

THE DEVELOPMENT OF MASTERY MOTIVATION IN YOUNG CHILDREN

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## **ABSTRACT**

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This dissertation presents two studies exploring the development of mastery motivation in the child's first six years of life. Study 1 examines potential sources of variation in children's levels of mastery motivation in the first three years. Study 2 focused on the role of mastery motivation in children's subsequent development, especially executive function skills in the first grade.

Study 1 revealed that early maternal depressive symptoms affected child's later mastery motivation and related domains including self-regulation and general cognitive skills. However, direct negative effect of early maternal depressive symptoms on children's later mastery motivation was not significant when considering maternal parenting at 24 months. In particular, maternal sensitivity mediated the effects of early maternal depressive symptoms on child's later mastery motivation. The results of chapter 2 also showed that boys were more vulnerable to the effects of maternal depression. Boys whose mothers had more early depressive symptoms displayed poor general cognitive skills at 36 months. However, boys' mastery motivation and self-regulation were not predicted by early maternal depressive symptoms directly but that was mediated by maternal sensitivity.

In chapter 3, mastery motivation played the unique role in the development of executive function skills. Children's mastery motivation at 54 months predicted the development of a set of executive function skills including short- and long-term memory abilities and problem-solving skills in the first grade. However, mastery motivation did not mediate the effects of children's early emotional regulation abilities and maternal sensitivity on later executive function skills.

Instead, mastery motivation predicted three of the executive function skills, while emotion regulation predicted another one. This finding confirmed that mastery motivation and emotional regulation are separate constructs, each with a unique role in the development of executive function skills.

This dissertation extends our current knowledge about children's mastery motivation. Mastery motivation is influenced by positive maternal behaviors rather than negative behaviors and there are no gender differences in the effects of early maternal depression on later mastery motivation. In addition, mastery motivation improves children's later executive function skills and plays a different role from emotion regulation ability in fostering of children's executive function skills. It implies that mastery motivation is a separate and unique construct. These two studies contribute to understanding more clearly the relations between mastery motivation and maternal behavior and the mechanism by which children's mastery motivation affects their cognitive outcomes.

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## **Chapter 1. Introduction**

Motivation to achieve a goal and learn new skills is an important characteristic for child development. This motivation is called mastery motivation which is defined as an intrinsic force that drives an individual to attempt to master moderately challenging tasks (Barrett, Morgan, & Maslin-Cole, 1993). Mastery motivation plays a key role in several domains of a child's development. First, many studies have found associations between a child's mastery motivation and cognitive development. For example, infants' mastery motivation at 6 and 14 months has been found to be directly associated with cognitive development at 14 months (Banerjee & Tamis-LeMonda, 2007). For both preschool and young elementary-school aged children, mastery motivation predicts cognitive performance and academic achievement (Broussard & Garrison, 2004; Deater Deckard, Petrill, Thompson, & DeThorne, 2005). Secondly, mastery motivation has an influence on children's social development, and low mastery motivation is associated with behavioral problems (Deater-Deckard, Petrill, & Thompson, 2007; Zhou et al., 2007). Zhou and colleagues (2007) measured children's mastery motivation and externalizing problems over five years and showed a significant relationship in which children with high and stable persistence in puzzle tasks (one of indicators of mastery motivation) across the five years were more likely to display low externalizing problems across the same time span. Given the importance of mastery motivation to both cognitive and social skills, it is important to understand sources of variation in the development of mastery motivation, and to further delineate its effects on children's development.

This dissertation investigated mastery motivation in young children (from six months old through the first grade) using longitudinal data derived from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development

(SECCYD) and consisted of two studies. Study 1 (chapter 2) allowed me to investigate potential sources of variation in children's levels of mastery motivation in the first three years. Study 2 (chapter 3) focused on the role of mastery motivation in children's subsequent development, especially executive function skills in the first grade.

Study 1 (chapter 2), titled *The Path from Maternal Depression to Mastery Motivation: The First Three Years*, examined possible associations among mastery motivation, early maternal depression, and maternal behavior in the first three years of the child's life. Maternal depression is known to be one of the risk factors associated with many aspects of child development, including physiological, emotional, cognitive, and social development (Field, 1995; Goodman & Tully, 2006). In particular, Bagner and colleagues (2010) emphasized the critical effects of maternal depression on later child development when it occurs during the first year – the sensitive period when the child's emotional regulation and cognitive abilities that are associated with mastery motivation are rapidly developing. Maternal depression affects mothers' abilities to care for and respond to their children. Mothers who report more depressive symptoms are likely to show more controlling or withdrawn behaviors, more negative affect, less affectionate touch, and spend less time playing with their infants (Field, 2010). Importantly, research has shown that maternal behavior that is associated with depression - intrusiveness or insensitivity - has a negative impact on children's mastery motivation (Banerjee & Tamis-LeMonda, 2007; Frodi, Bridges, & Grolnick, 1985; Lutkenhaus, 1984; Spangler, 1989; Yarrow, Morgan, Jennings, Harmon, & Gaiter, 1982). Although many studies have shown that child mastery motivation is an important characteristic for children in order to interact with and adjust to their environment effectively, the research that has examined how maternal depression affects mastery motivation in young children is limited. In addition, there is very little known about the

interaction of maternal depression, maternal behavior, and mastery motivation, especially at an early age. Study 1 investigated whether early maternal depressive symptoms would affect children's later mastery motivation and related domains (i.e., self-regulation and general cognitive skills). Specifically, I expected that early maternal depressive symptoms would predict children's mastery motivation and related domains at 36 months. Previous research has shown that the quality of maternal behavior (i.e., intrusiveness, sensitivity, and responsiveness) mediated the effects of maternal depression on children's development such as behavior problems, language development, and self-regulation (Leckman-Westin et al., 2009; Feldman et al., 2009; Stein, Malmberg, Sylva, Barnes, & Leach, 2008). We know that depression predicts intrusiveness, which in turn decreases mastery motivation, but no study has examined intrusiveness as a mediator between maternal depression and mastery motivation. Study 1 examined how the quality of maternal behavior at 24 months (i.e., sensitivity and intrusiveness) impacted the relations between early maternal depression and children's later mastery motivation (36 months) and related domains (i.e., self-regulation and general cognitive skills). Self-regulation and general cognitive skills are associated with academic achievement (Broussard & Garrison, 2004; Calkins, 2007; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008), and self-regulation and mastery motivation are intertwined skills (Wang & Barrett, 2013). However, these skills may be differentially influenced by maternal behaviors and maternal depression. Thus, self-regulation and general cognitive skills were included in the model in order to compare the effects of maternal factors on mastery motivation, self-regulation, and general cognitive skills. The results of study 1 has the potential to provide evidence that mastery motivation is in fact a separate construct with different predictors and effects than self-regulation and general cognitive skills. Figure 1 shows the conceptual model for Study 1.

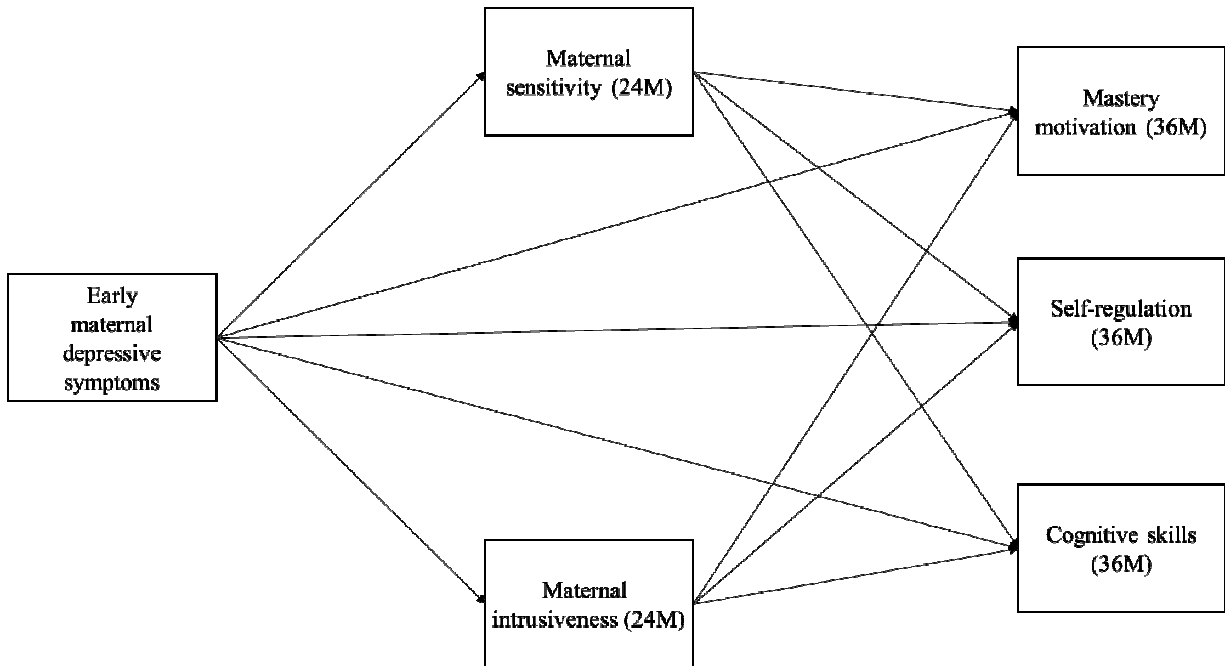


Figure 1. Conceptual Model for Study 1

Following on the examination of the early precursors to mastery motivation (Study 1), Study 2 (chapter 3) allowed me to test the role of mastery motivation in children’s development from 36 months to the first grade, focusing on the development of executive functions that are considered to be important capacities related to children’s social-emotional development and academic achievement. Executive function is defined as a set of higher order cognitive processes which are associated with abilities to control thought and action (Seguin & Zelazo, 2005). Both mastery motivation and executive function are necessary for a child’s goal-directed behavior. Further, both are related to self-regulation, thus their mechanisms may be correlated to each other. However, little research has studied their associations. Children with higher levels of mastery motivation tend to persist in conducting challenging tasks. During such tasks, children can practice their existing knowledge and skills and have opportunities to acquire new information that could apply to future problem solving (Wang & Barrett, 2013). Thus, in this

study, I hypothesized that mastery motivation would promote the development of executive function skills.

I also expected that the child's level of mastery motivation would mediate the relations between executive function skills and earlier predictors of mastery motivation, such as maternal behavior and child emotional regulation. Previous research has shown that children's executive function skills are promoted by characteristics of maternal behavior such as maternal sensitivity as well as behaviors that support the child's autonomy (Bernier, Carlson, & Whipple, 2010). Children's emotional regulatory abilities are also expected to influence their executive function skills. For example, children with higher levels of emotional regulation display better working memory and inhibitory control abilities in cognitively challenging tasks (Blankson et al., 2013; Calkins & Dedmon, 2000). Mastery motivation may impact these relations. However, little research has examined the interactions of these skills, particularly in relationship to the development of executive function. Task persistence is a key instrumental indicator of mastery motivation. In order for children to persist in a difficult task, they must manage the frustration or fear that may be elicited during the task. Some children may give up because of this negative emotion, while other children may keep at their tasks to achieve a goal by controlling their negative emotion. Therefore, the control of negative emotion is thought to facilitate children's persistence in tasks, which in turn provide children with more opportunities to learn new skills and knowledge and achieve their goals. Sensitive and supportive maternal behavior encourages children to initiate their own actions to achieve goals and to continue to engage in them. In particular, maternal behavior such as respecting the child's perspective, goals, and choices, and encouraging the child's active role in tasks improve children's motivation to achieve goals, which in turn helps children try out their current skills and eventually obtain age-appropriate

problem-solving skills that involve executive components (Bernier et al., 2010). Thus, it may be possible that a child's mastery motivation mediates the relationship between maternal behavior and the development of the child's executive function skills. No study has specifically examined the mediating role of mastery motivation among executive function skills and their precursors: maternal behavior and child's emotion regulation. Study 2 examined these questions more directly and contributed to our understanding of the role of mastery motivation in development of executive function skills. Specifically, I expected that maternal behavior (i.e., sensitivity and autonomy supporting behavior) and children's emotional regulation at 36 months would affect children's executive functions skills in the first grade directly, and also would affect executive function indirectly via children's mastery motivation at 54 months. Figure 2 shows the conceptual model for the study 2.

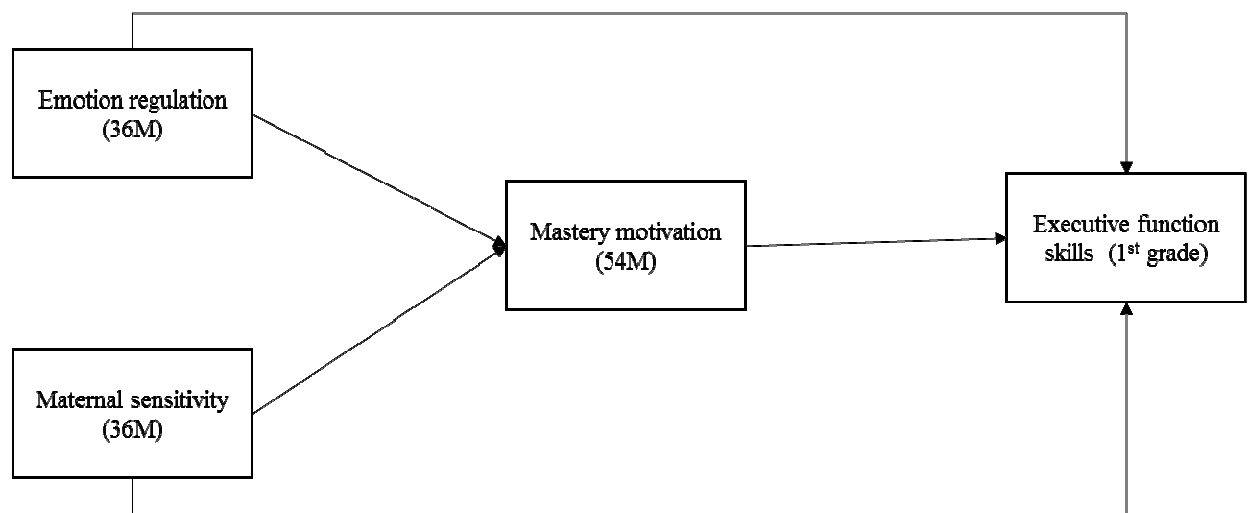


Figure 2. Conceptual Model for Study 2

This dissertation is organized as follows. In Chapter 2, Study 1 is described in more detail as a complete scholarly paper. It includes a review of previous research on the relations between early maternal depressive symptoms and later mastery motivation and related domain such as self-regulation and school readiness. In addition, the role of maternal behavior as a possible mediator in the relations of early maternal depressive symptoms to later mastery motivation and related domains is examined. Similarly, Chapter 3 explains Study 2 in more detail as a complete scholarly paper. Previous research on development of executive function skills and their predictors, especially maternal behavior and the child's emotion regulation, is reviewed. In addition, the possible role of the child's mastery motivation in mediating the relationship between executive function skills and their predictors is examined. Because Chapters 2 and 3 are written as separate papers, intended for individual submission and publication, the methods that are common across both studies (e.g. dataset, data collection, variables) are described in each chapter. Finally, in Chapter 4, I summarize these two studies, and discuss future research directions.

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## **Chapter 2. The Path from Maternal Depression to Mastery Motivation: The First Three Years**

Mastery motivation – motivation to achieve goals – is an important characteristic, supporting multiple domains of child development. For example, mastery motivation promotes better cognitive performance and academic achievement, and is associated with fewer behavior problems (Broussard & Garrison, 2004; Deater-Deckard, Petrill, Thompson, & DeThorne, 2005; Turner & Johnson, 2003; Zhou et al., 2007). However, the association between mastery motivation, self-regulation, and general cognitive skills call into question whether mastery motivation is actually a unique concept, separate from these other well-established characteristics. Further, mastery motivation is affected by parental behaviors including sensitivity and intrusiveness (Banerjee & Tamis-LeMonda, 2007; Yarrow, Morgan, Jennings, Harmon, & Gaiter, 1982); these same behaviors are important predictors of children's self-regulation and cognitive skills (Dodici, Draper, & Peterson, 2003; Moilanen, Shaw, Dishion, Gardner, & Wilson, 2010). However, we know very little about effects of maternal depression on child's mastery motivation even though maternal depression is known to be one of the risk factors associated with many aspects of child development including greater behavioral problems and lower academic performance (Goodman, 2007), as well as an influence on the maternal behaviors which support the development of mastery motivation (Banerjee & Tamis-LeMonda, 2007).

Mastery motivation, self-regulation, and general cognitive skills are each associated with academic achievement (Broussard & Garrison, 2004; Calkins, 2007; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). In particular, mastery motivation and self-regulation can be seen as intertwined skills (Wang & Barrett, 2013). However, they may be differentially influenced by maternal behaviors and maternal depression. For example, one previous study showed that mastery motivation is affected by positive maternal behaviors rather than negative behaviors

(Kelley, Brownell, & Campbell, 2000), while another study reported that self-regulation is influenced more by maternal negative behaviors (Karreman, Van Tuijl, Van Aken, & Dekovic, 2006). Limited research has examined the effects of maternal factors on mastery motivation, self-regulation, and general cognitive skills together. Comparing the effects of maternal factors on these three sets of skills could help elucidate whether mastery motivation is in fact a separate construct from self-regulation and general cognitive skills, with different predictors and outcomes.

The main focus of the current study is an examination of the possibility that early maternal depression influences the child's mastery motivation and related domains, including child self-regulation and general cognitive skills. In addition, the current study investigated the role of maternal behavior – specifically sensitivity and intrusiveness - in the association between early maternal depression and children's later mastery motivation, self-regulation, and general cognitive skills. The results of this study have the potential to elucidate sources of variation in the development of mastery motivation.

### **Development of Mastery Motivation**

In the current paper, the term “mastery motivation” refers to the child's motivation to persist in challenging tasks, achieve goals, and master skills. Many terms have been used, for the most part interchangeably, for describing the child's motivation to achieve goals: mastery motivation, intrinsic motivation, competence motivation, and achievement motivation (Messer, 1993). Rothbart and Hwang (2005) have defined motivation as “the energization (instigation, activation) and direction (focus, aim) of behavior” (p. 170). According to Barrett and Morgan (1995), mastery motivation is a multifaceted and intrinsic force that drives an individual to make active and independent attempts to interact with the world in order to master the environment or

achieve goals. It includes actions or activities to “explore (gain knowledge), influence (cause an auditory or visual display), or control the physical environment” (Jennings, 1993, p. 37). It is important to conceptually distinguish mastery motivation from competence; competence refers to an ability to conduct a task properly, while mastery motivation involves the motivation that urges an individual to attempt to master the environment or achieve goals. Thus, successful achievement of the goal is not necessarily implied in mastery motivation; the child does not need to be successful with the tasks in order to demonstrate mastery motivation (Barrett, Morgan, & Maslin-Cole, 1993). However, highly motivated children are more likely to learn successful strategies than children with low levels of mastery motivation, which fosters children’s competence in problem-solving (Barrett & Morgan, 1995).

Mastery motivation is an internal process that cannot be observed directly. Thus, mastery motivation has been assessed through individual’s behaviors. Barrett and colleagues (1993) suggested that indicators of mastery motivation can be seen as falling into two domains: instrumental and expressive aspects of mastery motivation. Instrumental aspects of mastery motivation refer to behaviors that are used to achieve a goal, including the length of time that a child persists or focuses on mastering a new skill or task. Other examples of instrumental aspects of mastery motivation are the child’s need for physical and/or cognitive control over his or her environment, and a preference for challenging moderate or difficult tasks or novelty, children’s agency such as initiative and choices about activities, and levels of engagement in tasks (Barrett & Morgan, 1995; Wigfield, Eccles, Schiefele, & Davis-Lean, 2006). Children who persist in conducting the task for a longer period or choose a difficult task rather than an easy task can be considered highly motivated children. Expressive aspects of mastery motivation refer to task-related emotions expressed by the child during or after conducting the task such as pleasure,

enthusiasm, interest, or pride (Barrett et al., 1993). Highly motivated children tend to engage in the task enthusiastically or show more smiles and positive expressions during or after the task. Researchers have argued that positive emotions promote children's persistence or engagement in challenging tasks and persistence helps children learn and master new skills. In the current study, children's task-persistence and enthusiasm in tasks are used as indicators of instrumental and expressive aspects of mastery motivation respectively.

Behavior and affect relating to mastery motivation can be seen during early development. However, the nature of mastery motivation transforms as the child develops and these changes are affected by changes in cognition (Barrett & Morgan, 1995). Barrett, MacTurk, and Morgan (1995) proposed that "mastery motivation is not a static, stable, unitary trait, but rather a complex, malleable, process" (p. 347). According to Jennings (1993), from birth to about 9 months, infants begin to find and explore novel objects with interest and they become aware of contingency produced by their own movements. They smile and laugh when this contingency occurs. This is consistent with Piaget's notion that the motivation to explore and engage the environment is intrinsic and one of the earliest schemas (Miller, 1983). From about 9 to 18 months many infants are able to separate means from ends and act in order to achieve both simple goals and process-oriented goals. For example, when putting blocks in a bucket, the goal of the infant in this period is to put an individual block into the bucket, rather than trying to fill the bucket, which involves a future goal. Infants show interest by smiling during this activity. From about 18 months to 3 years, toddlers become increasingly able to focus on goals, and the end points for their activities focus on outcomes. As in the previous example of block play, toddlers in this period can conceptualize, in a simple way, their goal to fill the bucket with the blocks, and will not terminate their activities (putting blocks in the bucket) until the bucket is

filled. They recognize that their goal is to *fill* the bucket with blocks rather than just putting blocks in the bucket. The behavior continues because they perceive that all the blocks are not yet in the bucket (Jennings, 1993). Focusing on outcomes allows toddlers to compare their own behavior or situation with the desired outcome so that they can evaluate their ongoing behavior. Toddlers may show pride or embarrassment based on this evaluation of their own success, and these emotional expressions are considered to be indicators of the evaluative aspect of mastery motivation (Jennings, 1993). After 17 months, children's self-awareness and self-evaluation increase and affect mastery motivation (Barrett & Morgan, 1995), which means that parental socialization or other aspects of the environment may have a greater influence on mastery motivation beginning in late toddlerhood. Relatedly, at this age, children begin to show individual differences in their interpretation of their own performance, in preference for more or less challenging tasks, and in their tendency to persist in a chosen task (Barrett & Morgan, 1995). Even though mastery motivation is intrinsic and operate from infancy, changes in the nature of mastery motivation, as indicated by increasing variability in degree of motivation, indicate that children are increasingly affected by interactions with parents (Barett & Morgan, 1995; Bush-Rossnagel, Knauf-Jensen, & DesRosiers, 1995). The effects of parenting on mastery motivation will be addressed later in more detail.

### **Development of Self-Regulation**

Self-regulation and mastery motivation are intertwined skills. Both mastery motivation and self-regulation are “umbrella constructs with a number of interrelated subsystems that, together, support children's adaptive functioning with respect to the nonsocial, social, and self-domains” (Wang & Barrett, 2013, p. 338). Self-regulation refers to the ability to adjust one's cognitive, emotional, and social behaviors appropriately to a particular situation (Posner & Rothbart, 2000).

In early life, children acquire self-regulation skills and strategies, such as the delay of gratification and exerting control over impulses, actions, and emotions. This repertoire allows the child to cope with challenges, and promote independent, autonomous, and self-initiated action (Calkins, 2007). Children who cannot acquire appropriate self-regulation abilities experience more behavioral problems (Calkins & Fox, 2002) and are reported to have difficulty controlling their negative emotions, forming positive relations with peers, following others' instructions, and achieving better academic performance (Calkins, 2007; Valiente et al., 2008).

Given this course of development, self-regulation could facilitate the development of children's mastery motivation. Higher self-regulatory ability could encourage the child to maintain positive engagement in challenging tasks by giving them the ability to control their negative attention or affect, such as frustration in response to initial task failures. Chang and Burns (2005) found that children with better self-regulation skills (attention-shifting and attention-maintaining) exhibited more mastery-oriented behavior in puzzle tasks. The ability to regulate attention could enable children to focus on tasks and enable them to gain knowledge related to tasks and appropriate solutions. According to Howes and colleagues (2003), children with poor self-regulatory abilities were more easily distracted from tasks, which would be expected to deprive them, over time, of opportunities to learn new skills. Ultimately, poor self-regulatory skills hinder children's success in school (Valiente, Lemery-Chalfant, Swanson, & Reisner, 2008). By examining whether self-regulation predicts mastery motivation in early childhood, this study addresses whether mastery motivation is a possible mechanism through which self-regulation affects children's school success.

## **The Relationship between Maternal Parenting and Children's Social and Cognitive Skills**

According to Vygotsky (1986), children develop their social and cognitive functioning through interactions with more knowledgeable partners who guide them in learning beyond their current skill level. For very young children, the mother, or primary caregiver, is the most likely partner. Thus, maternal behavior is important in the development of a wide range of children's behaviors and skills.

Previous research suggests that specific parenting behaviors facilitate or impede the development of mastery motivation. For example, Baumrind (1971) claimed that children have more opportunities to challenge and succeed in tasks when parents support the child's autonomy with warmth and nurturing. Maternal sensitivity and responsiveness are also associated with the child's mastery motivation, especially task-persistence. Spangler (1989) found that the high quality of maternal interaction during free play promoted the development of mastery motivation in 24-month-old children. In particular, children whose mothers showed high responsiveness and involvement were likely to display high persistence. Banerjee and Tamis-LeMonda (2007) showed the importance of maternal behavior at six months in the development of child's mastery motivation. A mothers' teaching (i.e., maternal sensitivity, fostering cognitive growth, and fostering social-emotional growth) at 6 months was significantly associated with her infant's persistence at both 6 months and 14 months. Mothers' sensitivity and responsiveness may encourage children to explore, access, and persistently engage in stimulating toys or activities, which in turn allows children to gain more knowledge and new skills. The idea that securely attached children use their mothers as a secure base from which to explore is consistent with this research (Risken-Walraven et al., 1993). Kelley, Brownell, and Campbell (2000) reported associations between a child's mastery motivation and maternal scaffolding, defined as correcting the child's behavior with a neutral or positive tone and supporting the child's efforts

and autonomy. Kelley and colleagues found that children whose mother used scaffolding were less likely to avoid challenging tasks; that is, maternal scaffolding appears to encourage a child to face challenges for the mastery of activities.

Contrary to the positive parenting described above, maternal control impedes the development of a child's mastery motivation. After 17 months of age, the child's self-awareness and intentionality are developed to the degree that children can select tasks and actions that they can do. If a mother is too directive and takes charge of the child's interaction with the environment, doing for the child what he could do for himself, children may learn to more passively respond to the environment rather than to initiate interactions with it (Busch-Rossnagel et al., 1995). This, in turn, deprives a child of opportunities to learn and master new knowledge and skills. This is also consistent with the tenets of attachment theory which posits that children develop a sense of self – their own characteristics and capacities in the world, and an expectation of how the world responds to them - within their relationship with their primary caregivers (Bowlby, 1982). Thus, experiencing maternal intrusiveness may cause children to internalize a distrust of self, which in turn, could weaken mastery motivation. Previous research has provided evidence of the negative effects of maternal intrusiveness on mastery motivation. For example, Lutkenhaus (1984) found that maternal physical interruption and critical feedback had negative effects on children's motivation in 3-year-old children. Yarrow and colleagues (1982) also showed that high levels of maternal control were related to decreased mastery motivation in toddlers. These findings indicate that mastery motivation is reduced when children feel controlled by others.

In addition to its associations with mastery motivation, maternal behavior is also associated with the child's cognitive skills. Dodici, Draper, and Peterson (2003) measured

qualities of parent-child interactions including parents' use of age-appropriate language, emotional tone, joint attention, parental guidance, and parental responsiveness when children were 14, 24, and 36 months. Children's literacy skills were assessed at the spring or summer prior to kindergarten entry. They found that higher quality parent-child interactions at 24 and 36 months promoted the development of children's literacy skills. In addition, maternal supportiveness and providing a positive learning environment are also strong predictors of children's later language development (Chazan-Cohen et al., 2009).

The role of parenting in the development of child self-regulatory ability has also been well studied. A meta-analysis of 41 studies on parenting and preschoolers' self-regulation showed that parental control (i.e., harshness, taking over an activity, insisting upon parent strategy) was negatively associated with children's self-regulation, while responsive parenting (i.e., positive affect, acceptance, sensitivity, process of coordination, or warmth) was unrelated to self-regulation (Karreman, Van Tuijl, Van Aken, & Dekovic, 2006). Specifically, Karreman and colleagues examined three categories of children's self-regulatory abilities, including compliance, inhibition, and emotion regulation, and examined the effects of different aspects of parent behavior on each of them. Interestingly, only child compliance was significantly associated with parents' controlling behavior. Children's inhibition and emotion regulation were not related to parental controlling behavior or to sensitive parenting. The researchers argued that there may be no relations between parental responsiveness and child's self-regulation because most studies used community samples in which there was little variability in parental responsiveness. They also suggested that parental controlling behavior might be less important for internalized self-regulation, such as inhibitory control and emotion regulation. According to Karreman and colleagues (2006), external monitoring is not needed for internalized self-

regulation so inhibitory control or emotion regulation may be less influenced by maternal controlling behavior. Recently, Moilanen and colleagues examined the relationships between parenting and initial levels and growth trajectories in children's self-regulation, especially in inhibitory control, between the ages of two and four years (Moilanen, Shaw, Dishion, Gardner, & Wilson, 2010). They reported that supportive and involved parenting of 2-year-olds was positively associated with children's inhibitory control at the same age, and predicted faster growth in inhibitory control between the ages of 2 and 4 years. Harsh parenting, such as negative verbal, directive, and physical behavior, was associated with lower levels of children's inhibitory control at two years of age, but did not predict growth in inhibitory control ability between the ages of two and four years. These results indicate that positive parenting may have concurrent and long-term effects on children's self-regulation, while negative parenting may have only concurrent effects.

Based on studies reviewed, the effects of parenting behavior on children's development may be very specific to different domains or skills. Thus, the present study focuses on the separate specific effects of maternal sensitivity versus intrusiveness on children's mastery motivation, self-regulatory ability, and general cognitive skills.

### **The Relationship between Maternal Depression and Children's Social and Cognitive Skills**

Maternal depression is known to be one risk factor associated with pathways to many different outcomes in child development. For example, infants of depressed mothers are more likely to have a difficult temperament, less likely to have secure attachments with their mothers, and show lower levels of mental and motor development than children of non-depressed mothers (Goodman & Gotlib, 2002). Children of depressed mothers show more behavioral problems, negative affect, and poorer academic performance than children of non-depressed mothers

(Goodman, 2007). Feldman and her colleagues (2009) also found that infants of mothers who were diagnosed with major depressive disorder showed poorer social engagement and higher levels of cortisol reactivity, which indicated poorer physiological regulation. In addition, higher negative emotionality and less mature self-regulatory behaviors and goal-directed tactics were observed in infants of depressed mothers (Feldman, et al., 2009).

The effects of maternal depression on children's cognitive development have also been established. Milgrom, Westley, and Gemmill (2004) found negative associations between early maternal depression and later cognitive development. Specifically, at the age of 42 months, children of mothers who were diagnosed with a major depressive disorder showed lower IQ scores and lower basic school skills than children of non-depressed mothers. Maternal depression early in the child's life also has negative effects on children's language development, an important indicator of school readiness (Janus & Offord, 2007; Milgrom et al., 2004). For example, Milgrom and colleagues (2004) reported that children whose mothers had been diagnosed with postpartum depressive disorder showed poorer language skills at 42 months.

Maternal depression also affects children's self-regulatory skills. Marchand, Hock, and Widaman (2002) found that maternal depressive symptoms had concurrent effects on children's behavioral regulation abilities, especially externalizing behaviors at age four. Longitudinal effects of early maternal depression have also been reported. For example, Chazan-Cohen and her colleagues (2009) measured maternal depressive symptoms when children were 14, 24, and 36 months, and at kindergarten entry, and investigated the relationship between early maternal depression and children's self-regulation abilities and related behavior problems at age five. According to their findings, children whose mothers reported more maternal depressive symptoms at 14 months showed more behavior problems at age five. Although there were no

significant associations of early maternal depressive symptoms (e.g. 14 months) with later children's emotional regulatory skills, increases in mothers' depressive symptoms from 14 months to five years were related to children's poorer emotional regulatory skills.

Although many researchers have studied the negative effects of maternal depressive symptoms on children's development, only a few studies have examined whether maternal depression affects mastery motivation in infants and toddlers. In one study, Redding, Harmon, and Morgan (1990) assessed the relationship between maternal depression and infants' mastery behaviors in 1- and 2-year-olds and their mothers. They found that infants whose mothers reported more depressive symptoms showed lower task competency (ability to put puzzle pieces in the right places) and lower persistence in challenging tasks at both ages. In addition, children's task pleasure at two years was negatively associated with maternal depression. Similarly, Hart and colleagues (1998) found that infants of depressed mothers spent less time in manipulating and examining a single toy than non-depressed mothers. Results of several other studies are consistent with these findings. Jennings and Abrew (2004) showed that 18-month-old toddlers of depressed mothers were less likely to show persistence and to display less mastery pleasure indicated by smiling and positive affect in mastery tasks than toddlers of non-depressed mothers. Moreover, toddlers of depressed mothers needed more prompts in order to focus on the tasks and were less likely to express pride. These results suggest that maternal depression can impede the development of mastery motivation.

Despite the relatively consistent findings regarding the relationship of maternal depression to children's motivation and skills, there are still some inconsistencies which may indicate more nuances in these relationships. Kurstjens & Wolke (2001) examined the influence of maternal depression on children's cognitive development over a 7-year period. According to

their findings, children whose mothers met diagnostic criteria for a depressive episode were not significantly different in cognitive skills measured at 20 months, 58 months (4.8 years), and 76 months (6.3 years) from those whose mothers had no depressive symptoms. Similarly, Brennan and colleagues (2000) failed to find any significant relationships between maternal depressive symptoms (postpartum, 6 months, and 5 years old) and children's language skills at age five. Additionally, Murray and colleagues (1996) found no adverse effects of postnatal depression on children's cognitive functioning at age five. However, they found that children who experienced insensitive parenting early in life showed poorer cognitive functioning than children with more sensitive parents. This suggests that children's cognitive functions may be affected by the quality of early parental interactions rather than directly by early maternal depression *per se*, or may be explained by interaction between the depressive symptoms and specific parenting behaviors. Further, it is also likely that the effects of maternal depression may act more directly on some domains of development, while the influence of maternal depression on other domains may be attenuated by mediators, specifically in parenting behavior.

### **The Relationship between Maternal Depression and Maternal Parenting**

Maternal depression limits mothers' abilities to care for and respond to their children. The negative effects of maternal depression on parenting and mother-child interactions have been well documented (for review, see Sohr-Preston & Scaramella, 2006). For example, mothers who report more depressive symptoms are likely to show more controlling or withdrawn behaviors toward their children, more negative affect, less affectionate touch, and they spend less time reading and playing with their infants (Field, 2010). In addition, depressed mothers have been shown to be less sensitive toward their infants' cues (Murray, Fiori-Cowley, Hooper, & Cooper, 1996). Hart and colleagues found that depressive mothers tended to be more intrusive

during free play with their infants than non-depressive mothers, and showed more physically intrusive behaviors, particularly to boys (Hart et al., 1998). Recent research has also provided additional evidence that maternal depressive symptoms are associated with negative emotional and behavioral characteristics of the mother-child relationship. For example, Caughy, Huang, and Lima (2009) found that depressed mothers were observed to have higher rates of conflict with their toddlers during a teaching task and were more likely to use criticism, scolding, threatening, and aversive physical control to the children's oppositional behavior.

Based on the evidence reviewed above, one hypothesis of the current study is that mothers with higher levels of depressive symptoms will show less sensitive and more intrusive behaviors toward their children than mothers with lower levels of maternal depressive symptoms. However, despite the strong evidence of associations between maternal depression and negative parenting behaviors, there are also some inconsistent associations between maternal depression and specific parenting behaviors. For example, Carter and colleagues (2001) did not find any differences in early play interactions or infant attachment security between groups of depressed mothers (without any other psychopathology) and non-depressed mothers (without any psychopathology). However, mothers who had depression and other psychopathology together showed poorer relationships with their infants. These results suggested that maternal depression may not affect the mother-child relationship directly by itself, but accompanied with other psychopathology may have a negative effect on the mother-child relationship. Further, Forman and colleagues (2007) asserted that reducing maternal postpartum depressive symptoms was not sufficient to improve positive parenting to the level of non-depressed mothers. They compared maternal responsiveness in depressed and non-depressed mothers and found that depressed mothers were less responsive to their infants at the first year than were mothers in the non-

depressed group. Even though mothers received treatment and recovered from depression, they were still observed to have significantly lower levels of maternal responsiveness than non-depressed mothers. The results indicated that current maternal depression might not sufficiently account for differences in maternal responsiveness. An alternate explanation for these findings is that those who received treatment recovered from clinical depression, but they may have maintained sub-clinical depressive symptoms which still affected their interactions with their children. The studies reviewed above suggest that there may be a more complex relationship between maternal depression and parenting behaviors, rather than a simple direct association. Variations in the relationship between maternal depression and parenting may be caused by differences in samples across the studies, in the severity of maternal depressive symptoms, or may be due to the different effects of maternal depression on specific parenting behaviors. For example, maternal intrusive behaviors may be strongly influenced by characteristics of maternal depression, however, maternal sensitivity or responsiveness may be affected more weakly by maternal depression. Another possible explanation is that maternal depression may have only short-term effects on maternal sensitivity or responsiveness, or may not be linked directly. A meta-analysis by Lovejoy and colleagues (2000) reviewed 46 observational studies and found that the association between depression and negative maternal behavior was strongest, while the relation of depression to positive maternal behavior was relatively weak. In the current study, we examine whether early maternal depressive symptoms (at 6 months) differentially affect positive (sensitivity) and negative (intrusiveness) maternal parenting when toddlers were 24 months of age.

## **Maternal Parenting Behavior as a Mediator or Moderator**

Positive and negative aspects of parenting may play distinct roles in the relationship between early maternal depression and toddlers' later development. Specifically, higher levels of insensitivity and intrusiveness, if present in depressed women, could be proximal contributors to the achievement of competent levels of self-regulation, mastery motivation, and school readiness. Previous research has supported the hypothesis that characteristics of mother-child interactions mediate the association between maternal depression and toddlers' development. Leckman-Westin and her colleagues (2009) examined the longitudinal effects of maternal depressive symptoms and mother-toddler interaction patterns during the child's second year on children's later behavior problems. They found that early maternal depressive symptoms were significantly associated with children's later behavior problems when mothers provided lower levels of responsiveness and more negative affect. At the same time, however, maternal positive interaction, such as high levels of responsiveness and positive affect, mitigated the negative effects of depressive symptoms on children's behavior problems, as much as 7 to 10 years from the first assessment of maternal depression and child behavior problems (at 2 years of age). These results support the role of maternal behaviors as a moderator in the relation between early maternal depression and children's later development. Similarly, a recent study showed the moderating effects of maternal sensitivity on the relationship between maternal depression and infant social behaviors (Feldman et al., 2009); however, maternal intrusiveness did not moderate the effects of maternal depression on infants' behaviors. Another study found that maternal parenting behavior mediated the effects of early maternal depression on children's later language development (Stein, Malmberg, Sylva, Barnes, & Leach, 2008). In that study, maternal depressive symptoms at child age 10 months, but not 36 months, predicted low quality of maternal parenting (i.e., less maternal responsiveness and less provision of opportunities for

learning), which in turn affected language skills in children at 36 months. Although previous research has found that maternal behavior mediates or moderates the relationships between maternal depression and various child outcomes, we still know very little about how maternal behavior may alter the relationships between early maternal depression and children's later mastery motivation.

### **Current Study**

In the current study, using longitudinal data, we examined whether early maternal depressive symptoms affect children's later social and cognitive skills (i.e., mastery motivation, self-regulation, and school readiness), and whether this effect is direct or indirect via maternal positive and negative parenting behaviors. Recent research has suggested that early maternal depression is a strong predictor of toddlers' developmental outcomes. For example, Bagner and colleagues (2010) emphasized the crucial effects of maternal depression during the first year on later child development because the first year is a sensitive period when the child's emotional regulation and cognitive processing abilities – which are both associated with mastery motivation – develop rapidly. However, mixed results of other studies suggest that these effects are mediated by specific qualities of maternal behavior. Based on these findings, the present study focused on how early maternal depressive symptoms, measured at 6 and 24 months, affect children's later social and cognitive skills at the beginning of preschool (36 months). I expected early maternal depressive symptoms would be significantly associated with maternal sensitivity and intrusiveness in toddlerhood, and that maternal depressive symptoms would predict children's regulatory ability, general cognitive skills, and mastery motivation at the beginning of preschool. I also tested whether maternal parenting in toddlerhood (i.e., sensitivity and intrusiveness) mediates or moderates the relations of early maternal depressive symptoms with

toddlers' social and cognitive skills at the beginning of preschool. Figure 3 provides a conceptual model of the hypothesized relationships.

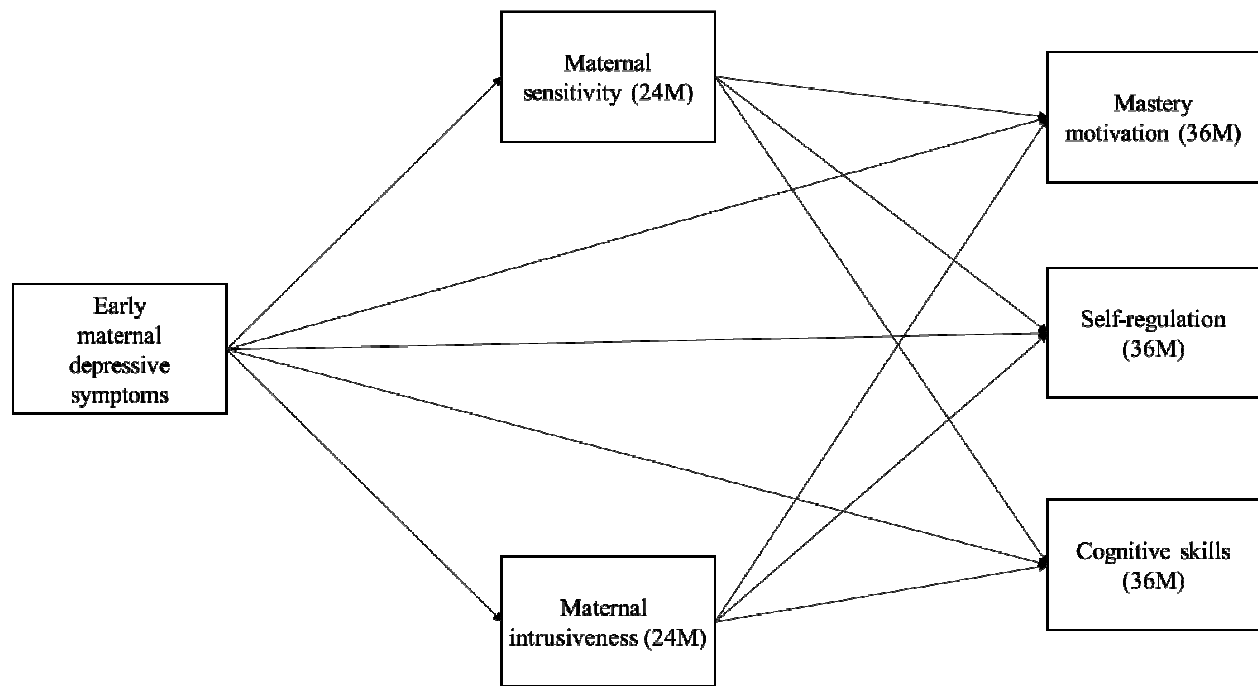


Figure 3. Conceptual model of hypothesized relationships among maternal depressive symptoms and parenting behaviors in early childhood, and children's mastery motivation, self-regulation, and cognitive skills.

## Method

### Participants

The data used in the present study came from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD). Families with full-term and healthy newborns were recruited from designated hospitals at ten locations across the United States: Little Rock, AR; Irvine, CA; Lawrence, KS; Boston, MA; Philadelphia, PA; Pittsburgh, PA; Charlottesville, VA; Morganton, NC; Seattle, WA; and

Madison, WI during January 1991 to November 1991. Mothers and children participating in this study met the following criteria: (a) the mother was over 18 years old, (b) the mother could speak and understand English, (c) the mother did not have any substance-abuse problems, (d) the child was a singleton, (e) the child did not have any disabilities, and (f) the child was not hospitalized for more than 7 days. Data were collected during home visits and in a laboratory playroom. In particular, the Phase I data were collected at 1 month, 6 months, 15 months, 24 months, and 36 months of a child's age. During the course of the first three years of the study some subjects dropped from the study for a variety of reasons such as the family moved away, family illness, and so on. Therefore, a total 1,231 children (635 boys and 596 girls) and their mothers participated in the current study. The mothers' mean age when children were 1 month of age was 28.28 years ( $SD = 5.60$ ). The majority of mothers were White ( $N = 1031$ ; 83.8%) and married ( $N = 993$ ; 77.8 %). In addition, the mean maternal education level was 14.2 years. The mean household income at 6 months of child's age was \$49,126 ( $SD = \$40,047$ ). Table 1 shows full maternal demographic characteristics.

Table 1. Maternal Demographic Characteristics

Maternal Characteristics	N	Percent
Marital status		
Married	993	77.8
Partnered, cohabitating	108	8.5
Separated	17	1.2
Divorced	2	.2
Widowed	1	.1
Single	147	11.6
Other	8	.6
Education		
Less than high school	115	9.2
High school diploma	255	20.7
College	409	33.2
Bachelor's degree	266	21.6
Graduate & professional	186	15.1
Ethnicity		
American Indian/ Eskimo/Aleut	8	.6
Asian/Pacific Islander	27	2.2
Black/Afro-American	145	11.8
White	1031	83.8
Other	20	1.6

## Measures

**Maternal depression.** In order to assess early maternal depressive symptoms, the Center for Epidemiological Studies Depression Scale was administered to mothers when their infants were 6 and 24 months of age (CES-D; Radloff, 1977). The CES-D is a self-report scale to measure depressive symptoms in non-clinical populations. Mothers were asked to rate the

frequency of 20 symptoms, during the past week. Responses were “rarely or none of the time (less than 1 day)”, “some or a little of the time (1-2days)”, “occasionally or a moderate amount of time (3-4 days)”, and “most of all of the time (5-7 days)”. Sample items include: I felt I was just as good as other people, I thought my life had been a failure, and I could not get “going”. The Cronbach alpha for the scale was .892. The average score between the measures at 6 and 24 months was used.

**Maternal sensitivity.** Maternal parenting was assessed by observing maternal sensitivity and intrusiveness in mother-child interactions when children were 24 months of age. Maternal sensitivity referred to a mother’s child-centered behavior that focused on her child’s needs, moods, interests, and capabilities. Sensitive behavior requires attention to the child’s cues, as well as correct interpretation of the signals. The sensitive mother uses this awareness to guide her behavior with her child. A semi-structured procedure, the three boxes episode, was utilized to measure the quality of mother-child interaction during the 24-month lab visit. Three toys (e.g., story book, toddler kitchen, and discovery cottage) were placed in separate boxes and the mother and her child were asked to play with these toys one at a time for 15 minutes. However, the researcher did not tell the mother that she had to interact with the child, nor how long the child could spend with each toy in order to observe more naturally how sensitive mothers were to their children’s interests and needs, the degree to which mothers were involved with play, and how mothers dealt with the transition from one toy to another. Child and maternal behaviors were videotaped during the episode. Trained observers coded maternal sensitivity from the videotaped three box episode at the end of each 30s interval using a four-point rating scale (1 = not at all characteristic, 4=highly characteristic). Ratings were summed over intervals and divided by the number of intervals. This qualitative scale was adapted from the Observation Record of the

Caregiving Environment (ORCE) developed for NICHD study (Vandell, 1996) . Sensitive maternal behaviors included acknowledgment of the child's affect, responsiveness to the child's talk and /or activity, facilitating the child's play, sensing the child's interests, providing an appropriate level of stimulation and appropriate range or variety of activities, and so on. Two coders received 19-20% of the tapes randomly in order to determine inter-coder reliability. Inter-coder reliability was calculated as the intra-class correlation (Winer, 1971), which was .80 for maternal sensitivity.

**Maternal intrusiveness.** In order to assess maternal positive parenting, maternal intrusiveness was examined. Maternal intrusiveness indicated adult-centered behaviors rather than child-centered behaviors. The intrusive mother imposes her agenda on her child and does not allow her child an opportunity to respond at his/her pace. As with maternal sensitivity, the three box procedure was used to assess maternal intrusiveness at 24 months of age. Maternal behaviors were videotaped and the trained observers coded following maternal intrusive behaviors: offering a continuous barrage of toys, directions or suggestions, taking away toys or curtailing activities without a reasonable explanation while the child still appears interested, not allowing the child to make choices, excessively disciplining the child, and so on. As with the assessment of maternal sensitivity, these behaviors were coded in 30s intervals with a four-point scale (1 = not at all characteristic, 4=highly characteristic), which had been adapted from ORCE (Vandell, 1996). Higher scores indicated higher levels of intrusive maternal behaviors. Intercoder reliability was determined and calculated in the same manner as was done for maternal sensitivity. The intraclass correlation for maternal intrusiveness was .69.

**Mastery Motivation.** The three box procedure during 36-month lab visit was used to assess the child's mastery motivation consisting of two measured components: enthusiasm and

persistence. Three toys, such as drawing materials with stencil set, dress up clothes and the cash register with 8 pennies, and Duplo Preschool Building set were placed in separated open boxes. These toys were selected based on several principles: the toys should be interesting to children in this age group, and were expected to foster a variety of activities which meant that children could have different goals for each toy. For example, children might try to learn how to stencil using toys in the first box or children could explore the operation of the cash register using toys in the second box. As with the three box task at 24 months, mother-child interactions at 36 months were videotaped for 15 minutes. Enthusiasm referred to whether the child acts with vigor, confidence, and eagerness to do the tasks, and involves a sense of agency. Enthusiasm ratings were based on goal-oriented behavior on the task with a seven-point scale (1 = Very low, 7 = Very high) that was adapted from Egeland and Hiester' teaching task rating scale (1993). For example, if child seemed hesitant to engage the task or does so mechanically and with no evidence of being interested in or excited by his/her performance, or the child showed extreme lack of confidence in his/her behavior, coders rated this behavior as 1. In order to master objects, children need to engage in and manipulate objects. Thus, instrumental aspects of mastery motivation were assessed using children's persistence to indicate the extent to which the child was actually involved with toys in the session. The child's involvement with toys was coded with a seven-point scale from Very low (1) to Very high (7). The coders rated involvement as 1 if the child did not engage with any of the toys, refused to become involved and either fled or spent his/her time in off-task activities; involvement was rated 7 if the child showed sustained attention and active involvement with the toys, and played persistently throughout the session. Intercoder reliability was determined and calculated using the same method described earlier for maternal

sensitivity and intrusiveness. The intraclass correlations were .67 for the child enthusiasm and .66 for the child persistence.

**Self-regulation.** The forbidden toy task was used to assess the child's level of self-control by measuring their ability to delay and/or inhibit play with an attractive toy. The procedure was conducted at the laboratory playroom at 36 months with the child's mother present. The child was asked not to touch an attractive toy (crocodile toy) that was placed within arm's reach, until told to do so (150 seconds). Mothers were also asked not to give any help to their children in order to minimize relationship-context confounds. Self-regulatory ability (self-control) was determined by measuring the length of time the child refrained from touching and playing with the toy after initial instructions from the experimenter. Inter-rater agreement for timing latency to touch the toy was .92.

**General cognitive skills.** Braken Basic Concepts Scale (BBCS; Bracken, 1998) was utilized to measure the child's general cognitive skills at 36 months. The BBCS is a full scale diagnostic instrument, along with two screening tests. The school readiness component, including the five subscales of the diagnostic scale, was administered in the current study. The battery consisted of a 10-item Colors test, a 10-item Letter Identification test, a 14-item Number/Counting test, a 7-item Comparisons test, and a 20-item Shapes test. Each item was scored either 1 or 0 for pass or fail. Scores on the five subtests were summed to create the school readiness composite. Subsequently, a School Readiness standard score, which used for the general cognitive skills in the study, were computed based on the BBCS standardization data and has a potential range of 1 to 19. The overall mean standard score was 9.02 (SD=3).

### **Data-analytic strategy**

Structural equation modeling (SEM) with SPSS and AMOS 17.0 was used to test a partial mediation model in which early maternal depression was hypothesized to affect children's later mastery motivation and related domains (general cognitive skills and self-regulation) both directly and indirectly via specific types of maternal parenting (sensitivity and intrusiveness). First, the direct path model was fit in order to assess the direct associations between early maternal depressive symptoms and children's later mastery motivation, self-regulation, and general cognitive skills. Second, the partial mediation model (with all paths estimated) tested the direct and indirect effects of early maternal depressive symptoms on children's outcomes via maternal parenting. Third, the direct model and partial mediation model were compared to determine the best fitting model by examining the differences between model chi-squares.

Models were evaluated based on several criteria. First, the  $\chi^2$  value, as an indicator of overall fit, was assessed comparing the covariances within the hypothesized model and the null model. The probability value related to  $\chi^2$  indicates the likelihood of obtaining a  $\chi^2$  value that exceeds the  $\chi^2$  value when the null model is true. Therefore, a low and statistically nonsignificant  $\chi^2$  value represents a good model fit (Schumacker & Lomax, 2010). The comparative fit index (CFI) and root mean square error of approximation (RMSEA) were also calculated to evaluate models. For a good model fit, CFI should be .95 or above; RMSEA should be .06 or below (Hu & Bentler, 1999). The current study compared two models including the partial mediated and the full mediated models, and the expected cross-validation index (ECVI) was calculated. A smaller ECVI value indicates a better model fit with data (Byrne, 2010).

## Results

### Preliminary Analyses

The mothers' and toddlers' mean scores, standard deviations, and ranges on main variables are reported in Table 2. Table 3 shows the results of correlations among the main variables. As expected, early maternal depressive symptoms were significantly correlated with 24-month maternal sensitivity and with 24-month intrusiveness, as well as with toddlers' self-regulation, general cognitive skills, and mastery motivation (i.e., enthusiasm and persistence) at 36 months. Early maternal depressive symptoms were positively related to 24-month maternal intrusiveness, and negatively related to maternal sensitivity and to toddlers' social and cognitive skills at 36 months. In addition, maternal sensitivity at 24 months was positively linked to child's social and cognitive skills at 36 months, while maternal intrusiveness at 24 months related negatively to child's social and cognitive skills. The full matrix of correlations is in Table 3.

Table 2. Descriptive Statistics for the Main Study Variables

Main Variable	Mean	SD	Range
Early maternal depression	9.12	7.33	0-46.5
Maternal sensitivity (24M)	3.01	0.75	1-4
Maternal intrusiveness (24M)	1.48	0.73	1-4
Child self-regulation (36M)	92.15	68.72	0-151
Child cognitive skills (36M)	9.02	2.90	1-17
Child enthusiasm (36M)	4.97	1.05	1-7
Child persistence (36M)	5.24	1.15	1-7

An independent-samples *t*-test was conducted to examine gender differences in the scores of our main variables (i.e., early maternal depressive symptoms, maternal sensitivity, maternal intrusiveness, children's self-regulation, general cognitive skills, and mastery motivation). There was not a significant difference in early maternal depressive symptoms between mothers of boys and girls, nor was there a child gender difference in maternal sensitivity at 24 months. However, mothers of boys were more intrusive than mothers of girls at 24 months. Further, consistent with previous research, there were significant gender differences for each of the child variables in which girls demonstrated more positive development than did boys (see Table 4).

Table 3. Bivariate Pearson Correlations among Main Variables

Main Variable	1	2	3	4	5	6	7
1. Early maternal depression	-						
2. Maternal sensitivity	- 0.24**	-					
3. Maternal intrusiveness	0.23**	- 0.54**	-				
4. Child self-regulation	- 0.14**	0.20**	- 0.19**	-			
5. Child cognitive skills	- 0.24**	0.31**	- 0.26**	0.28**	-		
6. Child enthusiasm	- 0.09**	0.22**	- 0.16**	0.16**	0.25**	-	
7. Child persistence	- 0.12**	0.18**	- 0.14**	0.18**	0.25**	0.56**	-

\*  $p < 0.05$ , \*\*  $p < 0.01$

Table 4. Comparing Means between Boys and Girls

Variable	Boys		Girls		t-value
	M	SD	M	SD	
Early maternal depression	8.95	7.50	9.30	7.15	-0.79
Maternal sensitivity (24M)	2.97	0.73	3.05	0.76	-1.87
Maternal intrusiveness (24M)	1.58	0.78	1.38	0.64	4.74***
Self-regulation (36M)	82.39	69.83	102.44	66.08	-4.88***
General cognitive skills (36M)	8.57	2.87	9.5	2.84	-5.53***
Enthusiasm(36M)	4.80	1.10	5.16	0.96	-5.83***
Persistence (36M)	5.03	1.19	5.46	1.06	-6.40***

\*\*\*  $p < 0.001$ 

### Direct and Mediated Effects of Maternal Depression on Child Outcomes

In order to analyze the mediational effects, direct path model and indirect path model need to be tested and the relationship of predictor and outcomes must decrease substantially when a mediator is in the model (Little, Card, Bovaird, Preacher, & Crandall, 2007). Maternal education and family income were included in the model as controls. Figure 4 shows the direct path model from early maternal depressive symptoms to children's later social and cognitive skills. The direct path model fit the data well ( $\chi^2[4] = 1.58$ , *ns*, CFI = 1.00, RMSEA= 0.00, ECVI= 0.052). Early maternal depressive symptoms were associated with children's later social and cognitive skills including self-regulatory, general cognitive skills, and mastery motivation, in the predicted direction. Next, the partial mediational model was tested to investigate whether maternal sensitivity and intrusiveness mediated the relationship between early maternal depressive symptoms and later children's social and cognitive skills at the end of the toddler

period. The partial mediation model is summarized in Figure 5. Consistent with the hypothesis, the model fit the data ( $\chi^2[6] = 3.69$ , *ns*, CFI = 1.00; RMSEA= 0.00, ECVI= 0.08). Children whose mothers had higher levels of early depressive symptoms showed poor self-regulation and lower levels of general cognitive skills at 36 months, but early maternal depressive symptoms did not predict children's mastery motivation. Mothers with higher levels of early depressive symptoms were less sensitive and more intrusive with their children at 24 months. In addition, children's social and cognitive skills were predicted by maternal sensitivity at 24 months. On the other hand, maternal intrusiveness predicted self-regulation and general cognitive skills, but not mastery motivation at 36 months.

Comparing the hypothesized model (partial mediation model) with the direct path model using chi-square difference test, the results showed that there was no significant difference between them. Next, we calculated the effect size for each pathway. Maternal sensitivity and intrusiveness at 24 months mediated 30% of the relation between early maternal depressive symptoms and later self-regulatory ability, 30% of the relation between early maternal depressive symptoms and general cognitive skills, and 48% of the relation between early maternal depressive symptoms and later mastery motivation. Therefore, the partial mediation model was considered to be a better explanation of the associations of early maternal depressive symptoms with children's later social and cognitive skills than the direct path model.

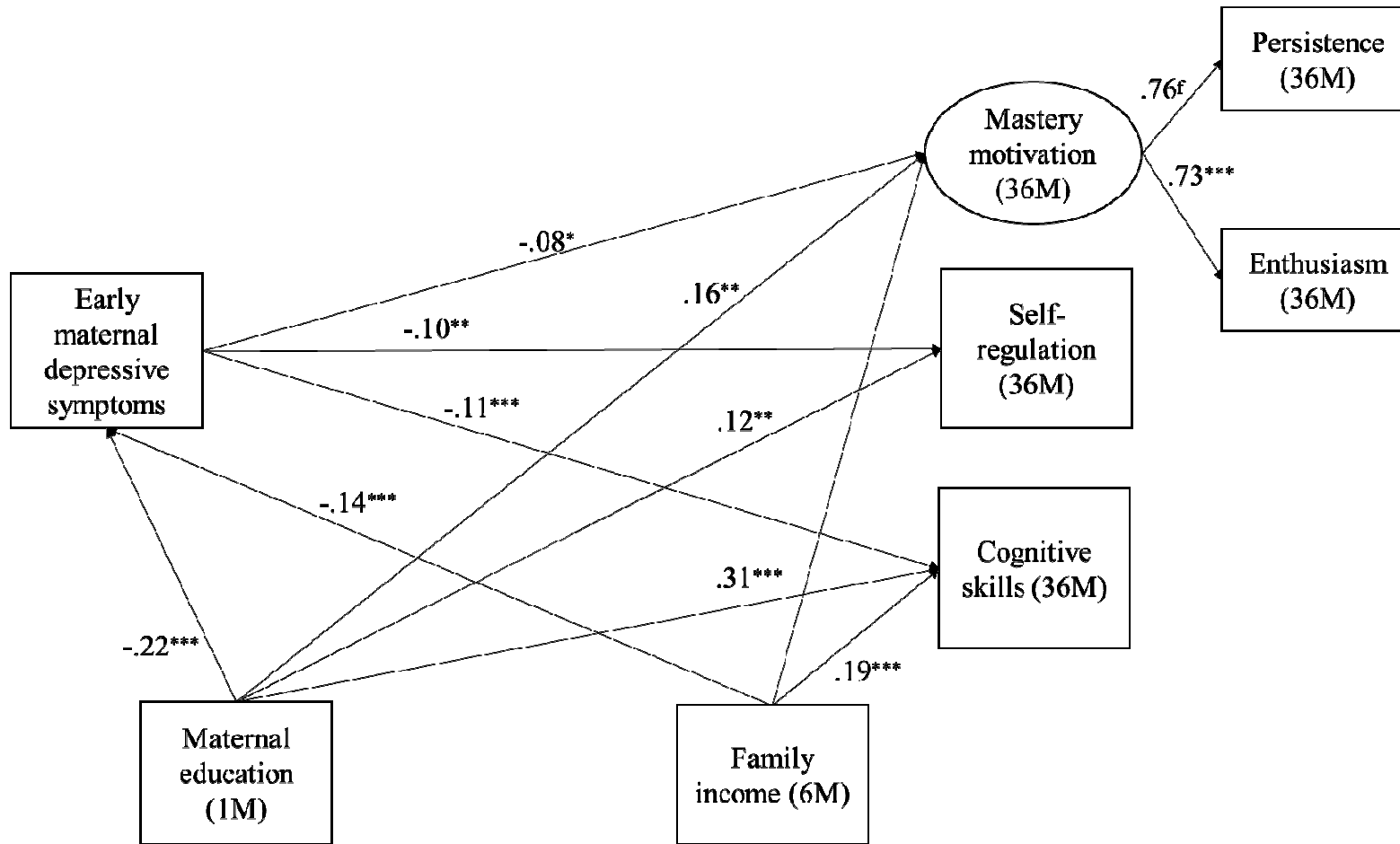


Figure 4. The direct path model including standardized path estimates. This model shows the direct effects of early maternal depressive symptoms on later social and cognitive skills.

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$

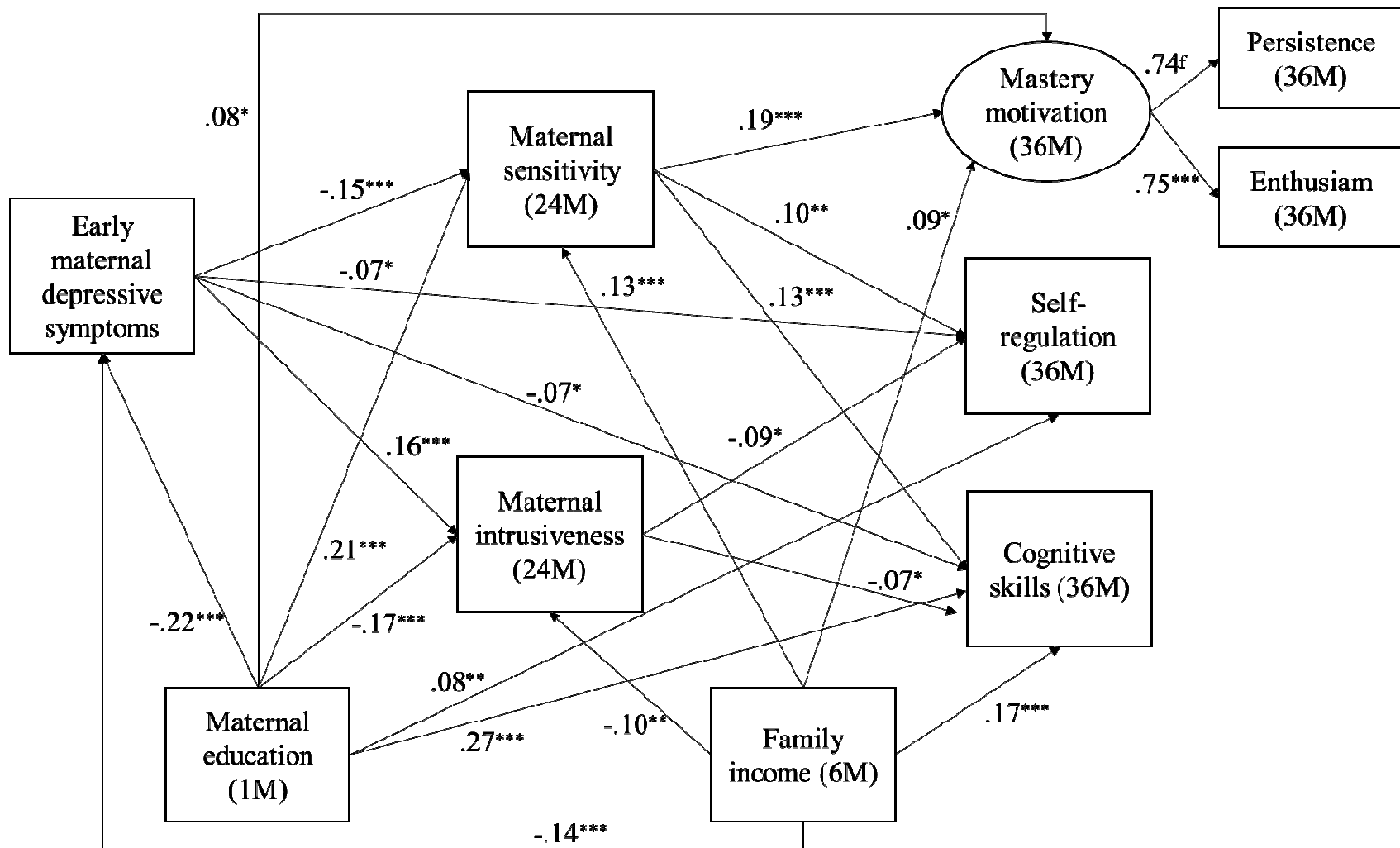


Figure 5. The mediational model including standardized path estimates. This model shows how maternal behaviors affect the relations between early maternal depressive symptoms and child's later social and cognitive skills.

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$

### **Gender differences in the partial mediation model**

The preliminary test showed that girls outperformed boys in social and cognitive skills at 36 months so the hypothesized model was retested to examine whether early maternal depressive symptoms would affect boys and girls differently. Figure 6 shows the mediational model for boys ( $\chi^2[12] = 11.43$ , ns; CFI = 1.00; RMSEA = .01). Early maternal depressive symptoms directly predicted only boys' later general cognitive skills, but not mastery motivation or self-regulation. In this model, early maternal depressive symptoms predicted maternal sensitivity and intrusiveness at 24 months, and maternal sensitivity at 24 months affected all later outcomes for boys, mediating the effects of early maternal depressive symptoms on later outcomes. Mastery motivation was predicted by maternal education levels.

The girls' model had different significant paths than that of the boys' (see Figure 7,  $\chi^2[12] = 11.43$ , ns; CFI = 1.00; RMSEA = .01). As expected, early maternal depressive symptoms predicted maternal sensitivity and intrusiveness at 24 months. However, early maternal depressive symptoms did not directly predict any of the later outcomes. Girls whose mothers were more sensitive at 24 months showed better mastery motivation and general cognitive skills at 36 months. Interestingly, maternal sensitivity did not predict girls' later self-regulation. In addition, mastery motivation was not affected by the demographic risks - maternal education or family income - for girls, though it was for boys.

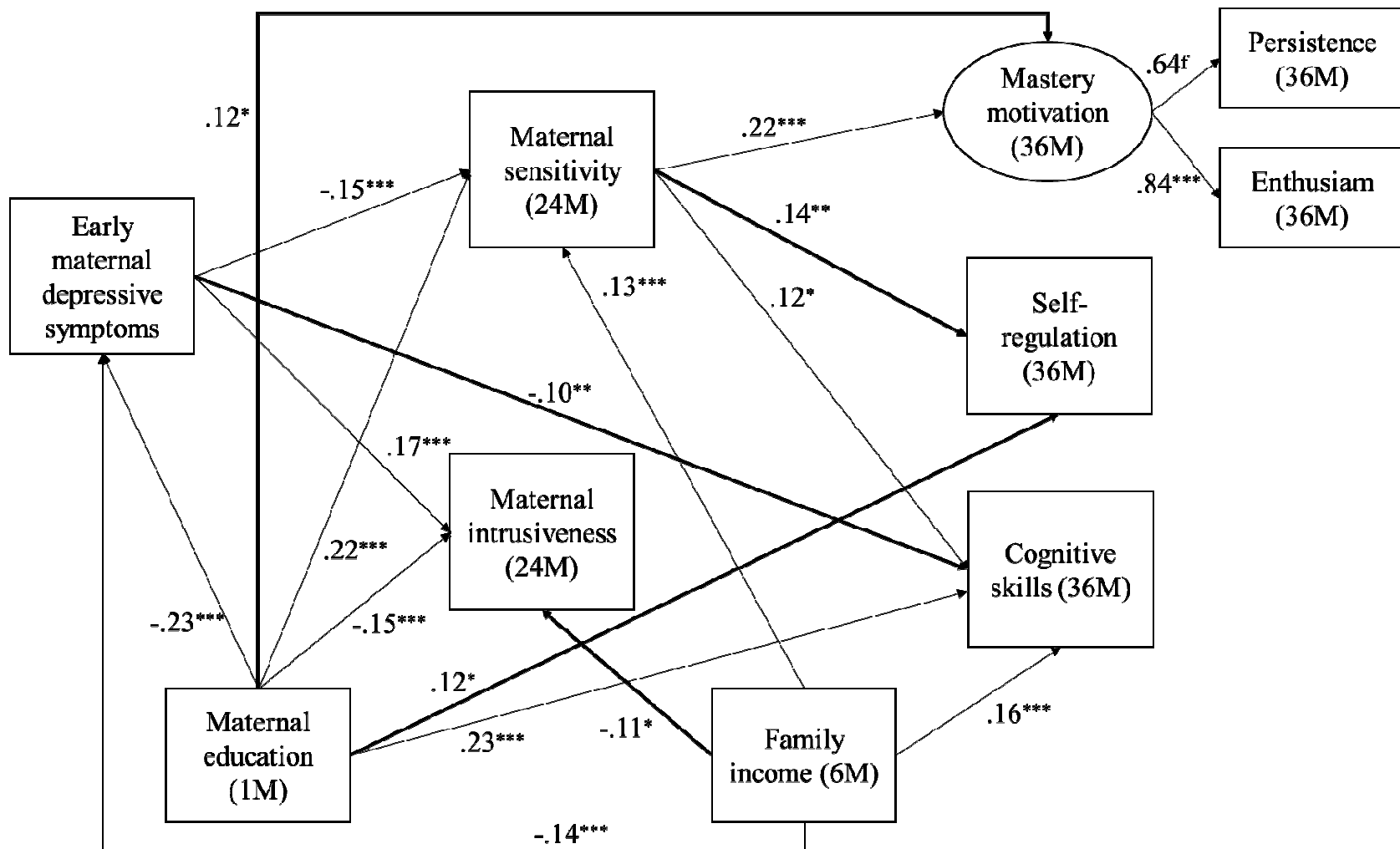


Figure 6. Fit of the boys' hypothesized model including standardized path estimates. This model shows that how maternal behaviors mediates the relations between early maternal depressive symptoms and child's later social and cognitive skills for boys. The darker lines indicate relationships identified for boys that were not identified for girls.

\*\*\*  $p < 0.001$ , \*  $p < 0.05$

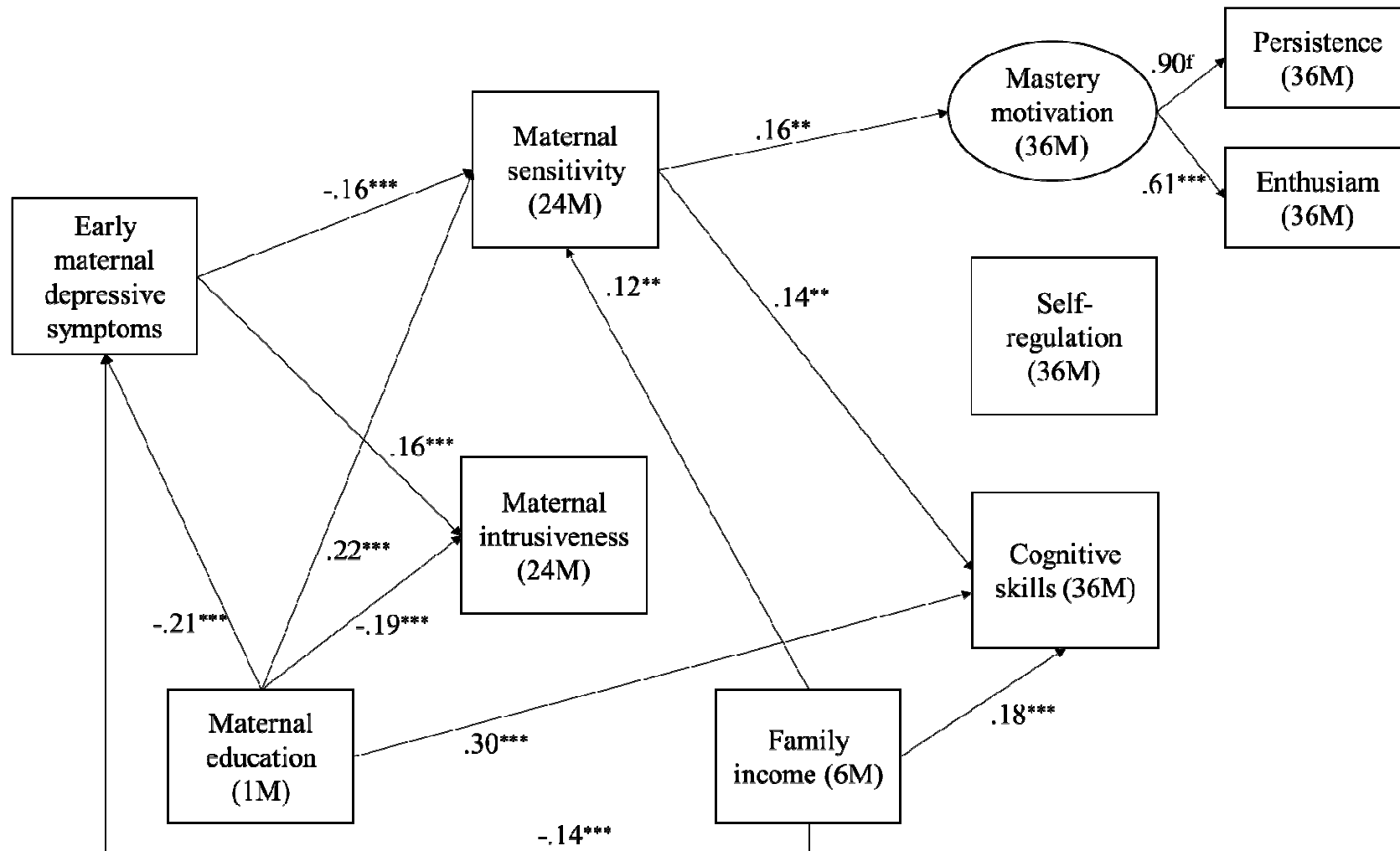


Figure 7. Fit of the girls' hypothesized model including standardized path estimates. This model shows that how maternal behaviors mediates the relations between early maternal depressive symptoms and child's later social and cognitive skills for girls.

\*\*\*  $p < 0.001$ , \*  $p < 0.05$

### **Moderated effects model**

Finally, interaction effects of early maternal depressive symptoms and maternal parenting (i.e., sensitivity and intrusiveness) were examined. The interactions of early maternal depressive symptoms with maternal sensitivity and maternal intrusiveness were calculated and were added to the model as predictors of children's outcomes, in addition to their main effects. This moderated effects model demonstrated a poor fit with the data ( $\chi^2 [14] = 1394.92$ ,  $p < 0.001$ , CFI = 0.82; RMSEA = 0.28). Thus the best fitting models remain the mediational models, with separate models for boys and girls.

### **Discussion**

In the current study, using a large and diverse sample of mothers and their toddlers, we examined the impact of early maternal depressive symptoms on children's later social and cognitive skills, and asked whether maternal sensitivity and intrusiveness mediated or moderated these relationships. Using a longitudinal design, we examined the mechanism by which early maternal depressive symptoms affect later child functioning during the first three years of a child's life.

Consistent with the results of previous research (Feldman et al., 2009; S. Goodman & Tully, 2006), results of the current study indicated that maternal depressive symptoms were negatively associated with children's later social and cognitive skills. In particular, children whose mothers had more early depressive symptoms showed poorer self-regulation skills and lower levels of general cognitive skills. Even though the direct path model showed that early maternal depressive symptoms predicted children's later mastery motivation, the relations between them did not remain significant when maternal sensitivity and intrusiveness at 24 months were included in the model. This finding suggests that the negative effects of early

maternal depressive symptoms on children's later mastery motivation were fully mediated via maternal parenting, specifically maternal sensitivity, but not maternal intrusive behavior, during toddlerhood. These findings build on previous research (Jennings & Abrew, 2004; Redding et al., 1990) which identified direct effects of maternal depression on aspects of children's mastery motivation such as task persistence and task pleasure, but had not examined possible mediators of this relationship. Further these previous studies examined the relations between concurrent maternal depression and children's mastery motivation, while the current research assessed how early maternal depressive symptoms influenced later children's mastery motivation. The lack of a significant direct effect of early maternal depressive symptoms on later mastery motivation indicated that mastery motivation may be more vulnerable to concurrent maternal depression than early maternal depression.

The results of the current study showed that maternal sensitivity, but not maternal intrusiveness, affected the relations between early maternal depressive symptoms and later mastery motivation. The specific associations between positive versus negative parenting behaviors and children's mastery motivation is consistent with the findings of Kelley and colleagues' (2000) in which maternal sensitivity and scaffolding at 24 months promoted child mastery motivation at 36 months, but maternal intrusive control was not associated with it. Maternal intrusive behavior may have only concurrent effects. Graziano, Calkins, and Keane (2011) examined maternal parenting and children's sustained attention which is associated with mastery motivation. They found that maternal over-control and intrusive behavior measured at the child age of 2 years was negatively related to children's sustained attention at 2 years old. However, maternal over-control and intrusiveness did not predict slower growth in children's sustained attention development from age 2 to 4.5 years. In contrast, maternal warmth and

responsiveness was positively associated with faster growth in children's sustained attention development. This pattern is consistent with our findings. Another possible explanation supported by the findings of the current study is that maternal intrusive behavior may affect different domains of social and cognitive development than does sensitivity. In the current study, maternal intrusive behavior predicted children's later self-regulatory ability and general cognitive skills, but not mastery motivation. This implies that mastery motivation is a different construct from self-regulation and general cognitive skills.

Feldman and colleagues (2009) argued that maternal sensitivity attenuated the effects of maternal depression on child social development. However, our findings showed no interaction effects of early maternal depressive symptoms (6 months) and maternal parenting behaviors (i.e., maternal sensitivity and intrusiveness) at 24 months. The negative effects of early maternal depressive symptoms on children's later social and cognitive skills were not reduced by maternal sensitivity or exacerbated by maternal intrusive behaviors at the second year. According to our findings, maternal sensitivity and intrusiveness at 24 months partially mediated the effects of early maternal depressive symptoms on children's later social and cognitive skills, except mastery motivation which was affected by only maternal sensitivity. Early maternal depressive symptoms still negatively affected children's later development, regardless of how sensitive or intrusive mothers were at 24 months. One implication of these findings may be that focusing solely on the parenting behaviors of mothers experiencing, or at risk for, depression is not sufficient to prevent mothers' mental health from impacting their children. Instead, early intervention may need to also focus directly on alleviating maternal depressive symptoms in order to foster children's later social and cognitive development.

The results of the current study showed that children's self-regulation and general cognitive skills were affected by early maternal depressive symptoms directly, as well as indirectly via maternal behavior including sensitivity and intrusiveness. However, the effect of early maternal depressive symptoms on later mastery motivation was fully mediated by only maternal sensitivity. This indicates that mastery motivation is a separate construct with different predictors than self-regulation and general cognitive skills.

### **Gender Differences**

We found gender differences in the relationship between early maternal depressive symptoms and children's later social and cognitive skills. Boys whose mothers had more early depressive symptoms displayed poor general cognitive skills, but boys' self-regulation and mastery motivation at 36 months were predicted indirectly via maternal sensitivity at 24 months. For girls, early maternal depressive symptoms did not have direct effects on any of the later outcomes.

These results are consistent with previous research in which maternal depression affected boys', but not girls', later IQ scores (Milgrom et al., 2004). We also found that boys had lower scores for general cognitive skills than girls in general. Thus, the direct and indirect negative effects of early maternal depressive symptoms via maternal behavior identified in this study may explain boys' lower cognitive skills. The current study provides additional evidence consistent with previous research indicating that young boys are more vulnerable to the effects of maternal depression than their female counterparts. Interventionists should be aware that boys may be particularly vulnerable to their mothers' depressive symptoms.

## **Limitations and Future Directions**

The current study contained some limitations for consideration in future research. First, the measure of maternal depressive symptoms used in this study was based on report of short-term symptoms, and may lack information on the duration of symptoms (Hoffman, Crnic, & Baker, 2006); however, use of this measure at both 6 and 24 months may help to overcome this limitation. Second, this study did not measure maternal depression concurrently with children's outcomes at 36 months; thus, the lack of significant direct effects of maternal depression on children's mastery motivation may be because mastery motivation is more vulnerable to the effects of concurrent maternal depression. Moreover, other studies have found the effects of chronic maternal depression on maternal parenting and child development (e.g., Campbell, Matestic, Von Stauffenberg, Mohan, & Kirchner, 2007). Therefore, future studies should examine the effects of concurrent maternal depressive symptoms, as well as the effects of chronic maternal depressive symptoms throughout early childhood. Third, this study investigated two general maternal parenting behaviors. Further research could define and further categorize sensitive and intrusive behaviors, such as verbal and physical intrusiveness, or distracting children's attention, which may have more specific effects on children's self-regulation, mastery motivation, and cognitive skills. Further, these more specific categories could provide a deeper understanding of the mediating effects of maternal sensitivity and intrusiveness in the relations between early maternal depression and children's later social and cognitive development.

Another limitation of the current study is the lack of inclusion of a measure of child temperament. Rothbart and Hwang (2005) argued that child temperament is related to motivation, including the temperament dimensions of surgency/extraversion and negative affectivity that are associated with children's approach, avoidance, interest, and frustration. However, to examine the relations between temperament and mastery motivation was beyond the scope of the current

study. Thus, future studies should consider the possibility that children's temperament could affect the development of mastery motivation, and may also be related to maternal depression and children's self-regulation.

Finally, the majority of the mothers and children participating in the study were European American, thus the findings of the current study may not apply to mothers and children more generally. Therefore, future research should compare effects of early maternal depression on children's later mastery motivation and related domains across other ethnicities.

## **Conclusions**

The current study shows the effects of early maternal depressive symptoms on children's later social and cognitive development, specifically mastery motivation, self-regulation, and general cognitive skills at the early preschool age. In addition, maternal sensitivity and intrusiveness mediated the relationship between early depressive symptoms and children's self-regulation and cognitive skills; however, maternal intrusive behavior did not affect the relations between early maternal depressive symptoms and children's later mastery motivation. The current study also provides evidence that boys are more vulnerable to the effects of maternal depressive symptoms than girls. These findings extend the current knowledge of the development of mastery motivation, providing evidence that mastery motivation is a unique construct, with different predictors and pathways, than self-regulation and general cognition.

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### **Chapter 3. The role of mastery motivation in the development of executive function skills**

Mastery motivation refers to a intrinsic force within children which helps them to sustain their attempts to master moderately challenging tasks (Morgan, MacTurk, & Hrnacir, 1995) and is associated with the development of both cognitive and social skills (Banerjee & Tamis-LeMonda, 2007; Zhou, Hofer, Eisenberg, Reiser, Spinrad, Fabes, 2007; Deater-Deckard, Petrill, & Thompson, 2007). Further, mastery motivation is closely related to self-regulation. Barrett and colleagues (1993) have asserted that mastery motivation requires self-regulation abilities involving an affective component, engagement, and sustained attention during attempts to achieve a goal.

Similar to mastery motivation, executive function skills are also necessary for a child's goal-directed behavior and are associated with the self-regulation process. In addition, like mastery motivation, executive function skills are important capacities in children's socio-emotional development and academic achievement. However, little research has studied associations between mastery motivation and executive function skills. The current study examined whether or how mastery motivation promotes development of executive function skills in early childhood.

#### **The Development of Mastery Motivation**

Mastery motivation is a multifaceted and intrinsic force that drives an individual to make active and independent attempts to interact with the world in order to master the environment or achieve goals (Barrett & Morgan, 1995). In addition, mastery motivation helps children to learn new knowledge and skills, solve new problems, and meet new standards (McCall, 1995). Barrett, MacTurk, and Morgan (1995) proposed that "mastery motivation is not a static, stable, unitary trait, but rather a complex, malleable, process" (p. 347). This is consistent with Barrett and

Morgan's notion that behavior and affect relating to mastery motivation can be seen during early development but the nature of mastery motivation transforms as the child develops and these changes are affected by changes in cognition (1995). Mastery motivation is elicited from uncertain situations in which children do not know whether they can achieve the goal. If they know they cannot attain the goal, they do not try to master the goal. Further, it is important to distinguish the notion of mastery motivation from that of competence. Competence refers to an ability to do something, while mastery motivation is the intrinsic force to make an attempt to obtain competence. Thus, successful achievement of the goal is not necessary in order to demonstrate mastery motivation (Barrett et al., 1993; McCall, 1995). However, highly motivated children are more likely to learn successful strategies than children with low levels of mastery motivation, which fosters children's competence in problem-solving (Barrett & Morgan, 1995).

Mastery motivation is an internal process that cannot be observed directly, thus several individual behaviors serve as indicators when assessing mastery motivation. Barrett and Morgan (1995) categorized indicators of mastery motivation into two major types: instrumental and expressive aspects of mastery motivation. Instrumental aspects of mastery motivation refer to behaviors that are used to attain a goal. A key indicator of instrumental type is the length of time or the tendency that a child has to persist or focus on mastering a new task. Other examples of instrumental aspects of mastery motivation are a preference for a challenging task or novelty, a desire for physical and/or cognitive control over the environment, and children's agency such as initiative and choices about activities and levels of engagement in tasks (Barrett & Morgan, 1995; Wigfield, Eccles, Schiefele, & Davis-Lean, 2006). Expressive aspects of mastery motivation are emotions elicited during or after conducting a task such as pleasure, interest, enthusiasm, or pride. Task pleasure is a main indicator of expressive aspects of mastery

motivation (Barrett & Morgan, 1995). Highly motivated children engage in the task enthusiastically and often smile during or after a moderately challenging task.

Previous research has demonstrated that the social environment, especially maternal behavior is an important predictor of the development of children's mastery motivation (Busch-Rossnagel, Knauf-Jensen, & DesRosiers, 1995). For example, maternal supports for the child's autonomy help children to have more opportunities to challenge and succeed in tasks (Baumrind, 1971). Kelley, Brownell and Campbell (2000) supported this assertion with evidence that children showed higher levels of mastery motivation when their mothers supported children's efforts and their autonomy for the challenging tasks. These maternal behaviors encourage children to face challenges for the mastery of activities so they were less likely to avoid challenging tasks. Neitzel and Stright (2003) also showed similar results. They found that maternal supportive behaviors such as support for children's autonomy and emotional encouragement during problem-solving tasks at preschool were significantly associated with children's task-persistence one year later, which is a key instrumental indicator of mastery motivation. Preschool aged children sustained effort and maintained interest in tasks more when their mothers supported their autonomy and gave emotional encouragement. This variability in degree of mastery motivation indicates that the development of mastery motivation is affected by parental socialization. In particular, mothers' sensitive and responsive behaviors may encourage children to explore, access, and persistently engage in activities, which in turn facilitates children to gain more knowledge and new skills. This research is consistent with the idea that securely attached children use their mothers as a secure base from which to explore (Risken-Walraven et al., 1993).

Motivation researchers have emphasized the important role of emotion in understanding children's mastery motivation (Meyer & Turner, 2006; Schutz & Lanehart, 2002; Turner, Meyer, & Schweinle, 2003). Bronson (2000) explains that as children experience pleasure in persistence and mastering tasks, their mastery motivation increases and they seek more opportunities to take on challenging tasks, which in turn facilitates the development of new knowledge and skills (Bronson, 2001). Spangler (1989) supports this assertion as well; he emphasized that the emotional quality of an experience is important to a child's task persistence. For example, children who experience and show more positive affect are more likely to persist in their activities (Spangler, 1989). In contrast, negative emotions such as sadness and anxiety are associated with the withdrawal system, so these emotions may cause children to avoid challenging tasks (Davidson, Jackson, & Kalin, 2000). Deater-Deckard and colleagues (2007) demonstrated the effects of negative emotion on mastery motivation. According to their findings, children who had higher levels of anger/frustration were likely to display lower levels of task persistence. However, the relationship between emotion and mastery motivation may be moderated by children's ability to regulate emotions. Emotional regulation is defined as "the capacity to regulate arousal appropriately in order to reach goals" (Bronson, 2000, p. 58). In cases in which a child does not succeed in a challenging task and feels frustrated, a child who has better emotional regulation ability may control this negative emotion appropriately to complete the task, which may enable him or her to keep their attention on tasks and have more opportunities to learn and master new skills and knowledge. Mastery motivation is the force for a child to persist in a challenging, and possibly emotion-evoking task. Thus, children's emotional regulatory abilities may promote their mastery motivation. However, to date, no studies have examined this association in young children.

## **The Role of Mastery Motivation in Executive Function**

In addition to skills in regulating emotions, executive function skills develop throughout early childhood and may have an important relationship to mastery motivation. Executive function (EF) is an umbrella term for complex cognitive processes related to goal-directed, purposeful, and problem-solving behaviors (Hughes & Graham, 2002; Gioia et al, 2000; Meltzer, 2007). EF is associated with the prefrontal cortex which is one of the late developing brain areas; this area functions to regulate thoughts and behavior, and becomes the seat of inhibitory control (Raaijmakers et al., 2008). EF consists of several dissociable components including working memory, inhibition, and cognitive flexibility (Diamond, 2006). Working memory indicates an ability to hold information in mind, recall it, and use it to guide behavior. Inhibitory control refers to an ability to suppress a dominant response and/or initiate a subdominant response. Cognitive flexibility is an ability to shift one mental set to another. These components have different developmental trajectories and are differentially linked to areas of the prefrontal cortex (Diamond, 2006). However, other researchers support a unitary EF model in which EF is a unitary construct with constituent sub-processes. For example, Posner and Rothbart (2001) propose that a central attention system manages these sub-processes and plays an important role in changes in EF abilities from two to six years. Previous research supports their assertion with evidence that performance on a variety of EF tasks is strongly associated with a central attention process (Garon, Bryson, & Smith, 2008). Recently, researchers have attempted to integrate these two perspectives. Miyake et al. (2000) proposed the integrative EF model which includes attention as a common EF mechanism and three components such as working memory, inhibition, and set shifting. Thus, the functioning of these components are seen as partially independent but correlated with each other.

The first five years of life are an important period for the development of executive function, with basic component skills of EF emerging before three years of age (Garon et al., 2008). EF skills show rapid growth in the last half of the first year and from three to six years of age (Diamond, 2001). According to Garon et al. (2008), working memory is observed first. Simple working memory capacity, such as the ability to hold a representation in mind over a delay, occurs before 6 months, and more complex working memory (i.e., updating or manipulation of representation) develops gradually. Over the preschool period, children are able to hold more representations in mind. Inhibition skills develop following working memory. Children show simple inhibition skills during the first year but children are not able simultaneously to use a rule held in mind to inhibit a dominant response and perform a subdominant response until the age of two years. Rapid development of inhibition ability occurs during the preschool period. Previous research supported this assertion with evidence that children between three and five years display better performance on inhibition and delay of gratification tasks than younger children (Garon et al., 2008). Cognitive shifting, which refers to the ability to adjust behavior quickly and flexibly to changing situations (Davidson, Amso, Anderson, & Diamond, 2006), is the most complex EF component and develops last. Further, it is affected by the development of working memory and inhibitory control. Even three-year-old children are often observed to have a difficulty switching from one task set to another (Wiebe et al., 2011). After three years old, development of the attention system and its connectivity with other brain areas involved in EF skills enable children to integrate and coordinate these EF basic skills (Garon et al., 2008).

How does a child's mastery motivation link to his or her executive function skills? It could be that children's mastery motivation promotes development of their executive function

skills. Persistence is considered an indicator of highly motivated children and is one behavioral indicator measured as mastery motivation. It may be that when a child persists in a challenging task longer, he or she has more chances than a child who easily gives up to use and practice his or her cognitive skills and learn new skills and knowledge. Duckworth and Seligman (2005) found that children who are more engaged in learning tasks tend to display better academic achievement than those who are not engaged. During a task, children will apply several strategies in order to have success at a task and they may find an appropriate solution through their attempts. This process would affect development of EF skills like planning strategies to solve problems. Wang and Barrett (2013) also asserted that children's "active trial-and-error explorations" with objects help children refine their existing knowledge and process new information that would apply to future problem solving (p.349).

Intrinsic motivation, like mastery motivation, promotes children's high quality attention to tasks and optimal use of meta-cognitive strategies in solving problems (Larson & Rusk, 2011). For example, middle school children with greater intrinsic motivation were shown to apply more self-regulatory and cognitive strategies in academic tasks (Pintrich & De Groot, 1990). While, limited research has examined the relationship between EF skills and mastery motivation directly, especially in young children, there is evidence for this association in school-aged children. Brock and colleagues (2009) showed significant associations between mastery motivation and EF skills in kindergarten children. According to their findings, teachers rated children with higher EF skills including executive attention, inhibitory control, and working memory, as children with longer persistence in difficult tasks, less distractibility, better autonomy (works well independently), and self-control. Mizuno and colleagues (2011) found that well developed mastery motivation in elementary school children correlated with executive function skills such

as abilities to retrieve learned materials, spatial working memory, and visual scanning. These studies assessed mastery motivation and EF skills concurrently, and were thus limited to showing concurrent associations. Thus, the present study will fill a gap in the research by examining whether early childhood mastery motivation predicts children's executive function skills at the first grade, which may elucidate the relationship between early mastery motivation and later executive function skills.

### **Mastery Motivation as a Mediator**

Another possible role of mastery motivation in the development of executive function skills is that it may mediate the effects of other predictors, such as maternal behavior or children's emotional regulatory ability, on executive function skills.

Emotion regulation affects children's executive function skills, because many aspects of human thought and actions are affected by emotions (Bronson, 2000). Positive emotions like joy are associated with creative thoughts and actions and help children broaden their cognitive and social resources (Fredrickson, 2001). In contrast, negative emotions like anger interfere with children's higher order cognitive process such as problem solving and memory (Blair, 2002). Thus, the ability to regulate emotion, especially negative emotion, during challenging tasks can facilitate one's cognitive processing including organizing one's thoughts and behaviors, and learning (Blair & Diamond, 2008; Carlson & Wang, 2007). For example, Carlson and Wang (2007) assessed the associations between emotional regulation ability (as measured by a child's control of emotional expression and their emotion understanding) and inhibitory control in four- and five-year-old children. They found that children with higher levels of emotional regulatory skills showed better ability to suppress dominant responses and activate subdominant responses after controlling for age and verbal ability.

Like mastery motivation, children's executive function skills are also influenced by maternal behavior such as maternal sensitivity, autonomy support, and intrusiveness. Bernier, Carlson, and Whipple (2010) found that children whose mothers were more sensitive at 12 months showed better performance on EF tasks at 26 months. In addition, maternal autonomy supporting behaviors at 15 months of age predicted child's better scores in EF tasks at 18 and 26 months after controlling covariates such as maternal education and other child's cognitive function. Further, Graziano, Keane, and Calkins (2010) found evidence for the effects of early maternal behavior on later inhibitory control. In particular, children whose mothers were more warm and responsive and less intrusive at age two years showed higher levels of effortful control at 5.5 years. The research reviewed above indicates that both early maternal behavior (i.e., sensitivity and autonomy supporting behavior) and children's emotion regulation promote children's mastery motivation and executive function skills; but that mastery motivation may play a role as a mediator of early maternal sensitivity and children's emotional regulation on later children's executive function skill.

### **Current Study**

Despite evidence of associations between children's mastery motivation and their executive function skills, few studies have examined these relations longitudinally, particularly in young children. In addition, previous research shows that maternal sensitivity and children's emotional regulation affect both children's mastery motivation and executive function skills, but limited research has studied these components together, particularly longitudinally in young children. In the current study, I propose that highly motivated children have more opportunities to apply their existing cognitive resources to tasks, which will influence the development of their executive function skills. I also examined whether children's mastery motivation mediates the

effects of early maternal sensitivity and children's emotional regulation on children's later executive function skills. In addition, I investigated whether different executive function skills are affected differentially by early predictors and mastery motivation.

Although both maternal sensitivity and children's emotion regulation have been studied as factors in the development of children's mastery motivation and executive function skills, few studies have examined these constructs together. The specific relationship between maternal sensitivity and children's emotional regulation may contribute to promoting children's mastery motivation and executive function skills. For example, negative effects of children's lack of emotional regulation may be buffered by maternal sensitivity, or children's emotion regulation may moderate the effects of maternal sensitivity on children's mastery motivation and executive function skills. The current study will be the first to examine these interactions. In the current study, I examined whether there are significant interactions between maternal sensitivity and children's emotional regulation on children's mastery motivation and executive function skills.

## **Method**

### **Participants**

The data in the current study come from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD), Phases I and II. Between January and November of 1991, mothers and children were recruited at ten locations: Little Rock, AR; Irvine, CA; Lawrence, KS; Boston, MA; Philadelphia, PA; Pittsburgh, PA; Charlottesville, VA; Morganton, NC; Seattle, WA; and Madison, WI. These mothers and children met the following criteria: (a) the mother was over 18 years old, (b) the mother could speak and understand English, (c) the mother did not have any substance-abuse problems, (d) the child was a singleton, (e) the child did not have any disabilities, and (f) the

child had not been hospitalized for more than 7 days. Phase 1 data were collected when children were 1 month, 6 months, 15 months, 24 months, and 36 months of age. During Phase 1 (1991-1994), 1,364 children and their families participated. Retention of the sample for the following Phase II was good; 1,226 children and their families continued participation in Phase II until children were in the first grade. Phase II data were collected when children were 54 months old, in kindergarten, and in first grade. The mothers' mean age when children were 1 month of age was 28.7 years ( $SD = 5.56$ ) and the mean maternal education at this time was 14.5 years. The majority of mothers and children were White ( $n = 795$  mothers or 84.8%;  $n=778$  children, or 82.9%). The mean total family income is \$39,371 ( $SD = \$33,239$ ) when children were 1 month, and \$54,539 ( $SD = \$43,747$ ) when children were 36 months of age.

## **Measures**

Each measure is described below. Descriptive information for all the main variables of interest are provided in Table 5, including means, standard deviations, and ranges.

Table 5. Descriptive Statistics for the Main Study Variables

Variable	Mean	SD	Range
Maternal sensitivity	17.39	2.65	4-21
<i>Child Emotion-Regulation</i>			
Defiance	1.15	0.52	1-5
Negative affect	1.19	0.55	1-5
<i>Child Mastery Motivation</i>			
Persistence	4.74	1.28	1-7
Autonomy	4.64	1.13	1-7
<i>Child Executive Function Skills</i>			
Impulsive responding	0.03	0.04	0.0 - 0.39
Short-term memory	101.66	13.81	43-161
Long-term memory	99.17	14.90	2-154
Problem solving	14.42	6.76	0-34

**Maternal sensitivity.** Maternal sensitive behavior was measured during a semi-structured mother-child interaction task. The mother was instructed to show her child toys in three sequentially numbered boxes. Drawing materials including markers and paper were in the first box, and dress up cloths and a cash register were in the second box. The last box contained Duplo block set with a picture of a model. The mother's and child's behaviors were videotaped for 15 minutes, and trained observers coded maternal behaviors using a seven-point rating scales (1 = very low, 7 = very high). In this study, scores on three maternal behaviors are used to assess maternal sensitivity. First, *maternal supportive presence* indicated the level of maternal emotional support and expression of positive regard. Mothers with high scores on this scale are

thought to provide verbal and physical encouragement and to be concerned about their children's emotional needs. Second is *mother's respect for the child's autonomy*. Mothers with high levels of this characteristic respect the child's individuality, motives, and perspectives. These mothers tended to form mutually negotiated relationship with their children. The last maternal behavior evaluated to contribute to the maternal sensitivity score was *mother's hostility*, which reflected the mother's expression of anger, discounting, or rejecting of the child. Intra-class correlation coefficients (ICC; Winer, 1971) were used to measure inter-rater reliability for these three variables; ICCs were .81 for supportive presence, .71 for respect for child's autonomy, and .82 for hostility. The current study used a maternal sensitivity composite score comprised of these three behaviors in the following way: supportive presence + respect for child's autonomy – hostility.

**Emotional regulation.** The child's emotional regulatory ability was assessed during a clean-up episode at 36 months of age. The mother and her child were asked to clean up toys with which the child played during a solitary play episode. The child's behaviors were videotaped for 5 minutes. Using a five-point rating (1 = very uncharacteristic, 5 = very characteristic), trained observers coded the child's behaviors for compliance, autonomy bids/self assertion, defiance, passive noncompliance, positive affect, and negative affect. In the current study, defiant noncompliance and negative affect scores were used as indicators of the child's emotional regulation (NICHD, 2004). Defiant behavior was indicated by a child's hostile, angry or affectively negative resistance, or response to the mother's demands, including yelling, throwing things, kicking, etc. Scores on a child's defiance and negative affect (i.e., distress, anger, or hostility) were summed, and the composite score was used as the measure of the child's

emotional regulation. Children with higher scores were considered to have poor abilities to regulate their emotions.

**Mastery motivation.** The child's mastery motivation was assessed during mother-child interaction at 54 months that was videotaped in a semi-structured 15-minute observation. The mother and her child were asked to complete a maze using an Etch-A-Sketch, and to build several identical towers with blocks of various shapes and sizes based on the instruction. These tasks were challenging to the children. The third task was a semi-structured play session between mother and child. They were instructed to play together with a set of six hand puppets. The child's persistence and agency behavior in these three tasks was used to assess mastery motivation in the current study. The child's *persistence* was rated on a scale based on the degree to which he or she engaged in a task, and *agency* was indicated by the ability to make a choice to act during a challenging task. The trained observers coded these behaviors using 7-point rating scales (1 = very low, 7 = very high). Inter-rater reliability was .86 for child persistence and .84 for child agency (ICC; Winer, 1971). Scores on a child's persistence and autonomy are summed and the composite score was used as the measure of the child's mastery motivation.

**Executive function skills.** Children's executive function skills were assessed in the areas of *impulsive responding*, *memory* (short-term and long-term), and *planning/problem solving* skills when children were in first grade. Impulsive responding was measured with the Continuous Performance Task (CPT) which was an 8.5-minute computer-generated task. Dot matrix letter stimuli were presented in 30 blocks on a 2-inch square screen. Ten stimuli were presented in each block for 200 ms with an inter-stimulus interval of 1,500 ms. Children were asked to press the red button when they saw the target stimulus (letter X), which randomly

appeared twice in each block. Impulsive responding was calculated from the proportion of incorrect response to a non-target.

The subset of Woodcock-Johnson Psycho-Educational Battery (WJ-R; Woodcock & Johnson, 1989) was used to examine children's short-term and long-term memory. In this test, short-term memory was defined as the ability to remember and repeat simple words, phrases, and sentences and was measured with the Memory for Sentences subtest. Long term memory was assessed using the Memory for Names subtest which measures a child's ability for long-term retrieval.

The Tower of Hanoi task (TOH; Welsh, 1991) was used to assess the child's planning/problem-solving skill. The child was asked to construct a tower on a specified peg using rings with different diameters and colors following several specific rules that no larger rings could be on smaller rings and only one ring could be moved at a time. This task requires the child to think ahead and plan an organized sequence of moves in order to transform an initial configuration of rings into the tower that he or she is asked to build. The child can try a maximum of six puzzles that could be solved within 1 to 6 trials. Each trial allowed using a maximum of 20 moves. A planning efficiency score for each puzzle was based on the number of trials the child attempted to achieve two successive optimal solutions. When children solved a puzzle on Trials 1 and 2 they received six points; five points were given to children who complete a puzzle on Trial 2 and 3, and so on. Children could receive a score between 0 and 6 for each puzzle and between 0 and 36 for the six puzzles. Children with higher total planning efficiency scores were considered to have greater planning/problem-solving skills.

### **Data-analytic strategy**

Structural equation modeling (SEM) with AMOS 17.0 was used to test whether there were interaction effects between maternal sensitivity and children's emotional regulatory ability on children's later executive function skills. Then, mediational model was tested such as whether children's mastery motivation mediated the effects of early maternal sensitivity, a child's earlier emotional regulatory ability, and the interaction between sensitivity and emotion regulation on the child's later executive function skills. First, the direct path model was fit in order to assess the direct associations between first grade executive function skills and early maternal sensitivity, child emotional regulatory ability, and their interaction. Second, the partial mediation model (with all paths estimated) was used to test the direct and indirect effects of early maternal sensitivity, the child's emotional regulatory ability, and their interaction, on the child's later executive function skills via child's mastery motivation. Models were evaluated based on several criteria. First, the  $\chi^2$  value, as an indicator of overall fit, was assessed comparing the covariances within the hypothesized model and the null model. The probability value related to  $\chi^2$  indicates the likelihood of obtaining a  $\chi^2$  value that exceeds the  $\chi^2$  value when the null model is true. Therefore, a low and statistically nonsignificant  $\chi^2$  value represents a good model fit (Schumacker & Lomax, 2010). The comparative fit index (CFI) and root mean square error of approximation (RMSEA) were also calculated to evaluate models. For a good model fit, CFI should be .95 or above; RMSEA should be .06 or below (Hu & Bentler, 1999). Figure 8 shows the model that the current study tested.

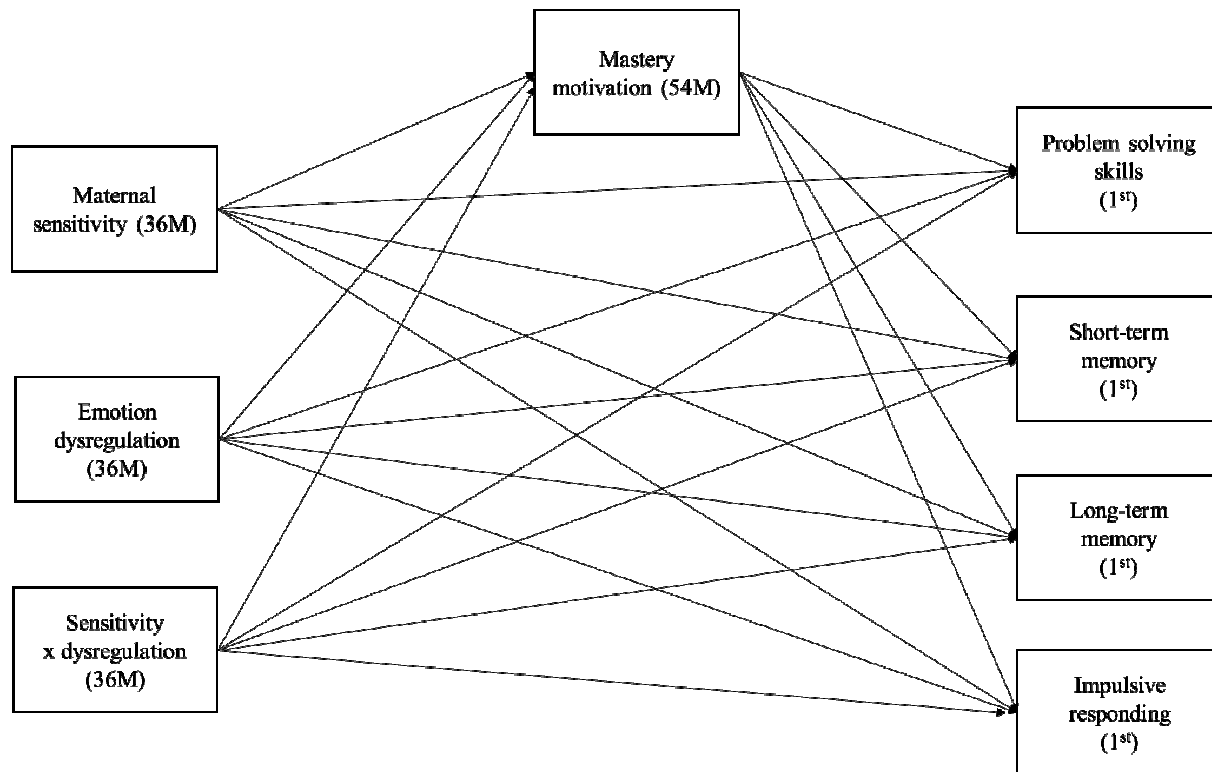


Figure 8. The Conceptual Model

## Results

### Preliminary Analyses

Table 6 provides the bivariate Pearson correlations among the main variables. Children's emotional regulation was assessed using their defiance and negative affect during the clean up episode, and these variables were highly correlated. Children's persistence and autonomy were measured in order to assess their mastery motivation at 54 months, and these two variables were also highly correlated. Children's executive function skills included impulsive responding, short-term and long-term memory, and planning/problem solving skills, which were significantly correlated. As expected, early maternal sensitivity at 36 months was significantly correlated with children's emotional regulation abilities (i.e., defiance and negative affect) at 36 months, mastery motivation (i.e., persistence and autonomy) at 54 months, and with executive function skills

including impulsive responding, short-term and long-term memory, and planning/problem solving skills in the first grade. Children whose mothers were more sensitive to them at 36 months were likely to show better emotional regulation abilities at 36 months, mastery motivation at 54 months, and executive function skills in the first grade. Early child defiance was correlated only with later impulsive responding, while early child negative affect was negatively linked to both mastery motivation (persistence and autonomy) at 54 months and to problem solving skills in the first grade. Finally, children's mastery motivation was positively related to their executive function skills (i.e., short-term and long-term memory, impulsive responding, and problem solving skills) in the first grade.

Table 6. Bivariate Pearson Correlations among Main Variables

Main Variable	1	2	3	4	5	6	7	8	9
1. Maternal sensitivity	1								
2. Child defiance	-.084* (N=900)	1							
3. Child negative affect	-.119** (N=900)	.722** (N=908)	1						
4. Child persistence	.165** (N=880)	-.051 (N=877)	-.096** (N=877)	1					
5. Child autonomy	.192** (N=880)	-.058 (N=877)	-.126** (N=877)	.792** (N=901)	1				
6. Child impulsive responding	-.245** (N=911)	.082* (N=908)	.030 (N=908)	-.088** (N=901)	-.062 (N=901)	1			
7. Child short-term memory	.132** (N=911)	.010 (N=908)	-.042 (N=908)	.123** (N=901)	.141** (N=901)	-.086** (N=938)	1		
8. Child long-term memory	.322** (N=911)	-.050 (N=908)	-.061 (N=908)	.131** (N=901)	.135** (N=901)	-.127** (N=938)	.286** (N=938)	1	
9. Child problem-solving skills	.123** (N=911)	-.065 (N=908)	-.076* (N=908)	.140** (N=901)	.131** (N=901)	-.153** (N=938)	.112** (N=938)	.167** (N=938)	1

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

## Path Analysis

**Direct Path Model.** The direct path model was tested to examine whether early maternal sensitivity and children's emotional regulation directly predicted children's later executive function skills including impulsive responding, short-term and long-term memory, and problem solving skills. In addition, in order to assess interaction effects of maternal sensitivity and children's emotional regulation, an interaction variable (maternal sensitivity x child emotional dysregulation) was created and added to the model. The results of the direct path model are summarized in Figure 9. The model fits the data well ( $\chi^2[2] = 5.07$ , *ns*, CFI = 1.00, RMSEA = .04).

Partially consistent with the hypothesis that maternal sensitivity and children's emotional regulation linked to children's later executive function skills, maternal sensitivity at 36 months predicted children's short- and long-term memory, however, it did not affect other executive function skills. Children's emotional regulation abilities at 36 months predicted only impulsive responding. Other executive function skills were not related to children's early emotional regulation abilities.

There were some significant interaction effects between maternal sensitivity and child emotional regulation on children's executive function skills. Children's emotional regulation moderated the effects of maternal sensitivity on children's long-term memory. In other words, for children with low emotional regulation, maternal sensitivity did not affect children's long-term memory, but for children with low dysregulation (those who are highly regulated), maternal sensitivity affects their long-term memory such that mothers who are more sensitive have children with better long-term memories.

For the effects on children's impulsive responding, there was no direct relationship between maternal sensitivity and children's impulsive responding when the interaction (maternal

sensitivity x child dysregulation) was in the model. This result shows that maternal sensitivity moderates the effect of children's emotion regulation on children's impulsive responding; that is, when mothers are highly sensitive, there is no impact of children's early emotional regulation on their impulsiveness, but when mothers are less sensitive, children's lower levels of emotional regulation leads to high impulsive responding.

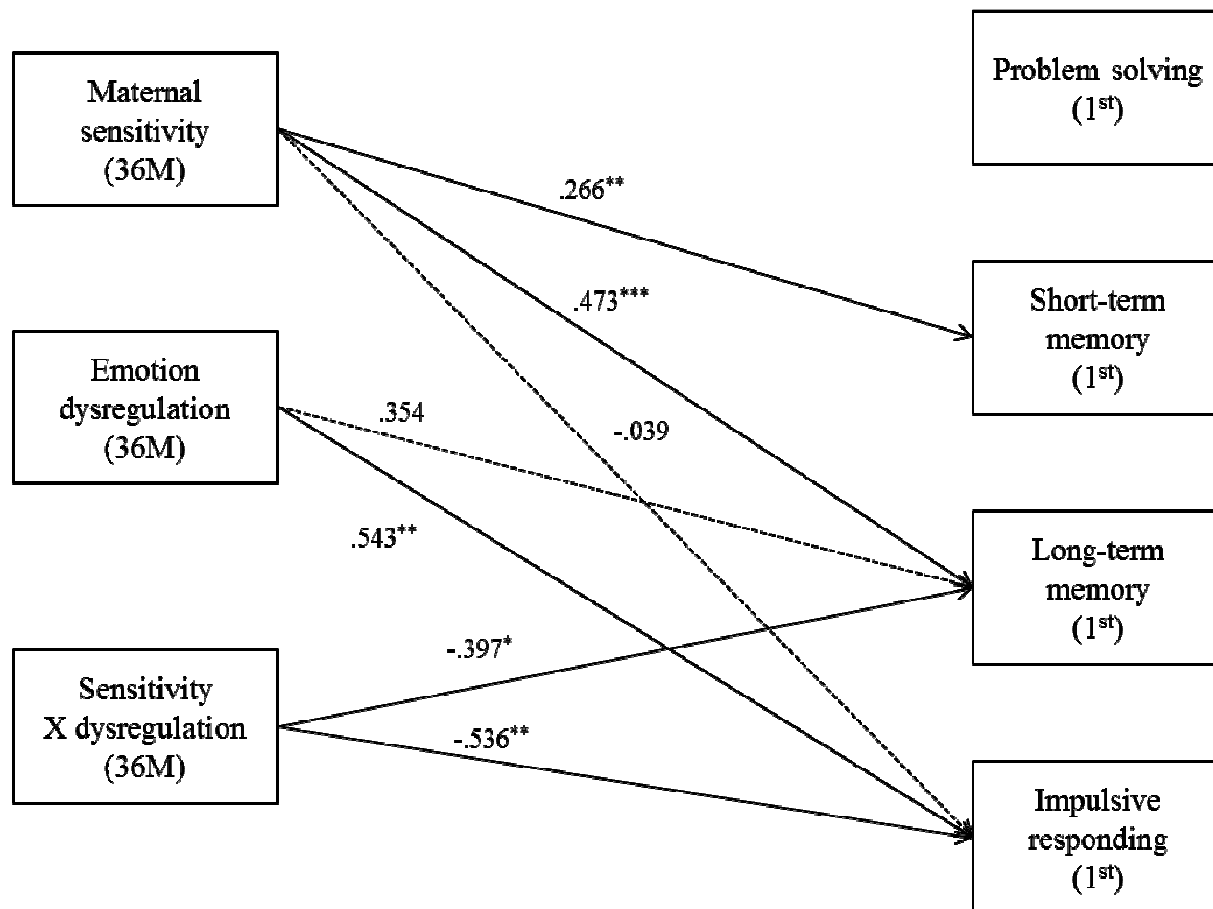


Figure 9. The Direct Path Model. This model shows the direct effects of early maternal sensitivity and child emotional regulation and their interaction on later children's executive function skills.

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$

**Mediated Models.** The mediated model was tested to investigate whether children's mastery motivation at 54 months mediated the relationships between first grade executive function skills and early maternal sensitivity, children's emotional regulation, and their interaction. First, the fully directed model was tested but the model did not fit the data ( $\chi^2[14] = 161.96$ ,  $p < 0.05$ ; CFI = .960; RMSEA=0.106). Then, the partially mediated model was tested to investigate whether earlier maternal sensitivity, children's emotional regulation, and their interaction affected children's late executive function skills directly and indirectly via children's mastery motivation at 54 months. The partial mediation model is summarized in Figure 10. Although the partially mediated model fit the data well statistically ( $\chi^2[2]=4.65$ , *ns*, CFI = 1.00; RMSEA=0.04), none of independent variables predicted mastery motivation in the model. Mastery motivation promoted some of EF skills, including problem solving and short- and long-term memory, but did not mediate the effects of maternal sensitivity, child's emotional regulation ability, and their interaction on later child's EF skills. This is consistent with the idea that mastery motivation is a separate construct, and is not a function of children's early emotional regulation.

Interestingly, children's problem solving skills were affected only by their mastery motivation. Children's early emotional regulation and maternal sensitivity did not predict later problem solving skills, while early maternal sensitivity predicted later memory skills and children's emotional dysregulation led to high impulsive responding.

Like the direct path model, there were interaction effects between early maternal sensitivity and children's emotional dysregulation on children's long-term memory and impulsive responding. Early maternal sensitivity moderated the effects of children's emotional dysregulation on their impulsive responding. Children with poor emotional regulation abilities

showed higher levels of impulsive responding when their mothers were less sensitive. However, there was no influence for children who had more sensitive mothers. With regard to children's memory, early maternal sensitivity led to better long-term memory when children regulated their emotion well at 36 months.

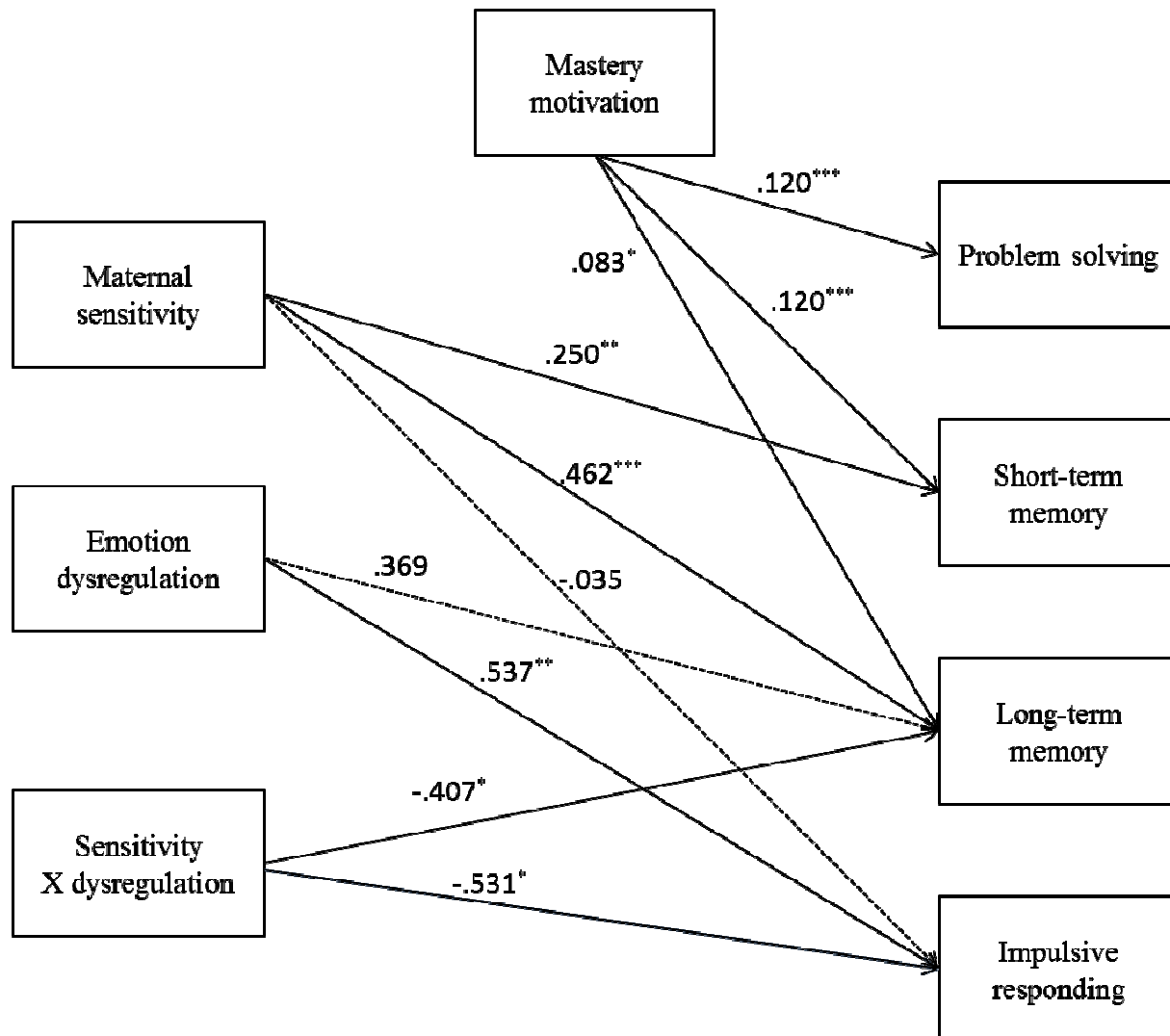


Figure 10. The Partial Mediated Model. This model shows how children's mastery motivation affects the relations of predictors (i.e., early maternal sensitivity, children's emotional regulation and their interaction) to children's executive function skills.

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$

## **Discussion**

Little research has addressed the role of children's mastery motivation in the development of executive function skills in early childhood. Moreover, even though previous research has shown that maternal sensitivity and children's emotional regulation each predict the development of mastery motivation and executive function skills, few empirical studies have examined these predictors together, along with their possible interactions. The current study, using a large and diverse sample of mothers and their children, directly examined links from early maternal sensitivity and children's emotional regulation to children's later executive function skills. Moreover, this study asked whether there were interaction effects between maternal sensitivity and child emotional regulation on the development of executive function skills. In addition, the current study used a longitudinal design to assess whether children's mastery motivation mediated these relationships. The current study findings confirm the unique role of mastery motivation in the development of executive function skills, and highlight the ways that maternal sensitivity moderates the effects of children's emotional regulation abilities on the development of a set of executive function skills.

### **Maternal Sensitivity**

The current findings confirmed that early maternal sensitivity predicted children's later executive function skills, especially memory skills. These findings are consistent with those of Gauvain (2001) who found that maternal scaffolding, such as sensitive responding and supporting children's autonomy, contribute to the development of children's memory skills including encoding and storage of information. Children may learn from mothers' behavior how to encode and use information held in mind.

Maternal sensitivity did not affect children's later impulsive responding. These findings are consistent with those of Granziano, Keane, and Calkins (2010) who found that maternal warmth and responsiveness did not predict children's impulsivity. However, they found that maternal over-control and intrusiveness influenced children's impulsive behavior. Unlike maternal intrusiveness, maternal sensitivity may indirectly affect children's control of impulsive behavior. The current results showed that mastery motivation did not mediate the relation of early maternal sensitivity to children's later impulsive responding. Thus, maternal sensitivity may be indirectly related to children's executive function skills through child skills other than mastery motivation which was tested in the current study. For example, Matte-Gagné and Bernier (2011) found that children's expressive vocabulary mediated the effects of early maternal sensitivity, especially maternal autonomy support, on children's later impulsive responding. According to them, maternal autonomy support promoted children's language skills which children can use to control their impulsive behaviors.

Problem-solving skills were not influenced by early maternal sensitivity. The problem-solving task in the current study was the most complex task assessed, and required children to integrate other executive function skills including working memory. Thus, children's problem-solving skills – as measured in the current study – are influenced by maturation of other executive function skills. In the current study, we found that maternal sensitivity promoted the development of these other executive function skills, including short-term memory, and thus may indirectly affect problem-solving through these other skills; however, testing these additional mediational effects was beyond the scope of the current study. An NICHD study (2005) suggests another possible explanation for the lack of significant relationship. Toddlers and preschool-age children may not be ready to take advantage of their family environment, such as

maternal sensitivity, to comprehend and learn the complex processes to solve problems. Thus, children could benefit more from later environmental input for developing problem-solving skills, but variation in early maternal sensitivity may not yet influence problem-solving in early childhood. Another possible explanation is that maternal sensitivity may be indirectly related to children's later problem solving skills. For example, Hammond and colleagues (2011) found that maternal scaffolding, including supportive and responsive behaviors, at age 2 affected children's problem-solving skills at age 4 indirectly via the child's verbal ability at age 3. Like the effects on impulsive responding, maternal supportive and responsive behaviors may promote children's verbal ability such as self-directed speech, which in turn facilitates children's ability to plan and organize their thoughts and regulate their behavior for solving problems. The current study did not examine these relationships, thus future study is needed to clarify this mechanism.

The current study findings show that early maternal sensitivity moderated the effects of children's emotional dysregulation on their impulsive responding. Children who had poor emotional regulation abilities and whose mothers were less sensitive at 36 months displayed higher levels of impulsive responding at the first grade. On the other hand, in the context of more sensitive mothers, there was no influence of children's emotion regulation on their impulsive responding. Previous research has shown maternal behavior such as warmth and responsive behavior buffers the negative effects of emotion regulation on attention capabilities (Graziano, Calkins, & Keane, 2011) which play an important role in the development of executive function skills from two to six years (Posner & Rothbart, 2000). The current study extends previous work by providing the evidence that maternal sensitivity buffered the effects of children's emotional dysregulation on the executive function skill of impulsive responding.

## **Children's Emotional Regulation**

As expected, early emotional regulation predicted later impulsive responding, which is consistent with previous research. Graziano and colleagues (2010) found that children with better emotional regulation skills showed low levels of behavioral impulsivity and greater improvement in reactive control over time. This indicates that children who, early on, experience successful regulation of their emotions can better control their behavior later. Children can learn some skills or strategies, such as self-talk, to modulate their emotion. Children with better emotion regulation abilities may use these skills more easily, which allows them to better control their impulsive behavior.

Children's early emotional regulation did not affect later memory skills and problem-solving skills in the current study. Although Blair (2002) asserted that emotion regulation promotes executive functions, emotion regulation may not directly affect children's memory and problem-solving skills. Researchers often categorize executive processes into two types: cool executive processes or hot executive processes. Cool executive processes are associated with cognitive, abstractive, and decontextualized problems. Hot executive processes are involved in affective aspects of executive functioning (Aelazo, Qu, & Muller, 2004). Children's early emotional regulation may facilitate the development of hot executive processes more than cool executive processes. Our results support this possibility with the evidence that emotional regulation did not predict later memory skills and problem-solving skills but control of impulsive responding.

The current study findings showed children's early emotional regulation moderated the effects of maternal sensitivity on children's later memory skills, especially long-term memory. That is, early maternal sensitivity led to better long-term memory when children regulated their emotion well at 36 months. No significant effects were found for children with poor emotional

regulation abilities, which indicated that children's emotional regulation enhances the positive effects of early maternal sensitivity on later children's long-term memory.

### **Relating the Child's Mastery Motivation to Development of Executive Function Skills**

Children's mastery motivation predicted their later executive function skills of short- and long-term memory and problem-solving. Previous research showed that mastery motivation promoted recall of information for deep processing on a memory task (DiCintio & Parkes, 1997; Graham & Golan, 1991). Our current study extends this relationship by providing the evidence that mastery motivation affects later memory skills including short-term and long-term memory for young children. Further, children's problem-solving skills were influenced by mastery motivation. According to Rogoff, Mistry, Goncu, and Mosier (1993), children's successful experience of solving difficult tasks helps them to internalize the skills required for such tasks. Children's mastery motivation drives them to attempt difficult tasks, in which they have more opportunities to practice and internalize new knowledge and skills, which in turn facilitates their executive function skills related to problem-solving.

In the current study, mastery motivation did not mediate the effects of early maternal sensitivity or children's emotional regulation on children's later executive function skills. This result indicates that the function of mastery motivation does not overlap with children's early emotional regulation and is a separate construct promoting executive function skills. However, mastery motivation predicted three executive skills, including short-term and long-term memory and problem-solving, which emotion regulation did not; on the other hand, emotion regulation predicted control of impulsive responding which mastery motivation did not. The fact that mastery motivation and emotional regulation predict separate executive function skills further strengthens the conclusion that these are separate constructs.

## **Limitations**

The current study had some limitations which should be considered in future research. First, this study measured only instrumental aspects of mastery motivation (i.e., persistence and autonomy). Including expressive aspects of mastery motivation could help to understand the role of mastery motivation more clearly, and these may be more related to children's emotion regulation. Second, assessing other maternal behaviors like intrusiveness may give more information about the development of children's mastery motivation and executive function skills. Third, we only examined longitudinal effects of maternal sensitivity and children's emotional regulation on mastery motivation and executive function skills, rather than including concurrent or short-term effects. Comparing short-term and long-term effects of maternal sensitivity and children's emotional regulation on children's skills could prove informative for promoting children's mastery motivation and executive function skills. Finally, the majority of mothers and children participating in the study were European American, so the current study findings may apply only to this segment of the population, rather than mothers and children more generally.

## **Conclusion**

The current study shows the unique role of mastery motivation in the development of executive function skills. In particular, mastery motivation and emotion regulation influence separate executive function skills, providing evidence that they are separate constructs. Moreover, the current study indicates that maternal sensitivity moderate the effects of children's emotional regulation abilities on the development of executive function skills such that when mothers are highly sensitive children's dysregulation does not hamper their executive function skills, whereas when mothers are not sensitive, children must be well-regulated in order to develop high levels

of executive function skills. The findings of this study contribute to a more understanding of the roles of maternal sensitivity and children's internal characteristics – self-regulation and mastery motivation – in the development of executive function skills.

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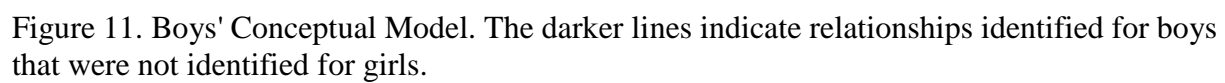
## **Chapter 4. Conclusions**

Every day children face different challenges that could lead to new knowledge or skills. Sometimes these new tasks may be easily completed, but other times they may not. When children have to conduct a moderately difficult task, some of them refuse to finish it and will give up, but some children continue attempting to achieve a task-related goal, and thus may gain the benefit of the knowledge or skills afforded by the task. What makes this difference in children's behavior and related cognitive outcomes? This dissertation considered children's mastery motivation as a key factor. Mastery motivation is defined as an intrinsic force that helps an individual to sustain their attempts to master moderately challenging tasks or skills (Barrett, Morgan, & Maslin-Cole, 1993). This dissertation consisted of two studies. The first study (chapter 2) addressed how mastery motivation develops and the kinds of factors can improve or hinder the development of mastery motivation during the first three years. The second study (chapter 3) explored how early mastery motivation affects children's later cognitive processes at school-age. The results from both studies within this dissertation extend current knowledge about the development of mastery motivation and its effects of mastery on later cognitive processes.

The findings of chapter 2 suggest that early maternal depressive symptoms affect children's later mastery motivation and related domains during the child's first three years. Furthermore, the results indicated mediational roles of maternal sensitivity and intrusiveness during the second year. More specifically, in the direct path model, maternal depression symptoms negatively linked with mastery motivation and related domains including self-regulation and general cognitive skills. However, a direct negative effect of early maternal depressive symptoms on children's later mastery motivation was not significant when considering maternal parenting at 24 months, while the negative effects of early maternal

depressive symptoms on children's later self-regulation and general cognitive skills were still significant. The negative effects of early maternal depressive symptoms on children's later mastery motivation were fully mediated via maternal sensitivity, but not maternal intrusiveness. Maternal intrusive behavior may affect different domain of social and cognitive development than does sensitivity. For example, maternal intrusiveness mediated the negative effects of early maternal depressive symptoms on children's later self-regulation and general cognitive skills. These findings imply that mastery motivation is affected by positive maternal behavior rather than negative behavior and mastery motivation is a different construct from self-regulation and general cognitive skills.

The results of chapter 2 also showed gender differences in the effects of maternal depression. Boys whose mothers had more depressive symptoms at 6 months displayed poor general cognitive skills at 36 months. However, mastery motivation and self-regulation were not predicted by early maternal depressive symptoms directly, but rather, the effect of depression was mediated by maternal sensitivity (Figure 11). For girls, early maternal depressive symptoms did not have any direct negative effects on later social-cognitive development. Maternal sensitivity mediated the effects of early maternal depressive symptoms on children's mastery motivation and general cognitive skills for girls (Figure 12). These findings indicate that boys may be particularly vulnerable to their mothers' depressive symptoms.



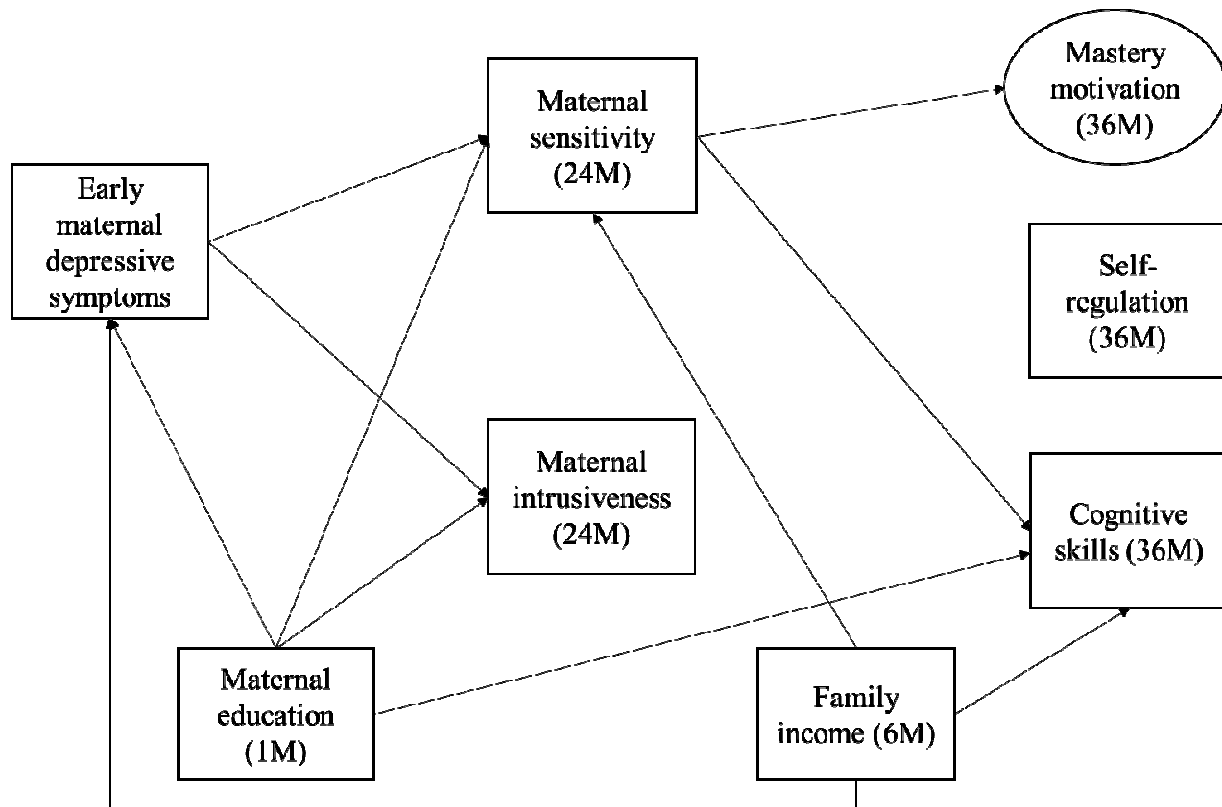


Figure 12. Girls' Conceptual Model

Girls had higher general cognitive skills than boys at 36 months. These results are consistent with previous research in which maternal depression affected boys', but not girls' later IQ scores (Milgrom et al., 2004). Thus, the direct and indirect negative effects of early maternal depressive symptoms via maternal behavior identified in this study may explain boys' lower cognitive skills.

The findings of chapter 2 suggested the importance of early intervention to decrease maternal depressive symptoms to prevent the negative effects of early maternal depression on later children's social and cognitive skills including mastery motivation, self-regulation, and general cognitive skills. In addition, parenting education helps depressed mothers to form

positive relations with their children. For example, mothers may benefit from interventions that support their use of more sensitive and less intrusive behavior toward their children at 24 months.

In chapter 3, the results indicate the unique role of mastery motivation in the development of executive function skills. As expected, children's mastery motivation at 54 months predicted the development of a set of executive function skills including short- and long-term memory abilities and problem-solving skills in the first grade. However, mastery motivation did not mediate the effects of children's early emotional regulation abilities on later executive function skills. Instead, mastery motivation predicted three of the executive function skills, while emotion regulation predicted only one which mastery motivation did not predict. This finding confirmed that mastery motivation and emotional regulation are separate constructs, each with a unique role in the development of executive function skills.

Maternal sensitivity also plays an important role in the development of children's executive function skills, especially memory skills. In this study, maternal sensitivity was characterized as less hostility and more emotional support and respect of children's autonomy. Children who received more sensitive care from mothers at 36 months showed better memory skills including short-term and long-term memory in the first grade. Children may learn from mothers' behavior how to encode and use mental information. Early maternal sensitivity moderated the effects of emotional regulation abilities on the development of executive function skills. Specifically, children with poor emotional regulation abilities showed high levels of impulsive responding later when their mothers were less sensitive at 36 months. In contrast, there was no influence of emotional regulation for children who had more sensitive mothers.

Children's early emotional regulation was directly linked with later control of impulsive responding. Earlier experience of successful regulation of their emotions leads children to better

control their behavior later in life. Children can learn some skills or strategies to modulate their emotion. Thus, children with better emotion regulation abilities may use these skills more easily, which would allow them to better control their impulsive behavior. Finally, this study also showed significant interactions of emotion regulation and maternal sensitivity for the development of long-term memory skills. Children's emotional regulation enhances the positive effects of early maternal sensitivity on later memory skills.

These two papers used longitudinal data from a large and diverse sample. However, the majority of the mothers and children participating in the study were of European American. Therefore, the generalizability of the results is limited as results may differ in other ethnic groups. For example, for African-American mothers and children in the current sample, early maternal depression directly affected only children's later general cognitive skills. There were no mediational roles of maternal sensitivity and intrusiveness between early maternal depression and children's later social and cognitive skills. Therefore, future research should compare effects of early maternal depression on children's later mastery motivation and related domains in other ethnicities. Also needed is the examination of whether the role of mastery motivation in later cognitive development differs across ethnicities. These future studies would extend knowledge about variation in the development of mastery motivation and its effects on later cognitive development across diverse ethnic groups.

The study reported in Chapter 2 examined maternal depressive symptoms at 6 and 24 months. Other studies have emphasized the effects of chronic maternal depression on maternal parenting and child development (e.g. Campbell, Matestic, Von Stauffenberg, Mohan, & Kirchner, 2007). Therefore, future studies should examine the effects of chronic maternal

depressive symptoms across early childhood. Doing so would expand knowledge of the effects of maternal depressive symptoms on the development of mastery motivation.

Overall, these two studies extend our current knowledge about children's mastery motivation. Mastery motivation is influenced by positive maternal behaviors rather than negative behaviors unlike self-regulation and general cognitive skills and there are no gender differences in the effects of early maternal depression on later mastery motivation. In addition, mastery motivation improves children's later executive function skills and plays a different role from emotion regulation ability in fostering of children's executive function skills. It implies that mastery motivation is a separate and unique construct. These two studies contribute to understanding more clearly the relations between mastery motivation and maternal behavior and the mechanism by which children's mastery motivation affects their cognitive outcomes.

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