with behavior problems through EC. Second, we hypothesized that the mediated pathways would differ based on attachment classification such that children who were insecurely attached would have lower EF skills compared to secure children due to compromises in exploratory behavior and a preoccupation with caregiver availability. These lowered EF capacities would then be associated with later outcomes. On the other hand, we hypothesized that both EF and EC skills would be significant mediators for securely attached children. Namely, higher levels of parenting sensitivity and enrichment will promote the development of more advanced SR skills, which will in turn promote more positive academic and behavior problem outcomes in this group.

Methods

Sample

Data from phases I, II, and III of *The NICHD SECCYD*, a comprehensive, longitudinal study on various aspects of child development, was used for this study. The dataset includes a sample of 1,364 children, their families, teachers, and peers. Information was gathered from 10 locations across the United States: Little Rock, Arkansas; Irvine, California; Lawrence, Kansas; Boston, Massachusetts; Philadelphia, Pennsylvania; Pittsburgh, Pennsylvania; Charlottesville, Virginia; Morganton, North Carolina; Seattle, Washington and Madison, Wisconsin. A total of 8,986 women gave birth during the sampling period and 60% (5,416) of those women agreed to be contacted for a telephone interview (NICHD ECCRN, 2004). Of the women who agreed to participate, 56% (3,015) were selected on the basis of a conditional random sampling plan. By 3rd grade, the sample size was 1,026. Of these, 53% were male, 24% were ethnic minorities, 11% of mothers had not completed high school, 14% were single mothers, and the average family had an income of over three times the poverty threshold (NICHD ECCRN, 2004). Only children who had attachment classification data at 15 months as well as outcome data at 3rd grade were included in this study, bringing the final analytic sample to 902.

It is important to note that there were numerous exclusion criteria for the study including families that intended to move, mothers under the age of 18, infants from multiple births, infants who were born with disabilities, mothers who did not speak English, mothers with medical problems/ substance abuse problems, and families that lived in dangerous neighborhoods. As a result of these exclusion factors, this sample is comprised of relatively low risk individuals and is not nationally representative. Nevertheless, participating families were similar to other families in the catchment areas on typical demographic variables with two exceptions; mothers in the sample were slightly more educated and families had slightly higher income levels.

Procedures

Data collection methods included home and laboratory observations, direct assessments, self-report questionnaires, home interviews, and phone interviews conducted when children were 1, 15, and 54 months old, as well as in the 3rd grade (other assessment points were included but are not relevant to the proposed study). Maternal reports were used to measure child behavior problems and data on academic achievement were gathered through direct assessments. Parenting sensitivity was observed in the home during structured play interactions when children were 15 months old. Parenting enrichment was also observed by research assistants during the home visit at 15 months; in cases where an item was not observed, mothers were asked directly about the presence and/quantity of the item. Child attachment was also measured when children were 15 months old via a laboratory assessment. Executive functioning and effortful control were reported by mothers via questionnaire and by researchers through laboratory observations when children were 54 months old. Finally, family and child demographics were collected at all major assessment points via maternal report.

Measures

Academic achievement. Academic achievement was measured when children were in 3rd grade using two subscales from the *Woodcock Johnson Psycho-Educational Battery-Revised*: Letter-Word Identification and Applied Problems (McGrew, Werder, & Woodcock, 1991; Woodcock, 1990). The Letter-Word Identification subscale is designed to examine a child's ability to match written words with their corresponding pictures. Children are also required to identify individual letters as well as whole words. The Letter-Word Identification task is a valid measure of symbolic learning and reading skills (McGrew, 1993; 1994), with reliability coefficient of $\alpha = 0.84$. The Applied Problems subscale evaluates a child's ability to solve practical problems in mathematics. The task requires recognition and use of common procedures for problem solving. The *Applied Problems* task is a valid measure of analytic

ability and mathematical skills (McGrew & Hessler, 1993; NICHD SECCYD, 2003), with a reliability coefficient of $\alpha=0.81$. Scores from these two subscales were averaged to create a composite of academic achievement in the 3rd grade.

Behavior Problems. Behavior problems were measured when children were in the 3rd grade using *The Child Behavior Checklist 4-18* (CBCL; Achenbach, 1992). The CBCL/4-18 consists of 113 items describing child behavioral and emotional problems. Mothers were asked to report on how well specific statements described their children's behavior within the past 2 months using a three-point Likert scale (*0 = not true, 1 = sometimes true, 2 = very true*; Achenbach, 1992). The total behavior problems composite consists of items from the aggressive behavior, destructive behavior, anxious/depressed, somatic, and withdrawn subscales. Items include: *defiant, hits others, destroys his/her things, argues, threatens others, steals, sad or depressed, is unresponsive to affection, feels worthless, and feels nervous*. T-scores were used and range from a possible 30 to 100, with higher scores indicating more behavior problems. Further, reliability for this subscale was 0.94 (Achenbach, 1992). The CBCL has well-established concurrent and predictive validity and is the most widely used screening instrument for tracking the emergence of behavior problems in children (Achenbach, 1991; Bub et al., 2007).

Key Predictor Variables

Maternal sensitivity. Maternal sensitivity was assessed at 15 months using the *Mother-Child Structured Play Observation Procedure* (Ainsworth, Blehar, Waters, & Wall, 1978; Egeland & Farber, 1984; Fish, 1990). In this procedure mothers and infants were video-recorded in a laboratory setting in 15 minute segments. Mothers were instructed to play with their infants using a series of toys. In the first segment mothers presented their infants with a story book. The second segment involved a toy stove and various props and the third and final segment involved a toy house with figures (McElwain & Booth-

LaForce; 2006; NICHD ECCRN, 1999). Observers coded interactions with a focus on how mothers engaged infants in play, as well as the nature of mothers' responses to child's gestures, expressions, and signals (Ainsworth et al., 1978; Egeland & Farber, 1984). Observations were recorded on a four-point scale (1= *not at all characteristic* to 4 = *highly characteristic*) and a composite was then created by combining the following scales: Sensitivity to non-distress, positive regard for the child, and intrusiveness (reverse-scored). Higher scores indicate more sensitive mothers. This measure has been used to measure parenting sensitivity in many studies (Bradley, 1994; NICHD SECCYD, 2003; Potharst et al., 2013) and has been deemed reliable in this sample ($\alpha = 0.70$).

Parenting enrichment. Parenting enrichment was measured using the *Stimulation of Development Subscale* of the *Home Observation for Measurement of the Environment (HOME) Inventory* (Bradley & Caldwell, 1984). Information on the opportunity for cognitive stimulation in the environment was collected during a home visit when the infant was 15 months old. Items were scored on a scale from zero to four (higher indicating more enrichment) and were averaged to create a composite score of parenting enrichment. Sample items include: *mother provides toys, consciously encourages development, structures play, and reads to child*. This measure has been validated (NICHD SECCYD, 2003; Bradley & Caldwell, 1988) and has a reliability of $\alpha = 0.72$.

Executive functioning. Executive functioning was measured at 54 months using three indices of attention-related behaviors: the Attention Problems subscale of the *Child Behavior Checklist 2/3*, the Memory for Sentences subscale of the *Woodcock-Johnson Revised (WJ-R)*, and the *Continuous Performance Task*. The Attention Problems subscale of the *Child Behavior Checklist* consists of 7 items describing attention focusing problems. Mothers were asked to report on how well specific statements described their child's behavior within the past 2 months using a three-point Likert scale (0 = *not true*, 1 = *sometimes true*, 2 = *very true*; Achenbach, 1992). This subscale consists of items such as *can't*

concentrate, daydreams, confused, nervous, twitches, poor school work, clumsy and stares. T-scores (or standardized scores) were used for the current analyses and range from a possible 50 to 100, with higher scores indicating more behavior problems. The CBCL has well-established concurrent and predictive validity and is the most widely used screening instrument for tracking the emergence of behavior problems in children (Achenbach, 1991; Bub et al., 2007), with a reliability coefficient of $\alpha=0.92$.

The Memory for Sentences subscale from the WJ-R (McGrew, Werder, & Woodcock, 1991; Woodcock, 1990) was designed to examine a child's ability to remember and repeat simple words and phrases. Sentences were presented using a tape player or by the examiner. This subscale is a test of short-term memory. Possible standardized scores for this task range from 17 to 142, with scores above 100 indicating higher than average abilities. The Memory for Sentences task is a valid measure of short-term memory (Woodcock & Johnson, 1989; 1990; NICHD SECCYD, 2003), with a reliability coefficient of $\alpha = 0.82$.

The *Continuous Performance Task* is a laboratory procedure that involves showing the child a series of familiar pictures (e.g., butterfly, fish, flower) along with a critical stimulus picture (a chair). The number of times the child's attention waivered and needed to be refocused on the task while remaining seated and the number of times the child completely walked away were calculated. These two indicators were averaged to create a single measure a child's ability to focus attention, concentrate, and stay on task in a laboratory setting. *The Continuous Performance Task* has been widely used to measure child cognitive executive functioning/attention skills (Barkley, 1994; Halperin, Sharma, Greenblatt, & Schwartz, 1991; Jahromi & Stifer, 2008; Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991). Observed scores from the CBCL attention problems subscale, the WJ-R memory for sentences subscale and *The Continuous Performance Task* will be used to create a single latent construct of executive functioning.

Effortful control. Effortful control was measured using at 54 months using two measures: the Inhibitory Control subscale from the *Child Behavior Questionnaire* (CBQ; Rothbart, Ahadi & Hershey, 1994; Rothbart, Ahadir, Hershey & Fisher, 2001) and the Self-Control subscale from the *Social Skills Rating System* (Gresham & Elliot, 1990; NICHD ECCRN, 2003). The Inhibitory Control subscale reflects how well a child can delay impulses. Mothers were asked to report on characteristics of their child in the past 6 months using a seven-point likert scale (1= *extremely untrue* to 7 = *extremely true*). This subscale includes items such as *child can't wait before entering into new activity*, *child easily stops activity when told to*, and *child is able to resist temptation*. Responses to items were summed (with several items reverse scored) and higher scores indicate more advanced EC skills. This subscale has been used to measure impulse control in preschool-aged children in previous studies (Cohen, MacWhinney, Flatt, & Provost, 1993; Clark et al., 2002; Langua, 2002; Raver et al., 2011) and demonstrates good reliability in this sample ($\alpha = 0.75$).

The Self Control subscale of the SSRS was measured when children were 54 months old and reflects how well a child can control their impulses, specifically in social situations. Mothers were asked to report how often items represented their child using a three-point likert scale (0 = *never*, 1 = *sometimes*, 2 = *very often*). This subscale includes items such as: *controls temper when arguing*, *follows instructions* and *responds appropriately when hit or pushed*. Responses to items were summed (with several items reverse scored) and higher scores indicate more advanced self-control skills. This subscale has been used to measure impulse control in preschool-aged children in previous studies (Gresham & Elliot, 1990; NICHD ECCRN, 2003) and demonstrates good reliability in this sample ($\alpha = 0.78$).

Child attachment. Child attachment style was measured using a modified version of Ainsworth's *Strange Situation Paradigm* (Ainsworth et al., 1978; Cassidy et al., 1992) at 15 months. Child behavior was observed in a playroom setting during a sequence of events. For the first three

minutes of the session the mother played with the child. Following a knock at the door, a stranger would enter the room and talk with the mother for one minute. After an additional two minutes the mother would leave the child alone with the stranger for 3 minutes. The child's behavior while alone, as well as when reunited with his/her mother was observed. The mother then returned to the child for a final reunion, lasting 3 minutes. The child's behavior during the mother-child interaction, as well as the reaction to absence of the mother and reunification with their mother was observed and coded. Children were classified as avoidant (category A), secure (category B), resistant (category C) or disorganized (Category D). The Strange Situation is a widely used measure of child attachment (Cassidy, Berlin, & Belsky, 1991; Cicchetti & Barnett, 1991; Sroufe et al., 2005). Inter-rater reliabilities for this categorical variable were 84%. For a complete description of the Strange Situation procedure see Appendix B.

Control Variables

Child temperament. Child temperament was measured using the *Early Infant Temperament Questionnaire* when the child was 1 month old (Medoff-Cooper, Carey & McDevitt, 1993). Mothers completed the questionnaire consisting of 57 items that tapped into different domains of child behavior including activity, approach, adaptability, mood and intensity. Items were rated on a 6 point scale ranging from "almost never" to "almost always" in describing their children. A total composite score that measured infant temperament on a continuous scale with higher scores indicating more difficult temperaments, mid-range scores average, and lower scores more easy temperaments (Carey & McDevitt, 1978; McDonnell & Beck, 2001; Sakamura, Dang, Ballard & Hansen, 2008). This scale has shown adequate reliability ($\alpha = 0.74$), (NICHD, Phase I instrumentation) and has good internal consistency (Goyal, Gay & Lee, 2009; Hall, Wilson & Frankenfield, 2003; Medoff-Cooper, 1995).

Child gender. Information on child gender was collected when children were one month old. A dummy variable was created that assigned a value of 0 to females and 1 to males.

Race/ethnicity. Information on child race/ethnicity was collected when children were one month old. A series of dummy variables was created, reflecting White/Non-Hispanic, African American, Hispanic, and Other.

Socioeconomic status. Socioeconomic Status was measured using the family income-to-needs ratio when children were 15-months of age. The income-to-needs ratio is computed by taking family income, not including federal aid, and dividing this by the federal poverty threshold for the appropriate family size (US Bureau of the Census, 1999). Families in this sample had highly stable income-to-needs ratios across time ($r = 0.74$) and thus only the 15-month value was used this study.

Maternal education. Maternal reports of the number of years of education were collected when the child was one month of age.

Site. A set of nine dummy variables representing the ten data collection sites will also be included in all analyses.

Data Analysis Plan

Means and standard deviations were obtained for all outcome and predictor variables. Each variable was examined for skewness and kurtosis. Inter-correlations were also examined to identify the strength and direction of the association between predictor and outcome variables. To investigate whether the effects of maternal sensitivity and enrichment at 15 months predicted academic achievement and behavior problems in 3rd grade through EF and/or EC at 54 months (Research Question 1), a series of structural equation models were fitted. The first set of models tested the direct effects of the parenting variables (i.e., maternal sensitivity and enrichment) on the mediators (i.e., EF and EC) and the outcomes (i.e., academic achievement and behavior problems in 3rd grade). Next, we fit a model that examined the direct effects of EF and EC on academic achievement and behavior problems. Finally, a model that contained all pathways concurrently was fitted. To investigate whether there was evidence of mediation,

we compared the path coefficients from maternal sensitivity and enrichment to academic achievement and behavior problems from the model in which EF and EC were not included, to the same path coefficients from the model in which EF and EC were included. When the path coefficients declined or became non-significant, partial or full mediation was indicated. For models that met all of the necessary criteria for mediation (i.e., direct effects from the predictors and mediators to the outcome as well as direct effects from the predictors to the mediators) as outlined by Baron and Kenney (1986), we calculated a Sobel's Z score to determine whether the mediation was statistically significant (see Appendix C for formula used).

To address our second research question of whether the indirect or mediated pathways from early parenting to later child outcomes through EF and EC differed for children who were classified as secure versus insecure at 15 months (i.e., moderated mediation), a series of multi-group models were fitted. More specifically, we compared a model that allowed all pathways and factor loadings to be freely estimated across attachment relationships (indicating group differences) with a model that constrained all pathways and factor loadings to be equal (indicating no group differences). When the freely estimated model provided the better fit to the data, indicating there was moderation, pathways of interest were fixed and freed systematically to identify where specifically, the group differences existed. For all models, a common set of control variables was included on academic achievement and behavior problem outcomes including: child gender, race, and temperament, as well as family SES and maternal education. Models were fit in MPlus version 6. Missing data on all predictors were handled using full information maximum likelihood and model fit was assessed using the Chi-Square (with non-significant values indicating good fit), Comparative Fit Index (CFI; with values greater than .90 indicating good fit), and Root Mean Square Error of Approximation (RMSEA; with values less than .10 indicating good fit) indices.

Results

Descriptive statistics for all variables can be found in Table 4. Correlations among outcome, predictor, and observed indicators for mediating variables (i.e., EF and EC) can be found in Table 5. Children had somewhat higher than average academic achievement scores in 3rd grade ($M= 112.6$ out of a possible 142). Children also demonstrated average levels of behavior problems in 3rd grade ($M= 47.6$ out of a possible 78), with scores were well below the clinical range. Means for indicators of executive functioning suggest that EF levels were fairly high. Average inhibitory control scores were 4.66 out of 7 and self-control scores were 12.96 out of 20, suggesting that children in this sample had also had relatively high EC skills at 54 months. Average maternal sensitivity and enrichment scores at 15 months were also high, suggesting that parenting quality in this sample was quite good. Of the analytic sample, 562 (62%) children were classified as securely attached and 340 (38%) were classified as insecurely attached at 15 months. Correlations among academic achievement, behavior problems, maternal sensitivity, and enrichment were significant, moderate, and in the expected direction, ranging from -0.17 to 0.32. All observed indicators of EF and EC were mildly correlated in the expected direction with both domains of parenting, as well as with academic achievement and behavior problems. Interestingly, attachment status (secure/insecure) was only significantly correlated with the Continuous Performance Task, an indicator of executive functioning ($0.074, p<0.05$). No other statistically significant correlations were found.

EF and EC as Mediators between Early Parenting and Later Outcomes

In order to investigate whether the associations between maternal sensitivity and parenting enrichment assessed at 15 months and academic achievement and behavior problems assessed in 3rd grade were mediated by EF and EC assessed in preschool, we first fit a set of direct effects models to verify that all criteria for mediation were present (i.e., direct effects of parenting on 3rd grade outcomes,

direct effects of parenting on SR, and direct effects of SR on 3rd grade outcomes). Parameter estimates and goodness of fit statistics from these models can be found in Table 6. Controlling for child and family demographics (i.e., child gender, ethnicity, and temperament, family SES, and maternal education), as well as the concurrent effects of parenting enrichment, maternal sensitivity at 15 months was not significantly associated with either academic achievement or behavior problems in the 3rd grade (see Table 6, Model 1). In contrast, parenting enrichment predicted both academic achievement and behavior problems such that children who experienced higher levels of enrichment at 15 months had higher academic achievement scores and fewer behavior problems in the 3rd grade. Next, we examined the direct pathways from EF and EC at 54 months to academic achievement and behavior problems in the 3rd grade (see Table 6, Model 2). EF significantly predicted both academic achievement and behavior problems such that children who exhibited greater levels of EF had higher achievement scores and fewer behavior problems in the 3rd grade compared to children with poorer EF skills in preschool. Additionally, EC was significantly associated with behavior problems such that children who demonstrated higher EC skills in preschool had lower behavior problems in the 3rd grade. Interestingly, however, EC was not related to academic achievement in the 3rd grade. Finally, both maternal sensitivity and parenting enrichment at 15 months positively predicted EF and EC in preschool (see Table 6, Model 3).

To test for mediation, we fit a fourth model that contained all twelve direct pathways of interest (i.e., the eight pathways from maternal sensitivity and enrichment to EF, EC, academic achievement, and behavior problems as well as the four pathways from EF and EC to academic achievement and behavior problems). When mediation was evident, we also calculated Sobel's Z-scores. Because maternal sensitivity was not directly associated with children's 3rd grade outcomes, and EC did not predict academic achievement, and thus does not meet the first requirement for mediation, we can only

test mediation for three of the eight possible mediated pathways (1) from parenting enrichment through EF to academic achievement (2) from parenting enrichment through EF to behavior problems and (3) from parenting enrichment through EC to behavior problems. Parameter estimates and fit statistics from this model are presented in Table 6 (Model 4). In addition, statistically significant direct effects are depicted in the path model in Figure 2. With one exception, the pattern of direct effects that were identified in Models 1 through 3 (and described above) held in the model containing all pathways. Specifically, in the full model, the pathway from parenting enrichment to academic achievement became non-significant when compared with the model that included only the direct pathways from parenting to 3rd grade outcomes (Model 1), suggesting the possibility of full mediation. The Sobel's *Z*-statistic indicated that EF skills at 54 months significantly mediated the association between early enrichment and later academic outcomes ($Z = 3.16, p < 0.001$). The direct pathway from parenting enrichment to behavior problems remained statistically significant (i.e., higher levels of enrichment predicted fewer behavior problems) and did not decline, suggesting that EF and EC do not mediate this association.

Although only one pathway indicated full mediation, we also estimated indirect effects for all eight pathways from parenting to 3rd grade outcomes through self-regulation (see Table 6, Model 4). Results suggest that although sensitivity did not significantly predict child outcomes directly, the indirect pathways through EF were statistically significant. That is, higher maternal sensitivity was associated with higher EF skills, which in turn predicted better academic achievement (Indirect effect = 1.107, $p < .001$) and fewer behavior problems (Indirect effect = 0.952, $p < 0.01$). Maternal sensitivity was also associated with child behavior problems indirectly through EC (Indirect effect = -0.234, $p < .01$). There was no significant indirect pathway through EC to achievement. Parenting enrichment was also indirectly associated with academic achievement (Indirect effect = 1.942, $p < .001$) and behavior problems (Indirect effect = -1.818, $p < .001$) through child EF at 54 months. In other words, children

who experienced more enrichment at 15 months demonstrated higher EF skills in preschool and these skills promoted better academic outcomes and fewer behavior problems in the 3rd grade. Effortful control did not serve a mechanism in predicting academic outcomes for children, regardless of early parenting experiences. For a depiction of all indirect pathways to academic achievement and behavior problems see Figure 6 in Appendix C.

Do these associations differ by child attachment classification at 15 months?

To test the hypothesis that the indirect and mediated pathways from maternal sensitivity and enrichment at 15 months to child academic achievement and behavior problems in the 3rd grade through EF and EC differed by attachment classification in infancy (i.e., whether there was moderated mediation), a series of multi-group structural equation models were fitted. First, we re-fit the model presented in Figure 1 but allowed all of the pathways of interest and factor loadings to differ across attachment classification. In other words, we simultaneously estimated separate models for the secure and insecure children in the sample. We then fit a model in which all parameters were fixed and equal across groups (i.e., secure and insecure children). A comparison of fit statistics between these models allowed us to test the null hypothesis that there were no differences in this path model across attachment classifications. The X^2 statistic from the fully unconstrained model ($X^2 = 673.43$) was compared to that of the fully constrained model ($X^2 = 731.00$) and a significant difference ($\Delta X^2 = 57.57, p = 0.05$) suggested that there were, in fact, model differences for secure and insecure children. In other words, there was evidence of moderation. Thus, we fit several additional models to determine where those differences were.

We began by freely estimating the direct pathways from maternal sensitivity, enrichment, EF, and EC to academic achievement and behavior problems, as well as from parenting to EF and EC. Factor loadings for the latent constructs and the control variable effects were fixed to be equal across

attachment groups. Results are presented in Table 7, Models 1, 2, and 3 for secure children and Models 5, 6, and 7 for insecure children. Several findings are noteworthy. First, although enrichment significantly predicted academic achievement for both secure and insecure children, the effect was stronger for insecure children, suggesting that they may benefit more from enrichment behaviors than their secure peers. Interestingly, enrichment was also associated with behavior problems for secure children but not for insecure children. Direct effects for self-regulatory skills also differed somewhat by attachment group. Children with better EF skills demonstrated greater academic achievement and fewer behavior problems, regardless of their attachment status, although the effects were again considerably larger for insecure children (see Table 7, Models 2 and 6). EC, on the other hand, predicted academic achievement for insecure children but not for secure children. Further, children with higher EC in preschool exhibited fewer behavior problems in third grade, with the effects being nearly twice as large for secure children as insecure children. Finally, maternal sensitivity and parenting enrichment were positively associated with EF and EC for secure and insecure children, with one exception: for secure children, maternal sensitivity was not related to their EC skills (see Table 7, Model 3).

Next, we fit a model in which all of the direct and indirect pathways of interest were freely estimated across attachment groups (the factor loadings and control variable effects remained fixed). A comparison of model fit from this model ($X^2 = 683.79$) to the fully constrained model ($X^2 = 731$) indicated that allowing the direct and indirect paths from sensitivity and enrichment to academic achievement and behavior problems to differ across attachment groups offered a significant improvement in model fit ($\Delta X^2 = 45.21, p < 0.001$) providing further support for moderation. Importantly, this model did not differ from the fully unconstrained model, suggesting that fixing the control variables and factor loadings to be equal across groups (and thus fitting a more parsimonious model) did not harm our model fit. To confirm that group differences were not due to the control variables, we fit one final

model in which the statistically significant control variables (i.e., child race and maternal education) were freely estimated across groups. This model did not offer a significant improvement over the previous model, indicating that group differences are in the direct and indirect pathways not the control variables. Parameter estimates and goodness of fit statistics from these models can be found in Table 7 (Models 4 and 8). All significant indirect pathways for the secure attachment group can be found in Figure 3, and pathways for the insecure attachment group in Figure 4.

Controlling for child and family demographics, children who experienced higher levels of enrichment demonstrated better academic achievement but only when they were securely attached (see Model 4). No other significant associations between parenting domains and children's 3rd grade outcomes were found. Note that when all direct pathways were included in the model, the significant effects of parenting enrichment on academic achievement for insecure children (see Model 8) and on behavior problems for secure children (see Model 4) became non-significant, suggesting mediation. We calculated Sobel's Z-statistics and found evidence of significant mediation for the effects of parental enrichment on behavior problems through EC ($Z = -2.37, p < 0.001$) for secure children. Two other findings from the full model are noteworthy. First, for secure children the pattern of findings examining the associations between EF and EC and 3rd grade outcomes were no different in the full model (Model 4) than in the direct effects only model (see Model 2). Second, for insecure children, the associations between EC and both academic achievement and behavior problems became non-significant in the full model (see Model 8). That is, controlling for the effects of parenting on children's EF and EC as well as their 3rd grade outcomes, EC was no longer associated with academic achievement or behavior problems.

In addition to estimating the direct effects for both attachment groups, we also estimated the indirect effects. Several indirect pathways emerged for securely attached children. First, maternal

sensitivity predicted both academic achievement (Indirect effect = 0.93 , $p < .05$) and behavior problems (Indirect effect = -0.84 , $p < .05$) through EF skills. Additionally, parental enrichment predicted both academic achievement (Indirect effect = 2.21 , $p < .001$) and behavior problems (Indirect effect = -1.99 , $p < .05$) through EF skills as well. Three indirect pathways emerged for insecurely attached children. Maternal sensitivity predicted both academic achievement (Indirect effect = 0.96 , $p < .05$) and behavior problems (Indirect effect = -1.58 , $p < .05$) through EF. Additionally, parental enrichment predicted behavior problems (Indirect effect = -1.54 , $p < .05$) through EF skills as well. There were no mediated pathways for insecure children and EC did not serve as a mechanism through which later outcomes developed.

Discussion

Parenting has long been established as an important predictor of child outcomes, including academic achievement and behavior problems. There is strong consensus that multiple domains of parenting, including sensitivity and enrichment promote positive developmental outcomes. Despite this fact, relatively few studies consider simultaneously the influences of multiple domains of parenting in infancy when examining outcomes later in childhood (Cole et al., 2008; Mize & Pettit, 1997). Further, experts are moving in the direction of looking beyond direct impacts of parenting to examine mechanisms that might explain how early experiences are related to later development. One such mechanism is self-regulation (Posner & Rothbart, 2000; Raver et al., 2011). Finally, although research has demonstrated that children's outcomes are a function not only of direct parenting experiences but also of dyadic interactions between parents and children, only a handful of studies have examined the attachment relationship as a moderator of the relationship between early parenting and later outcomes (Graham & Easterbrooks, 2000; Kochanska & Kim, 2013; Milan et al., 2009). To begin to address these gaps, we examined two domains of SR in preschool, EF and EC, as potential mediators of the

associations between maternal sensitivity and enrichment in infancy and academic achievement and behavior problems in the 3rd grade. Importantly, operating within an attachment framework, we investigated the possibility that indirect or mediated pathways from early parenting to later outcomes through SR skills differed across infant attachment statuses.

Self-Regulation as a Developmental Mechanism

We began by examining whether EF and EC mediated the pathways from maternal sensitivity and enrichment in infancy to academic achievement and behavior problems in the 3rd grade. We found evidence of both mediation and indirect effects. More specifically, the pathway from maternal enrichment to academic achievement was fully mediated by EF. That is, children who experienced more enrichment behaviors in infancy developed significantly higher EF skills in preschool and these skills in turn predicted better academic outcomes in 3rd grade. Although the direct pathway from enrichment to academic achievement is well established (Carr & Pike, 2012; Pointz, McClelland, Matthews, & Morrison, 2009; Lan, Legare, Pointz, Li, & Morrison, 2010) and studies have shown that the cognitive capacities associated with EF skills (i.e., attention focusing, planning and working memory) are directly related to school performance (McClelland & Cameron, 2011; Volling et al., 2006), our identification of a mediated pathway is relatively novel. One study that has investigated self-regulation as a mediator used a sample of 291 kindergarten-aged children and found that cognitive self-control (i.e., concentrating, staying on task, and distractibility) mediated the effects of preschool aggression and social withdrawal, on academic achievement (Normandeau & Guay, 1998). To our knowledge, however, no other study has investigated a similar mediated pathway. Thus, our paper offers important insight into how early parenting may influence later outcomes and suggests that parenting programs that offer strategies for cognitive stimulation may be particularly beneficial to children at risk for academic failure.

Several indirect pathways through EF emerged as well. For example, early sensitivity influenced both academic and behavior problems in 3rd grade through EF skills in preschool. That is, higher sensitivity was associated with enhanced EF skills and subsequently with better academic achievement and fewer behavior problems. Importantly, higher levels of enrichment in infancy were associated with better EF in preschool, which in turn predicted fewer behavior problems in third grade. The direct links between parenting are relatively well established. Indeed, previous studies have linked early sensitivity to the development of EF skills, with more sensitive mothers promoting higher child EF skills (Carr & Pike, 2012; Schroeder & Kelley, 2010). The link between early enrichment behaviors and the EF skills has also been established (Bernier, Carlson, Deschane, & Matte-Gagne, 2011; Hustedt & Raver, 2002), with maternal scaffolding promoting a variety of cognitive capacities including working memory, the ability to shift attention, plan and organize (Schroeder & Kelley, 2010). Further, children with higher EF skills tend to do better in school (Raver et al., 2008; Willoughby, Blair, Wirth, & Greenberg, 2012) and exhibit fewer behavior problems (McClelland & Morrison, 2003). Indeed, learning-related skills including the ability to stay on task, listen and follow directions are key in preventing behavior problems in young children (Cooper & Farran, 1991; McClelland & Morrison, 2003).

Although these direct links are well established, the indirect pathways from maternal sensitivity and enrichment to academic and behavioral outcomes through EF has not been identified before. These findings have important implications for practice, as studies have shown that specific intervention programs that target EF skills improve academic performance, increase learning motivation and reduce behavior problems (Raver et al., 2008). Therefore, programs that support parenting practices and behaviors that are especially relevant for EF early in life may offer an important means for improving the social and academic outcomes of children at risk for poor outcomes.

Maternal sensitivity also influenced behavior problems through EC. That is, children who experienced higher maternal sensitivity in infancy displayed more advanced self-control skills in preschool, which predicted fewer behavior problems in 3rd grade. Both direct pathways have been supported in the literature, as maternal sensitivity has been positively linked to EC skills (self-control, compliance) and EC skills have been associated with behavior problems. For example, a 2011 study by Von Suchodoletz and colleagues used a sample of 102 kindergarten children and determined that high levels of warmth and low levels of intrusiveness promoted child internalization of rules of conduct and behavior regulation (Von Suchodoletz, Trommsdorff, & Heikamp, 2011). Sroufe and colleagues (1996) have long asserted Kopp's (1982) notion that early regulation of emotions and behaviors is dependent on early parenting experiences. A dyadic process has been described in which the infant gradually learns to manage high levels of emotions and behaviors. That is, an infant is born completely reliant upon their caregiver to help sooth high levels of arousal. The infant will grow in the context of care and responsiveness, and will increasingly participate in the co-regulation of their emotions and behaviors, relying on their caregiver especially when overwhelmed. Gradually, the young child will become more autonomous, managing most of their internal states and behaviors on their own. The success of navigating this new autonomy is highly related to the nature of early care and interaction between the caregiver and child (Calkins, 2011; Kopp, 1982; Sroufe, 1995; Sroufe, 2005). Because self-control skills are required during times of high emotionality and frustration, our findings offer further support for the importance of early sensitivity in the development later behaviors. Programs that strengthen parental sensitivity may not only directly benefit children's EC but they may ultimately reduce the risk of behavior problems and thus improve learning outcomes.

Differential Pathways by Attachment Status

The second aim of this paper was to investigate whether attachment status moderated the mediated pathway from early parenting to later outcomes through EF and EC. Several findings are particularly noteworthy. First, parental enrichment behaviors differentially predicted child outcomes for secure and insecure children. That is, for children who were securely attached, the influence of maternal enrichment in infancy on child behavior problems in 3rd grade was fully mediated by child EC skills. Children who were securely attached in infancy and who were exposed to more enrichment behaviors developed higher EC skills, which then predicted fewer behavior problems. One explanation for this finding is that enrichment behaviors positively influence EC skills for secure children because the enrichment behaviors they experience are of higher quality and more sensitive in general (compared to those experienced by insecurely attached children). The incorporation of sensitive parenting styles into enrichment behaviors has been addressed in the literature, a term referred to as Contingent Shifting (Carr & Pike, 2012). Contingent shifting refers to a specific approach to scaffolding in which the parent is able to gauge their child's changing needs and adjust behaviors accordingly. Parents who are able to practice contingent shifting are more likely to be in touch with their child's developmental capacities and able to adjust their scaffolding approaches as need arises (Carr & Pike, 2012; Evans, Moretti, Shaw, & Fox, 2010). The benefits of such an approach are clear and parents of securely attached children are significantly more likely to use contingent shifting during enrichment activities (van der Lippe et al., 2010). They are also less likely to be controlling or intrusive and their children are more likely to develop fewer externalizing and internalizing behavior problems (Carr & Pike, 2012; Karaman, van Tuijl, van Aiken, & Dekovic, 2006). Thus, it may not be surprising that secure children are able to develop more advanced self-regulatory capacities, including emotional and behavioral self-control, because their caregivers tend to be more emotionally available during cognitively stimulating

interactions, modeling and helping to regulate emotions and behavior in distressing situations (Kopp, 1982; Karreman et al., 2006; Sroufe, 1996). For example, using a sample of 731 preschool-aged children, Hardaway and colleagues (2012) found that positive behavior support (observed guidance and encouragement with tasks) at age 3 predicted fewer behavior problems at age 5 through improvements in impulse control at age 4. Finally, studies have shown that mothers of securely attached children engage in scaffolding behaviors that are positive, non-intrusive, and that emphasize autonomy development (van der Lippe et al., 2010). In contrast, mothers of insecurely attached children tend to use more punitive, non-encouraging and directive techniques in their enrichment behaviors. Therefore, it is possible that secure children benefit more from enrichment behaviors due to the use of developmentally appropriate and hands-on cognitive stimulation (van der Lippe et al., 2010).

Contrary to expectation, maternal sensitivity was not directly related to academic achievement or behavior problems in our full model. There was, however, an indirect effect of maternal sensitivity through EF skills in preschool for both attachment groups. That is, for secure and insecure children, experiencing higher levels of maternal sensitivity was associated with more advanced EF skills, which promoted better academic outcomes and fewer behavior problems. Thus, it seems that early maternal sensitivity continues to influence children's academic and behavioral outcomes by fostering EF. The lack of direct effects of sensitivity in infancy on later outcomes has been found before (Bradley & Corwyn, 2007). For instance, in a 2007 study by Bradley and Corwyn, maternal sensitivity and harshness in infancy did not directly predict behavior problems in the 5th grade. However, these aspects of parenting did predict behavior problems indirectly through later self-regulation skills. There are many additional factors, including later parenting and subsequent changes in the attachment bond (not to mention other concurrent attachment relationships) that may influence developmental trajectories as children age. Thus, although sensitivity continues to be an important influence on children's

development, that influence may be overshadowed by other factors as children get older. Nevertheless, this finding adds to the growing body of literature that highlights the importance of sensitivity in promoting skills that will enhance child outcomes (Bradley & Corwyn, 2007; Hardaway et al., 2011; Sroufe et al., 2005).

Interestingly, there were two additional indirect pathways from enrichment behaviors to academic achievement for secure but not insecure children. That is, children who were securely attached in infancy and who experienced more enrichment behaviors had higher EF skills and as a result, better academic outcomes and fewer behavior problems. Given that enrichment behaviors are strongly associated with the development of cognitive skills, and that insecure children assume behavioral organization patterns that devote considerable cognitive resources to focusing on caregiver availability and proximity-seeking, it is not surprising that more pathways from enrichment emerged for securely attached children. Arguably, this pattern of behavioral organization, found in both resistant and avoidant children (the former hyper-vigilant and the latter suppressing or minimizing attachment behaviors), inhibits the exploratory system and reduces skill development opportunities (Ainsworth et al., 1978; von der Lippe et al., 2010).

In sum, our findings suggest that the indirect effects of early parenting on later outcomes are more salient for secure children than for insecure children. This is especially true for maternal enrichment and for the development of EC skills. Given that insecure children tend to be far more preoccupied with caregiver availability and experience less optimal care, it is likely that they benefit less from sensitivity and enrichment behaviors (Goldberg, 2000; Whipple et al., 2010). Nevertheless, these findings have important implications for prevention and intervention programs. Programs that focus not only on improving parenting sensitivity but also on promoting enrichment behaviors that are developmentally appropriate and of higher quality may offer greater benefits, especially to securely

attached children. Intervention approaches for the securely attached would benefit by targeting enhancement of both EF and EC skills in order to promote positive academic and behavior outcomes. On the other hand, for insecurely attached children programs that focus on sensitivity and the promotion of exploration may be of particular use. Also of use for insecurely attached children would be programs that focus specifically on building EC skills. Perhaps by helping mothers become aware of their own abilities and limitations in managing emotions and frustrations we can promote positive co-regulation in infancy, and subsequently enhance EC skills before at-risk children enter preschool.

Study Contributions

The current study offers several substantial contributions to our understanding of the interplay between parenting, child attachment, self-regulation and child developmental outcomes. First, because the majority of studies that focus on parenting focus on single construct, such as “quality” or “positive parenting”, previous knowledge concerning the potentially unique influences of parenting has been limited. By examining maternal sensitivity and enrichment separately but simultaneously we were able to identify that enrichment behaviors in infancy have a particularly powerful and long-lasting impact on child developmental outcomes. In contrast, maternal sensitivity does not appear to have a lasting direct effect on child outcomes in 3rd grade. We did, however, identify indirect effects of both parenting domains. To our knowledge, this is one of the first studies to identify indirect effects of these parenting behaviors and practices measured in infancy through self-regulation measured in preschool on academic and behavioral outcomes measured in 3rd grade.

Second, by examining EF and EC separately we were able to highlight the differential roles of two related domains of self-regulation in predicting academic and behavior outcomes in third grade. More specifically, we found that while EF was only related to academic achievement, EC was related to both achievement and behavior problems. Additionally, EF and EC do indeed serve as developmental

mechanisms to explain how early parenting influences later academic and behavioral outcomes. This was especially so for EF, which was instrumental in multiple domains. That is, sensitivity and enrichment both predicted academic and behavior outcomes indirectly through EF skills. Again, no other study to our knowledge has investigated EF and EC as separate but related mechanisms through which parenting is related to later outcomes.

A third contribution of the current study was the comparison of developmental pathways for children who were securely versus insecurely attached in infancy. Examining the differing indirect pathways across these groups enabled us to identify differential effects of parenting sensitivity and enrichment for secure versus insecure children. Namely, we learned that while securely attached children benefit from early parenting through both EF and EC skill development in preschool, EC was not a mechanism for insecure children. This information provides powerful insight into how differential outcomes may develop for secure versus insecure children and highlights specific skills that can be targeted in order to improve developmental outcomes for children, regardless of their attachment relationship.

Limitations and Future Directions

Although this study contributes to our knowledge concerning early parenting, SR and later academic and behavior outcomes, there are still several limitations that must be addressed. The greatest limitation is reliance on maternal report measures for SR skills (specifically for EC). Using the same reporter not only increases the risk of mono-reporter bias, but in the case of SR skills it limits our ability to gain a more objective picture of these skills in preschool. Future studies will benefit from incorporating more established and objective measures of both EF and EC.

A second potential limitation has to do with our measurement of attachment at one time period. Despite using what has been referred to as “the gold standard” of attachment behavior classification

infancy (Ainsworth's strange situation). That is, Bowlby and others have clearly conceptualized child attachment as a relational and not a stable construct. As such, it is possible that attachment status changes in later years. Although studies have shown that attachment tends to be more stable in low-risk samples, this is still a possibility. Therefore, a next step will be to combine measures of attachment at later ages to account for the potential change in this relationship over time. Further, it is important to consider that attachment behaviors, and the mental representations that will arise later in childhood, are unique to the dyadic relationship. As such, children experience multiple attachment relationships and all are likely to influence cognitive and behavioral development. Thus, a valuable next step will be to consider alternate attachment relationships, such as the father-child bond.

A final limitation was our use of a normative sample to predict academic and behavior outcomes from early parenting in children who were secure and insecurely attached. That is, the exclusion criteria for the NICHD SECCYD substantially reduced many contextual risk factors that have been identified as predictors of insecure attachment (such as less education/awareness of developmental expectations, lower parental support, maltreatment, poverty and high levels of stress). Thus, our ability to detect differential pathways in the effects of parenting behaviors, especially sensitivity, may have been somewhat limited. It is worth noting that 38% of the sample was classified as insecure despite the limited risk factors, aligning with average rates of insecure attachment. Nevertheless, the generalizability of the study is limited. Therefore, additional studies using both clinical and normative samples, as well as nationally representative samples, are needed to better understand the role of parenting sensitivity and enrichment on the development of EF and EC for children from all backgrounds.

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	Mean	SD	Range
<i>Outcome Variables</i>			
Academic Achievement 3 rd Grade	112.6	13.24	0-143
Behavior Problems 3 rd Grade	47.39	10.31	0-78
<i>Predictor/Mediator Variables</i>			
Parenting Sensitivity	9.46	1.58	0-12
Parenting Enrichment	6.96	1.41	0-8
<i>Observed indicators EC</i>			
Inhibitory Control	4.66	0.78	0-7
Self-Control	12.96	3.10	0-20
<i>Observed indicators EF</i>			
Attention Problems	2.71	2.39	0-14
Memory	91.94	18.34	0-142
Continuous Performance	32.83	8.36	0-44
<i>Control Variables</i>			
Child Sex	0.49	0.5	0-1
Child Temperament	2.47	0.43	1-3
White	0.81	0.38	0-1
Black	0.02	0.32	0-1
Hispanic	0.06	0.23	0-1
Income to Needs Ratio	3.70	3.14	0-36
Maternal Education	14.46	2.41	7-21

Table 4.

Descriptive Statistics for all Outcome, Predictor, Mediator and Control Variables.

	1	2	3	4	5	6	7	8	9	10
1. Achievement	1									
2. Behavior Probs.	-.195**	1								
3. Sensitivity	.243**	-.137**	1							
4. Enrichment	.324**	-.170**	.322**	1						
5. Attachment	.009	-.006	.045	.023	1					
6. Self-Control	.190**	-.320**	.164**	.230**	.042	1				
7. Inhibitory Control	.191**	-.332**	.158**	.177**	.005	.626**	1			
8. Att. Problems	-.143**	.510**	-.136**	-.180**	.024	-.380**	-.467**	1		
9. Memory	.422**	-.174**	.216**	.281**	.056	.205**	.241**	-.181**	1	
10. CPT	.237**	-.099**	.096**	.144**	.075*	.124**	.136**	-.111**	.240**	1

*** $p < .001$, ** $p < .01$, * $p < .05$

Table 5.

Intercorrelations among Outcome and Key Predictor Variables.

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>
<i>Academic Achievement</i>				
Maternal Sensitivity	0.27 (0.28)			-0.62 (0.36)
Parenting Enrichment	1.14*** (0.33)			-0.61 (0.52)
EF		2.60*** (0.52)		2.79*** (0.66)
EC		0.34 (0.21)		0.12 (0.19)
<i>Behavior Problems</i>				
Maternal Sensitivity	-0.40 (0.24)			0.60 (0.32)
Parenting Enrichment	-0.72** (0.28)			1.20*** (0.48)
EF		-1.21** (0.46)		-2.16** (0.93)
EC		-1.50*** (0.20)		-0.95*** (0.23)
<i>Executive Function</i>				
Maternal Sensitivity			0.32*** (0.10)	0.37*** (0.10)
Parenting Enrichment			0.56*** (0.14)	0.70*** (0.15)
<i>Effortful Control</i>				
Maternal Sensitivity			0.22*** (0.06)	0.25*** (0.07)
Parenting Enrichment			0.36*** (0.08)	0.40*** (0.08)

Table 6.

Taxonomy of SEMs testing the direct and indirect effects of parenting on child outcomes through EF and EC.

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>
<i>Indirect Effects</i>				
Sensitivity-EF-Achieve				1.11*** (0.31)
Sensitivity-EC-Achieve				0.03 (0.05)
Sensitivity-EF-Behavior				-0.95** (0.32)
Sensitivity-EC-Behavior				-0.23** (0.08)
Enrichment-EF-Achieve				1.94*** (0.48)
Enrichment-EC-Achieve				0.05 (0.08)
Enrichment-EF-Behavior				-1.82*** (0.48)
Enrichment-EC-Behavior				-0.38** (0.49)
<i>Model Fit Statistics</i>				
X^2	699.84*** (66)	494.82*** (56)	606.73(96)	565.16*** (92)
CFI	0.61	0.72	0.69	0.71
RMSEA	0.103	0.093	.080	0.08
Achievement R^2	23.2%	44.8%	18.3%	39.5%
Behavior R^2	7.4%	23.0%	3.3%	40.1%

*** $p < .001$, ** $p < .01$, * $p < .05$

Table 6 (continued).

Taxonomy of SEMs testing the direct and indirect effects of parenting on child outcomes through EF and EC.

	Secure Attachment				Insecure Attachment			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<i>Achievement</i>								
Sensitivity	.55 (.34)			-.28 (.46)	-.17 (.45)			-1.01 (.58)
Enrichment	1.18** (.42)			-1.46* (.72)	1.71*** (.53)			1.14 (.69)
EF		2.32** (.56)		2.67*** (.79)		3.62** (1.3)		2.67** (.99)
EC		.43 (.27)		.35 (.23)		1.71*** (.53)		-.12 (.27)
<i>Behavior Problems</i>								
Sensitivity	-.17 (.30)			.61 (.38)	-.72~(.40)			.60 (.64)
Enrichment	-1.27*** (.37)			1.16 (.64)	.10 (.45)			1.22 (.73)
EF		-.83* (.44)		-2.40** (.89)		-2.78* (1.34)		-4.38*** (.13)
EC		-1.80*** (.26)		-1.17*** (.24)		-.92** (.33)		-.13 (.24)
<i>EF</i>								
Sensitivity			.45*** (.13)	.35** (.19)			.37**(.17)	.36** (.14)
Enrichment			.93*** (.19)	.82*** (.17)			.65*(.19)	.35* (.17)
<i>EC</i>								
Sensitivity			.14~	.14~			.42***(.11)	.44***

	(.08)	(.08))	(.11)
Enrichment	.50***	.49***	.28*(.12)	.27*
	(.10)	(.09)		(.12)

Table 7.

Taxonomy of SEM models for secure versus insecurely attached children at 15 months.

	Secure Attachment				Insecure Attachment			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<i>Indirect Effects</i>								
Sens→EF→Achieve				.93** (.38)				.964* (.49)
Sens→EC→Achieve								
Sens→EF→Behave				-.084** (.16)				-1.58* (.69)
Sens→EC→Behave								
Enrich→EF→Achieve				2.21*** (.67)				
Enrich→EC→Achieve								
Enrich→EF→Behave				-1.99** (.63)				-1.54* (.76)
Enrich→EC→Behave				-.58*** (.16)				
<i>Model Fit Statistics</i>								
X ²	801.35***	573.32***	253.59***	683.79***	801.35***	573.32***	253.59***	683.79***
CFI	0.59	0.71	0.74	0.71	0.59	0.71	0.74	0.71
RMSEA	0.103	0.09	0.14	0.07	0.103	0.09	0.14	0.07
Achievement R ²	8.4%	54.6%		37.8%	8.4%	54.6%		37.8%
Behavior R ²	24.4%	41.5%		37.4%	24.4%	41.5%		37.4%

Table 7 (continued).

Taxonomy of SEM models for secure versus insecurely attached children at 15 months.

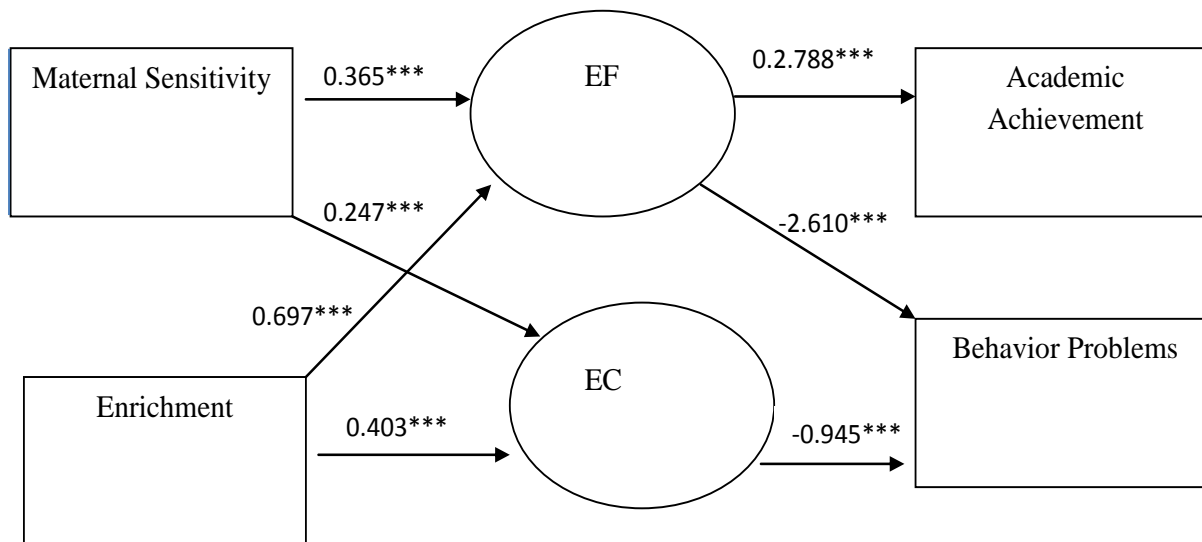


Figure 2.

Structural Equation Model of statistically significant direct pathways from parenting sensitivity and enrichment at 15 months to executive functioning and effortful control at 54 months, and from EF and EC to academic achievement and behavior problems in the 3rd grade. $X^2=565.16(92)$; CFI=0.71; RMSEA=0.08.

Note : Direct pathways from sensitivity and enrichment to 3rd grade outcomes are not depicted for ease of interpretation.

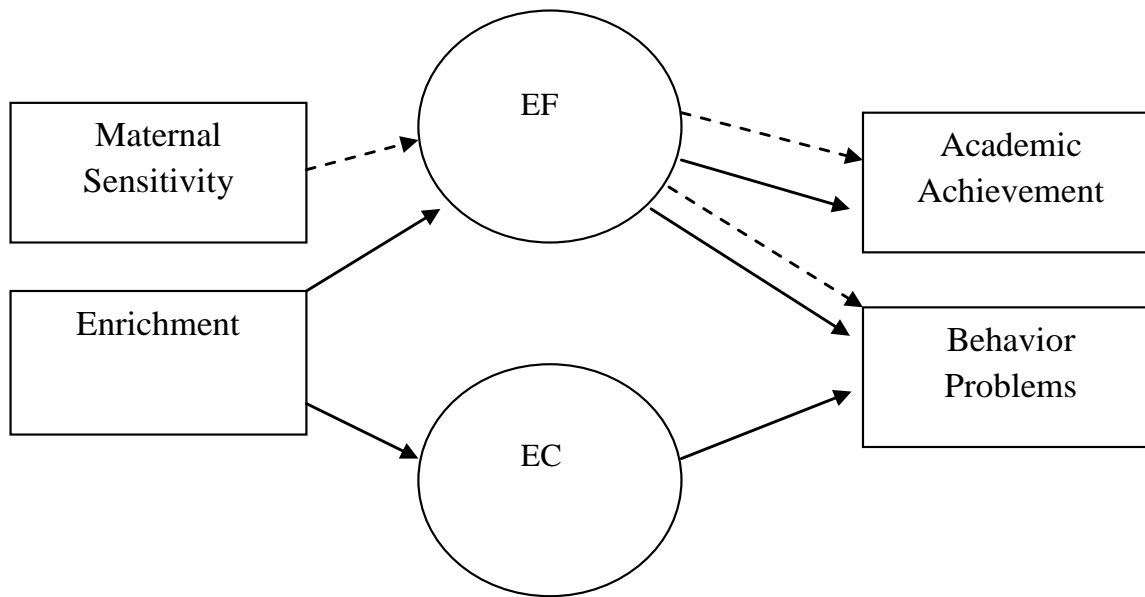


Figure 3.

Structural Equation Model of statistically significant indirect Pathways from parenting sensitivity and enrichment at 15 months to academic achievement and behavior problems in the 3rd grade through executive functioning and effortful control at 54 months for children who were securely attached at 15 months. Solid lines represent pathways from enrichment and dashed lines represent pathways from sensitivity.

Enrichment → EC → Behavior ($\beta=-0.58, p<0.001$); ($Z=-0.237, p<0.001$)
Enrichment → EF → Behavior ($\beta=-1.99, p=0.002$); (indirect effect only)
Enrichment → EF → Achieve ($\beta=2.21, p=0.015$); (indirect effect only)
Sensitivity → EF → Achieve ($\beta=0.93, p=0.015$); (indirect effect only)
Sensitivity → EF → Behavior ($\beta=-0.84, p=0.010$); (indirect effect only)

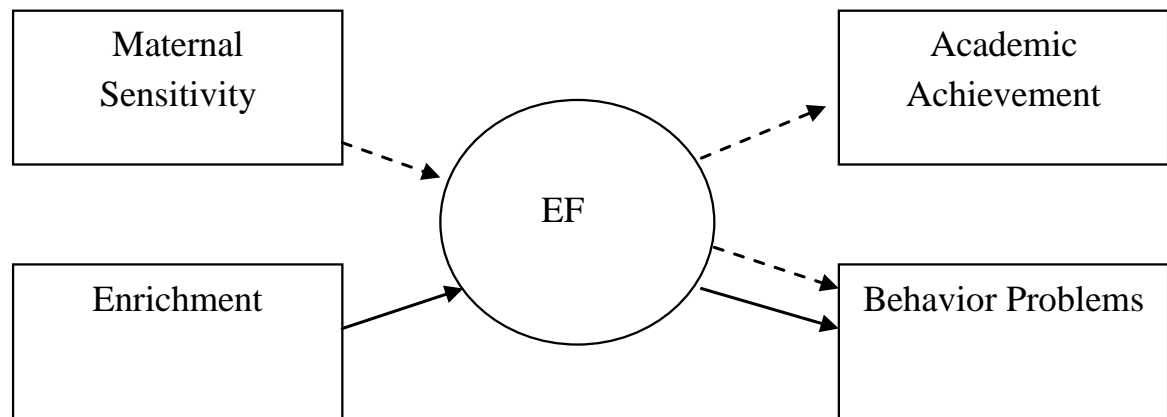


Figure 4.

Structural Equation Model of statistically significant indirect Pathways from parenting sensitivity and enrichment at 15 months to academic achievement and behavior problems in the 3rd grade through executive functioning and effortful control at 54 months for children who were insecurely attached at 15 months. Solid lines represent pathways from Enrichment and dashed lines represent pathways from sensitivity.

*Enrichment → EF → Behavior ($\beta=-1.54$, $p=0.046$); (indirect effect only)
 Sensitivity → EF → Achieve ($\beta=0.96$, $p=0.048$); (indirect effect only)
 Sensitivity → EF → Behavior ($\beta=-1.58$, $p=0.022$); (indirect effect only)*

Appendix A

Attachment Concepts

According to theorists, the formation of an attachment bond is a critical developmental milestone during the first year of life (Ainsworth, 1978; Bowlby 1969; Landry, Smith, & Swank, 2003; Oxford & Lee, 2011). Scholars argue that our development is comprised largely of a balance between two central behavioral systems, exploration and attachment. The attachment system ensures safety, assistance and comfort. According to Bowlby (1969), these behaviors are rooted in our biological and evolutionary need for survival. On the other hand, the exploratory system promotes curiosity, cognitive stimulation and skill development. Both of these systems are essential for healthy and ideal growth and development, but are argued to be inherently contradictory in nature. During times of low stress or safety an infant will ideally follow their natural motivation to explore and learn. However, when aroused or threatened, cognitive resources will be devoted to the caregiver, and the child will seek the safety and comfort of the attachment figure (diverting attention away from exploration). When a balance between attachment and exploration is achieved the child will ideally be able to use the caregiver as a secure base, seeking them out when distressed and exploring their environments with confidence of availability during times of non-distress (van der Lippe, Eilersten, Hartman, & Killen, 2010). Under this central premise, early experiences of caregiver availability and the nature of caregiver response to infant needs, along with concurrent parent-child interactions directly influence how infants organize their behavior. This organization serves as a blueprint or a prototype for what will evolve into a symbolic or mental representation-the internal working model as more advanced cognitive capacities emerge (Bowlby, 1973; Raikes & Thompson, 2008).

During Ainsworth's famous Strange Situation experiment (1978) marked patterns in behavioral organization were evidenced through differences in exploration and proximity-seeking behaviors.

Babies who were secure were able to explore and engage with their surroundings, sometimes showed distress when their mothers left but actively engaged and were able to be soothed upon reunion. They were most likely to engage in play and interacted with their mother in a generally positive manner. On the other hand, insecure children displayed very different patterns. One group, termed *resistant*, showed lower levels of exploration and higher levels of distress. They were difficult to soothe when their mother left and continued to show distress upon her return. Resistant children were less likely to explore, were clingy and demonstrated high levels of negative affect (Cassidy & Berlin, 1994; Goldberg, 2000).

Another pattern of attachment behavior, *avoidant*, was marked by distancing or detachment, with infants showing very little affect. While resistant children were clingy, avoidant children showed especially low engagement with their mothers. They appeared to be relatively unfazed by her departure and showed a similar lack of affect when she returned (Ainsworth et al., 1978). A third pattern of insecure attachment behavior was later identified (Main & Soloman, 1986), and was marked by the use of a combination of strategies and a dazed, disorganized pattern of behavior. Thus, the fourth group was termed *disorganized*.

A central difference between the likelihood to organize behavior in a resistant manner versus an avoidant versus a disorganized pattern is arguably associated with differences in experience with the caregiver. Namely, resistant children were likely to have experienced caregiving that was inconsistent, and their mothers were less likely to be aware of/ in touch with the developmental needs of their children. This inconsistency created a state of “hyper-activation” of the attachment system, wherein the child was excessively preoccupied with and sought out the caregiver to ensure their availability. On the other hand, avoidant children were likely to have experienced caregiving that was harsh or rejecting, especially during times of expressed distress (Main, 1997). Avoidant children are likely to suppress affect and distance themselves from their primary caregiver, first through the organization of behavior

and later through mental representations. These strategies arguably decrease the likelihood of further rejection and increase the possibility of maternal response. Often avoidant children appear to be more fixated on their surroundings, and appear to be more oriented towards their environment compared to their resistant peers. Disorganized children are the most likely of the insecure attachment classifications to have experienced maltreatment. Arguably, this “organization” or lack thereof arises from the contradiction of experiencing both comfort and fear from the attachment figure. Disorganized children are less predictable in their behaviors, often switching techniques. Of the three subtypes of insecure attachment disorganized children are the most likely to exhibit behavior problems and psychopathologies.

It is important to highlight that attachment is not a trait. That is, while behaviors are descriptive of the child’s actions and responses, they are representative of a dynamic relationship that is subject to change. This is one of the argued benefits of considering the attachment relationship when examining child development, as it moves past parenting behaviors or child characteristics to capture the dynamics between caregiver and child. That said, just as attachment is not a trait, and attachment security (or insecurity) is not guaranteed to remain the same. Although studies suggest stability in attachment (in low-risk samples), changing context and interaction will influence the attachment bond. Additionally, the contribution of the infant to the attachment bond (including the influence that an infant has on his or her caregiver), should not be overlooked, as children actively participate in shaping their relationships (Sroufe, 1979).

Attachment security and the influences of attachment behavior on SR, as well as on concurrent and subsequent outcomes becomes especially salient during the preschool years, as the ability to self-regulate has been identified as a central task of this developmental period (Sroufe et al., 1990; 2005). Despite differences in the organization of behaviors, insecure children share the common trait of

engaging in poorer quality exploration and therefore have fewer opportunities for growth and development (Ainsworth et al., 1978; Bowlby, 1973; Cassidy & Berlin, 1994; Shaver & Mikulincer, 2010; Vaughn et al. 2007). Given that the parent-child relationship provides the primary context for early development, gaining a better understanding of the interplay between parenting and attachment may certainly offer insight into the multiple developmental pathways through which children develop. Further, despite a recent call for studies examining potential mechanisms (e.g., self-regulation skills) that link early experiences with later child outcomes for children across attachment groups, such studies are limited (Kochanska & Kim, 2013; O'Connor & McCartney, 2007; West et al., 2013). By examining associations between parenting sensitivity and enrichment at 15 months, executive functioning and effortful control at 54 months, as well as academic and behavior outcomes in the 3rd grade, this study offers substantial contribution to our understanding of how early experiences differentially impact later child developmental outcomes for secure versus insecure children. Further, identifying executive functioning and effortful control as potential mechanisms through which early experiences may differentially influence later outcomes offers unique insight regarding strategies to support child well-being.

Appendix B

Self-Regulation Concepts

Self-Regulation (SR) is argued to be a key mediator between genetic predisposition, experience and later functioning (Fonagy & Target, 2002; Rueda, Posner, & Rothbart, 2005). SR has been defined in a variety of ways. Some define this construct broadly as the ability to monitor and control behaviors (Raffaelli, Crockett, & Shen, 2005; Robinson, 2010). This definition includes all processes that help a child to control their cognitions and behaviors (Bernier et al., 2011; Jahromi & Stifter, 2008; Raffaelli et al., 2005; Robson, 2012). Others have conceptualized regulation with greater specificity, suggesting it is the ability to manage behaviors, cognitions, and emotions in an adaptive manner across social and physical contexts (Volling, McElwain, Notaro, & Herrera, 2002). Still others describe SR as the ability to comply with requests, begin and end activities based on situational demands, modulate verbal and motor acts, and act in a socially appropriate manner without external monitoring (Boyer, 2009; Kopp, 1982). The inclusion of emotion-regulation, or the ability to regulate affective states, is also common in global definitions of self-regulation (Jahromi & Stifer, 2008; Raffaelli et al., 2005).

Other scholars such as Raver and colleagues (2011) differentiate cognitive tasks associated with self-regulation (e.g., attention focusing, concentration, planning and working memory), referred to as executive functioning, from behavioral tasks (e.g., impulse control, resisting temptation), referred to as effortful control (conceptualized similarly to the works of Rothbart and colleagues). Within these circles the term executive functioning (EF) is used to describe the predominantly cognitive aspects of regulation. EF is defined as “interrelated cognitive abilities that are required when one must intentionally or deliberately hold information in mind, manage and integrate information and resolve conflict or competition between stimulus representations and response options” (Blair & Ursache, 2011;

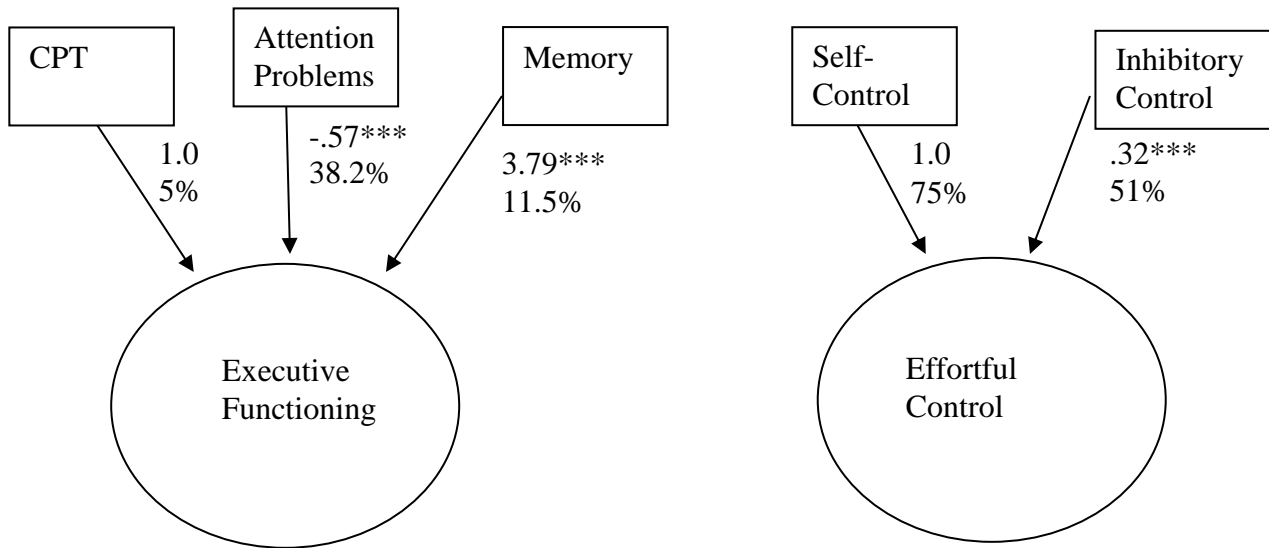
Carlson, 2005; Miyake et al., 2000; Raver et al., 2011; Willoughby et al., 2011). These capacities have been specifically linked to the pre-frontal cortex, proving a “top-down” organizing role that allows children to engage in higher-order cognitive and memory processes (such as remembering rules, shifting attention or concentrating). EF studies are common in literature that focuses on learning and academic outcomes (Willoughby, Blair, Wirth, & Greenberg, 2012). Other terms that have been used to describe EF include mastery skills, executive attention, learning-related regulation, self-regulated learning skills (Hole & Crozier, 2007; Jahromi & Stifer, 2008; Lipsey et al., 2010; McClelland & Morrison, 2003).

In addition to executive or cognitive domains of self-regulation are behavioral domains, including effortful control (EC). EC is defined as the child’s ability to inhibit a dominant response (such as taking a desired toy) in favor of some subdominant response (such as waiting one’s turn) in accordance to the demands of a social situation (Blair & Razza, 2007; Kochanska, Philbert, & Barry, 2009; Rothbart & Bates, 1998). Because effortful control commonly involves frustrating situations, it has been described as “hot regulation,” as children must control impulses in emotionally arousing or demanding situations (Metcalf & Mischel, 1999; Willoughby, Kupersmidt, Voegler-Lee, & Bryant, 2011). Whereas executive functioning is often conceptualized as a top-down process that involves the pre-frontal cortex, effortful control is often viewed as a bottom-up system involving the limbic system wherein the child regulates behaviors through inhibition and management of responses, often in frustrating situations (Calkins & Fox, 2007; Raver et al., 2011; Willoughby et al., 2011). It is important to note that Mary Rothbart, one of the predominant scholars in the field and especially research on EC, considers this domain within the context of child temperament to include executive capacities. That said, the simultaneous contributions of executive and behavioral capacities are recognized.

Further, with separate neurological pathways indicated for cognitive and behavioral aspects of self-regulation, examining them independently but simultaneously may provide useful insight into the

differential pathways involved not only with the development of these skills, but also of the impact of these skills on child outcomes. Therefore, EF and EC were considered here as distinct but highly related subcomponents of more global self-regulation capacities.

Appendix C
Figures and Measures Information



Note. $\chi^2=31.66^{***}$ (4); $CFI=0.96$; $RMSEA=0.087$

Figure 5.

Measurement Model for Latent Constructs.

Note. Model fit was assessed using the Chi-Square (with non-significant values indicating good fit), Comparative Fit Index (CFI ; with values greater than .90 indicating good fit), and Root Mean Square Error of Approximation ($RMSEA$; with values less than .10 indicating good fit) indices. These constructs are strongly correlated ($r=0.85$), indicating that they are indeed highly related domains of self-regulation.

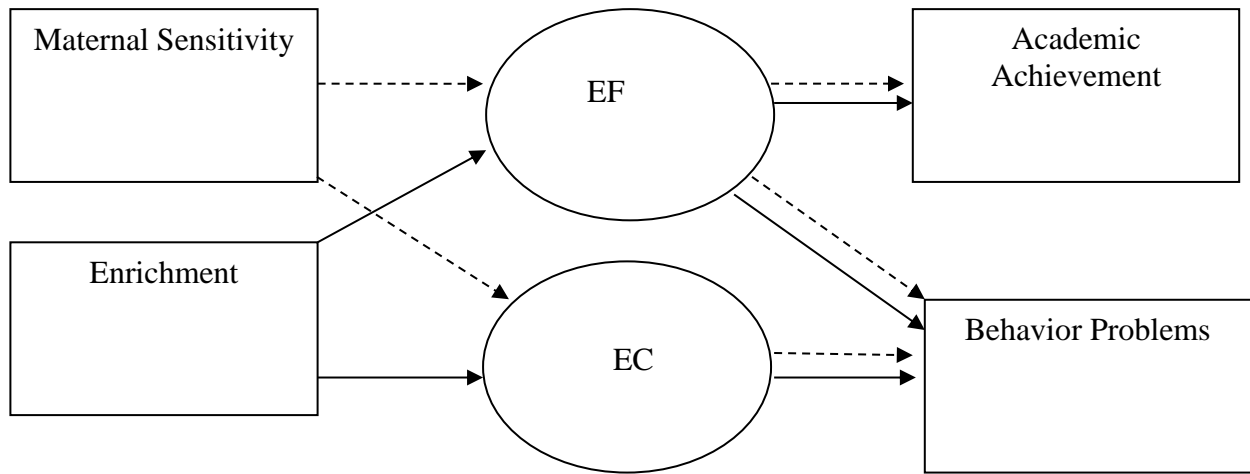


Figure 6.

Structural Equation Model of statistically significant indirect Pathways from parenting sensitivity and enrichment at 15 months to academic achievement and behavior problems in the 3rd grade through executive functioning and effortful control at 54 months. Solid lines represent pathways from Enrichment and dashed lines represent pathways from sensitivity.

Indirect Pathways:

Enrichment → EF → Achieve ($\beta=1.942, p<0.01$); ($Z=3.16, p<0.001$)

Enrichment → EF → Behavior ($\beta=-1.818, p<0.001$); (indirect effect only)

Enrichment → EC → Behavior ($\beta=-0.381, p<0.001$); (indirect effect only)

Sensitivity → EF → Achieve ($\beta=1.017, p<0.01$); (indirect effect only)

Sensitivity → EF → Behavior ($\beta=-0.952, p=0.003$); (indirect effect only)

Sensitivity → EC → Behavior ($\beta=-0.234, p=0.005$); (indirect effect only)

Sobel's Z-Score

For pathways that met mediation criteria according to Baron and Kenney (1986), Sobel's Z scores were calculated to determine whether statistically significant mediation was present using the following formula

$$\frac{a*b}{\sqrt{b^2s_a^2 + a^2s_b^2}}$$

where "a" represented the direct effect of maternal sensitivity or enrichment on either executive functioning or effortful control, "b" represented the direct effect of either executive functioning or effortful control on academic achievement or behavior problems in the 3rd grade, "s_a" represented the standard error for coefficient "a", and "s_b" represented the standard error for coefficient "b".

Measurement Details and Validity Information

Sensitivity (Mother-Child Structured Play Observation Procedure)

The *Mother-Child Structured Play Observation Procedure* Mothers and infants were video-recorded in a laboratory setting in 15 minute segments. Mothers were instructed to play with their infants using a series of toys from three boxes across three segments. During the first segment mothers were observed presenting a story book to their infants. For segment two mothers and infants were observed playing with a toy stove, and segment three included a toy house and small figures. Observers coded interactions across the three segments to gauge how mothers engaged infants in play, as well as the nature of mothers' responses to child's gestures, expressions, and signals guided by Ainsworth's early research on maternal sensitivity (Ainsworth, Blehar, Waters & Wall, 1978; Egeland & Farber, 1984; McElwain & Booth-LaForce; 2006; NICHD ECCRN, 1999). The scenario was designed to provide context for

evaluating the extent to which the mother's behaviors were age-appropriate and in touch with her child's needs (Brooks-Gunn, Han, & Waldfogel, 2002). Each videotaped session was coded by 5 or 6 separate observers. All coders were blind to other characteristics of the children and families, and reliabilities across coders was 0.83 at 15 months. Observations were recorded on a four-point scale (1= *not at all characteristic* to 4= *highly characteristic*) and a composite of sensitivity was created using a combination of the following observed scores: *Sensitivity to non-distress, positive regard for the child, and intrusiveness* (reverse-scored). Higher scores indicated more sensitive mothers. This measure has been used to measure parenting sensitivity in many studies (Bradley, 1994; Brooks-Gunn; 2002; NICHD SECCYD, 2003; Potharst et al., 2012) and has been deemed reliable in this sample ($\alpha= 0.70$). This measure has been correlated with outcomes that are theoretically linked to sensitivity including depression, substance use and attachment outcomes, and has been validated extensively by the NICHD network (1997, 1999, 2001). Further, mother-child play is beneficial to capture sensitivity because it can be measured consistently across contexts and developmental periods (Campbell et al., 2004; Vandell, 1979).

Enrichment (HOME Inventory)

The enrichment measure of the HOME inventory was used to gauge 1.) parent provision of developmentally appropriate and cognitively stimulating materials and 2.) parent report of engagement in enrichment activities with the child. The following items were included in this subscale: *parent provides toys, parent facilitates learning, parent promotes simple eye-hand coordination, parent provides child with literature and music-related toys, parent structures play, parent provides toys that are developmentally challenging, parent reads to child and child has 3 or more books of his/her own* ($\alpha=0.72$). The Home Observation for the Measurement of the Environment (HOME) inventory is among the most widely used measures of the home

context including parenting, parent-child interactions, general home surroundings and the child's overall environment. The Infant-Toddler inventory has been used in both low and high-risk samples, across socioeconomic and ethnic groups and has been utilized in international samples (Bradley, Corwyn, Mcadoo, & Garcia Coll, 2001). Further, the HOME inventory has several patterns of relationships that are consistent with theoretical expectations regarding the influence of risk on family functioning including poverty, drug use, parent IQ, parent mental health and child's health status (Bradley, 1994). The HOME measure has also been used by clinicians to assess risk and identify intervention strategies for children and families in a variety of settings. Overall, since its development, the HOME inventory is one of the most popular and widely accepted methods of gathering information on a child's caregiving environment. Further, because information is collected in the child's caregiving environment, a higher level of ecological validity has been asserted (Mulvaney, McCartney, Bub, & Marshall, 2006).

Executive Functioning (Child Behavior Checklist *Attention Problems* subscale)

The Child Behavior Checklist (CBCL) 2/3 is a well-established instrument designed with the purpose of gathering information on 8 separate dimensions of potential child behavior problems or psychopathologies. Categories include: Withdrawn, somatic problems, anxious/depressed, social problems, thought problems, attention problems, delinquent behavior and aggressive behavior. In addition, three composites are commonly used including internalizing behavior problems, externalizing behavior problems and total behavior problems (NICHD ECCRN, 1999). Mothers were asked to report on how well specific statements described their child's behaviors over the past 2 months using a three-point Likert scale (*0= not true, 1=sometimes true, 2=very true*; Achenbach, 1992). The CBCL is among the most widely used instruments to gauge child behavior problems within the US and in other countries (Koot,

Van Den Oord, Verhulst, & Boosma, 1997). It is used in both normally developing and high-risk samples and often provides benchmarks for clinical levels of behavior problems in children. The CBCL has well-established predictive validity and discriminate validity has been ensured by comparing scores for children who have been clinically referred to those from normally developing samples (Koot et al., 1997). This scale has also been correlated with other scales of general development as well as behavior problems (both significantly correlated). The CBCL is among the most widely used screening instrument for tracking the emergence of behavior problems in children (Achenbach, 1991; Bub et al., 2007). The Attention Problems subscale of the CBCL was used as an indicator of executive functioning (EF). This subscale consists of items such as *can't concentrate, daydreams, confused, nervous, twitches, poor school work, clumsy and stares*. This subscale is commonly used to measure child attention focusing (Lehn et al., 2007; Rietveld et al., 2004; Yaetes et al., 2005), and is often used to identify children who experience attention problems. In fact, the CBCL is used as a diagnostic tool for children with ADD/ADHD (Ostrander, Weinfurt, Yarnold, & August, 1998). The Attention Problems scale has shown high discriminant validity in distinguishing children with attention problems from those without (Chen, Farone, Biederman, & Tsuang, 1994).

Executive Functioning I: (*Memory for Sentences* subscale)

An additional indicator of child executive functioning was measured using the *Memory for Sentences* subscale from the Woodcock Johnson Psycho-Educational Battery-Revised (WJ-R) (McGrew, Werder, & Woodcock, 1991; Woodcock, 1990). The *Memory for Sentences* subscale measures a child's ability to remember and repeat simple words and phrases. Sentences were presented either with a tape recorder or by the examiner. The *Memory for Sentences* task is a valid measure of short-term memory (Woodcock & Johnson, 1989; 1990; NICHD SECCYD,

2003). Studies have shown that this measure correlates well with other indicators of memory, is sensitive to age and developmental capabilities, and has been significantly linked to other dimensions of cognitive ability including fluid intelligence, episodic memory and executive functioning (Salthouse, Berish, Siedlecki, 2004). Further, the WJR-memory for sentences subscale is one of several indicators in this instrument commonly used as a diagnostic tool for learning and cognitive difficulties (Woodcock, McGrew, Mather, & Schrank, 2003).

Executive Functioning III: (The Continuous Performance Task)

The Continuous Performance Task (CPT) is a laboratory procedure that involves showing the child a series of familiar pictures (e.g., butterfly, fish, flower) along with a critical stimulus picture (a chair). The child is instructed to press a button when the chair appears. For a total of 7 minutes and 20 seconds the child views pictures; the session is structured into 22 blocks of 10 pictures. The chair picture appears twice during each block at random. The number of times the child's attention waivered and needed to be refocused on the task while remaining seated and the number of times the child completely walked away were calculated. These two indicators were averaged to create a single measure a child's ability to focus attention, concentrate, and stay on task in a laboratory setting. *The CPT* has been widely used to measure child cognitive executive functioning/attention skills (Barkley, 1994; Halperin, Sharma, Greenblatt, & Schwartz, 1991; Jahromi & Stifer, 2008; Mirsky et al., 1991). The CPT has been established as a valid measure of attention and accurate in capturing attention deficits in children. It was originally designed to determine differences in the attention span between brain-damaged and normatively developing individuals. It has been shown to have excellent discriminant validity identifying capabilities in across several groups of normally developing and developmentally challenged groups.

Effortful Control I: (The Child Behavior Questionnaire *Inhibitory Control* Subscale)

The first of the two indicators of Effortful Control (EC) was the *Inhibitory Control* subscale The Child Behavior Questionnaire (CBQ). The *Inhibitory Control Subscale* of the *CBQ* measures how well a child can control their impulses. Mothers report on how characteristic several statements are of their child in the past 6 months (*1= extremely untrue to 7=extremely true*). Sample items from this subscale include: *child can't wait before entering into new activity*, *child easily stops activity when told to*, and *child is able to resist temptation*. Although the CBQ was designed for purposes of measuring temperamental characteristics, this instrument has been used to measure impulse control and other forms of behavioral regulation (including EC) in preschool-aged children in previous studies (Cohen, MacWhinney, Flatt, & Provost, 1993; Clark et al., 2002; Langua, 2002; Raver et al. 2011). Further, convergent validity has been established through correlations with other observed tasks of behavioral regulation and impulse control (e.g., Head-Toes-Knees-Shoulders task) (Pointz, McClelland, Matthews, & Morrison, 2009). Discriminant validity concerning self-regulation has also been identified through correlation with dimensions of SR deficits, namely with indicators of ADHD (Foley, McClowry, & Castellanos, 2008).

Effortful Control II: (Social Skills Rating System *Self-Control* subscale)

Effortful control was also measured using the *the Self Control* Subscale of the *SSRS*. This instrument reflects how well a child can control impulses, especially in social situations. Mothers reported on “how often” items represented their child using a three-point likert scale (*0= never, 1=sometimes, 2=very often*). The subscale includes items such as: *controls temper when arguing, follows instructions and responds appropriately when hit or pushed*. Higher scores on

this subscale indicate more advanced self-control skills. *The Self-Control Subscale* of the *SSRS* has been used to measure impulse control in preschool-aged children in previous studies (Gresham & Elliot, 1990; NICHD ECCRN, 2003). The *SSRS* is commonly used to measure SR and has been used in young children to link self-control deficits with behavior problems (Beaver, Wright, & Delisi, 2007). This subscale has also been correlated with other measures of impulse control and has shown discriminant validity in identifying children who have impulse control problems and deficits in social skills (e.g. ADHD) (Antshel & Remer, 2003; Gresham & Elliot, 1990).

Attachment (The Strange Situation)

Child attachment style was measured using a modified version of Ainsworth's *Strange Situation Paradigm* (Ainsworth et al., 1978; Cassidy et al., 1992) at 15 months. Child behavior was observed in a unfamiliar playroom setting during a sequence of events. Mother and child were videotaped during a series of three minute episodes that were designed to activate the child's attachment system. For the first segments the child grew accustomed to the playroom and was encouraged to explore. An unfamiliar female entered the room, sat quietly and began to speak with the mother after one minute. After speaking with the mother the stranger attempts to engage with the child. After three minutes passed with the stranger in the room the mother left quietly. The mother then returned for three minutes. If the child became too distressed the separation was curtailed. After another three minutes the mother left again and the stranger attempted to calm the child. The mother returns after a final three minutes (or sooner if the child is too distressed). The child's behavior during the mother-child interaction, as well as the reaction to absence of and reunification with their mother was observed and coded. Children who were classified as Avoidant (category A) were given a score of 1, secure children (category B)

were given a score of 2, resistant children (category C) were scored as 3, and disorganized children (Category D) were scored as 4. The Strange Situation is a widely used measure of child attachment (Cassidy, Berlin, & Belsky, 1991; Cicchetti & Barnett, 1991; MacArthur; Cassidy & Marvin and the MacArthur Working Group on Attachment, 1992), with inter-rater reliabilities for this categorical variable at 84%. It is referred to as the “gold standard” of attachment measurement in infancy (Kochanska & Kim, 2013), has been replicated across normative, high-risk and clinical samples (van Ijzendoorn & Kroonenberg, 1988), is used as a benchmark in determining concurrent validity for other indicators of attachment, such as the Attachment Behavior Questionnaire (Vaughn & Waters, 1990). The strange situation has also been used cross-culturally, and although rates of group classification differ across samples, basic organizational patterns are similar (van Ijzendoorn & Kroonenberg, 1988).

Academic Achievement (WJ-R)

Child academic achievement was measured using subscales from the Woodcock Johnson Psycho-Educational Battery-Revised when children were in 3rd grade (McGrew, Werder, & Woodcock, 1991; Woodcock, 1990). The *Letter-Word Identification* and *Applied Problems* were combined to measure both verbal skills and analytic/problem solving abilities. *The Letter-Word Identification* subscale examines vocabulary skills by assessing how well a child can match written words with their corresponding pictures. *The Letter-Word Identification* task is a valid measure of symbolic learning and reading skills (McGrew, 1993; 1994). The *Applied Problems* subscale evaluates the ability to solve practical problems in mathematics. The task requires recognition and use of common procedures for problem solving. The *Applied Problems* task is a valid measure of analytic ability and mathematical skills (McGrew & Hessler, 1993; NICHD SECCYD, 2003). Both subscales are commonly used to measure child achievement in reading

and mathematics (Sanbonmatsu, Kling, Duncan, & Brooks-Gunn, 2006). The WJ-R shows excellent concurrent validity through correlations with other established indicators of academic achievement (e.g. the Wesler Intelligence Scale for Children), as well as with related skills and outcomes (Watkins & Glutting, 2000).

Behavior Problems (CBCL *Total Problems* subscale)

Behavior problems in the 3rd grade was measured using The Child Behavior Checklist (CBCL) 4/18, a well-established instrument designed with the purpose of gathering information on child behavior problems (Achenbach, 1992). Mothers were asked to report on how well specific statements described their children's behavior within the past 2 months using a three-point Likert scale (*0= not true, 1=sometimes true, 2=very true*; Achenbach, 1992). The total behavior problems composite consists of items from the aggressive behavior, destructive behavior, anxious/depressed, somatic and withdrawn subscales of the CBCL. Items in this composite include externalizing items such as *defiant, hits others, steals, argues* and *destroys his/her things*, and internalizing items such as *sad or depressed, feels worthless, feels nervous, complains that no one loves him/her* and *is unresponsive to affection*. The CBCL has well-established concurrent and predictive validity and is the most widely used screening instrument for tracking the emergence of behavior problems in children (Achenbach, 1991; Bub et al., 2007). The behavior problems subscale is a benchmark measure and is commonly used to established concurrent validity in other measures. Further, the subscale correlates with theoretically related outcomes and discriminates between children who do and do not exhibit behavior problems (Newton, Litrownik, & Landsverk, 2000; Schmeck et al., 2001).