VITHLANI, PARITA P., M.A. Emotion Regulation and Executive Functioning as Predictors of Theory of Mind Competence during Early Childhood. (2010)
Directed by Dr. Susan Calkins. 59 pp.

The linkage between emotion regulation (ER) skills and executive functioning (EF) abilities as predictors of theory of mind skills (ToM) was examined. 263 3.5-year-old children that participated in an on-going longitudinal study were administered various executive function, emotion regulation, and theory of mind tasks; maternal reports of emotion regulation abilities were also obtained. It was predicted that children who score higher on ER measures will better be able to perform on EF tasks and in turn have a superior ToM ability; superior EF skills would mediate the relation between ER skills and ToM abilities. Results showed no relationship between ER, EF, and ToM after controlling for demographic variables such as maternal education, race, language, gender, and maternal marital status; the mediation hypothesis was not supported. But associations between some EF tasks and ToM tasks were found. Results are discussed in terms of limitations and possible implications for supporting the development of cognitive, regulatory, and social skills in young children.

EMOTION REGULATION AND EXECUTIVE FUNCTIONING AS PREDICTORS OF THEORY OF MIND COMPETENCE DURING EARLY CHILDHOOD

by

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A Thesis Submitted to
the Faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Master of Arts

Greensboro
2010

Approved by

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To my family and friends in recognition of the unconditional support, guidance, and love during my vital educational years. Special thanks to my mom and my brother who mean the world to me; without them, the completion of this work would not have been possible. Thanks to my dog who adds brightness in my gloomy days. Lastly, I dedicate this work in the loving memory of my dad.

"In my heart, I shall always carry those precious memories,
For your life meant the world to me and you taught me so much,
You taught me to live, enjoy, cherish, laugh, dream and above all
To remember OUR time together"

- author unknown

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4/5/2010 .
Date of Acceptance by Committee

4/5/2010 .
Date of Final Oral Examination

ACKNOWLEDGEMENTS

I would like to thank my advisor, Susan Calkins, my committee members, Stuart Marcovitch and Marion O'Brien, and all current and former research assistants at the Family Research Center. I would also like to thank Nayena Blankson, Korinne Chiu, Jennifer Weaver, Rachael Kelleher, Sara Loudermilk, Jennifer Mackler, Caitlin Stone, and all others in the Emotional Development Lab for their guidance and support.

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CHAPTER I

INTRODUCTION

Children who are socially competent have the necessary social, emotional, and cognitive skills and behaviors for successful social adaptation. Parents are the primary source of emotional and social support for children (Landry, 2008); however, as children develop, peers play a significant role in promoting socio-emotional development (Salisch, 2001). Research findings suggest that at least some aspects of social development and social competence are related to theory of mind (ToM) competence (e.g., Dunn, 1991; Lalonde and Chandler, 1995). ToM is the ability to attribute mental states, such as desires, intentions, and beliefs, to self and to others: this ability plays a central role in human social interaction (Frith and Frith, 2001). Hughes and Ensor (2007) found that adverse effects of harsh parenting are lessened for children as young as 2 year-olds that have good ToM skills. Given the importance of ToM competence for later positive developmental outcomes, it is important to investigate factors that may contribute to earlier competency.

ToM skills are fundamental for understanding the social world and following social norms. For example, a person who has a ToM may be able to understand if someone is lying or intends to deceive. A standard task used to assess ToM skills in young children is the unexpected contents task. In this task, a box is filled with deceiving contents (for example, band-aid box filled with blocks). A child is shown the contents of the box and is asked a series of questions regarding his own beliefs and a protagonist's belief regarding the contents of the box. A child with a ToM skill would be able to understand that the protagonist is not aware that the band-aid box contains blocks and therefore will think that the band-aid box will in fact contain band-aids. Growing evidence suggests that children begin to acquire an ability to attribute mental states from the second year of life (Bretherton, McNew, & Beeghly-Smith, 1981). Research indicates that within Western cultures, all children acquire a fairly sophisticated ToM between the second and the sixth year of life (Callaghan et al., 2005).

In the past several decades, investigators have focused on age differences in ToM performance for typically developing children (Wellman, 1990). Individual differences in early experiences have also been explored. Family conversations about desires, beliefs, intentions, and other mental states have been positively correlated with ToM competence (Bartsch & Wellman, 1995). The presence of siblings (Jenkins & Astington, 1996; Peterson, 2000), maternal educational levels (Cutting & Dunn, 1999), maternal parenting style, and mental state talk (Ruffman, Slade, Devitt, & Crowe, 2006) have been found to contribute to the rate at which children are able to achieve success on the standard false-belief tasks and ToM understanding. Much of the research examining the source of individual differences in ToM has focused on the influence of contextual factors. However, little is known about the factors within the child that predict individual differences.

There are a number of child factors or child skills that may support the development of ToM. Because ToM has both a cognitive element and a social element, it is possible that other social and cognitive skills may influence or may be related to the emergence of ToM skills. Past research has found correlational relations among executive function (EF) and ToM abilities in typically developing children (Carlson & Moses, 2001). EF is cognitive functions underling goal directed behavior. But little is known about the relation between emotion regulation (ER) and ToM competence. ER is the goal-directed processes involved in control of affect. Recent studies have shown correlation between EF and ER (e.g., Hoeksma, Oosterlaan, & Schipper, 2004; Kieras, Tobin, Graziano, & Rothbart, 2005) suggesting that ER may support the development of EF. The objective of the current study was to examine the relation between children's functioning in cognitive and social domains and their acquisition of ToM abilities. Cognitive factors were assessed in the domains of executive functioning ability and social factors were assessed by examining emotion regulation skills among young children because emotion regulation has a social element.

The Development of Executive Functioning

Research from the past two decades has revealed that the first five years of life play a critical role in the development of cognitive functions (Garon, Bryson, & Smith, 2008). Executive Functioning (EF) is a broad term referring to the cognitive functions that underlie goal directed behavior enabling the conscious control of thought and action (e.g., Zelazo, Carter, Reznick, & Frye, 1997), the ability to hold relevant information in short-term memory, and the skill to manipulate this information by engaging in focused attention (NICHD ECCRN, 2005; Wolfe & Bell, 2007). According to Diamond (2006), EF abilities are required in various tasks such as problem solving, planning, concentrating, coordinating, consciously choosing one choice over the other, and overriding a strong internal or external pull. These abilities develop through maturation of brain areas during the childhood and adolescent years (Anderson, Anderson, Northam, Jacobs, & Catroppa, 2001).

EF broadly encompasses several cognitive processes including inhibitory control (IC), working memory (WM), and attentional flexibility (AF). Inhibitory control is the ability to inhibit responses that are dominant but are not relevant to the goal or task at hand in order to produce a subdominant response (Rothbart & Posner, 1985). For example, in the game of "Simon says," children are asked to inhibit the actions unless they hear that Simon commanded the action. According to Diamond (2006), WM is the process of holding information in mind for the purpose of goal directed action; it is the ability to hold some information in that mind for a short amount of time and later produce that information from the memory. For example, a secretary rehearsing a phone number in her mind until she dialed it or a student holding the information projected on the screen in mind until he transfers it to his notes: both are using their working memory. WM is thought to be the main underlying contributor to executive functioning (Roberts & Pennington, 1996). Attentional Flexibility refers to the rapidity with which set or attention can be switched from one signal requiring attention to another; the ability to change back and forth between multiple tasks, mental sets, and operations (Monsell, 1996). For example, someone driving on an unfamiliar route while following a navigation system has to switch their attention between the road and the instructions from the navigator in order to avoid an accident and get to the destination without getting lost.

Based on these definitions, these skills appear distinct. But each of these skills may be dependent upon one another. For instance, in order to inhibit dominant responses, a child may need working memory to hold the rules of the task in mind and also may need the ability to switch attention between dominant responses and subdominant responses. Therefore, these skills combined together make up for EF abilities. Findings from studies exploring activation of certain brain areas have revealed that these executive functioning abilities are associated with the prefrontal cortex (Blair, Zelazo, & Greenberg, 2005). Furthermore, both EF abilities and the development of the prefrontal cortex rapidly mature during the first five years of life (Zelazo & Müller, 2002).

EF ability is primarily thought to be associated with the prefrontal cortex because damage to this area of the brain has been linked to impairments on a variety of cognitive tasks (Stuss, Eskes, & Foster, 1994) such as the Wisconsin Card Sorting Task (the WCST; Milner, 1964) and the Stroop Color-Word Task (Perret, 1974; Stroop, 1935). Although the "hot" cognitive aspects and "cool" affective aspects of EF are associated with different brain areas (Zelazo & Müller, 2002), findings indicate that performance on both types of tasks develop and foster during the pre-school years (Hongwanishkul, Happaney, Lee, & Zelazo, 2005).

Executive Function and Theory of Mind

Based on the definitions, the constructs of ToM and EF appear to be distinct. For instance, according to Leslie's (1994) theoretical account, the development of ToM depends upon a modular cognitive system which is dedicated to process social information, while EF is generally regarded as a nonsocial construct, overlapping with cognitive constructs such as attention and memory (Leslie, 1994). Despite these contrasts, recent researchers conducting studies with preschoolers have found a developmental relation between the performance on EF tasks and ToM tasks (Carlson, Moses & Hix, 1998; Carlson & Moses, 2001).

The emergence of understanding internal states is initiated by experiencing one's self as an active agent (Russell, 1996). As children's capacity to control and direct their own action increases, they become aware of other alternative courses of action such as actions based on false beliefs. Children may require some level of executive ability before they may begin to formulate complex constructs of mental life (Carlson & Moses, 2001). Several research findings have supported this claim. Investigators have revealed that population that performs poorly on ToM tasks, typically shows deficits in EF tasks (Hughes & Ensor, 2007). Evidence comes from studies conducted using a special population of children with autism; these children perform considerably poorly on both, measures of ToM abilities (Baron-Cohen, 1995; Leslie, 1991) as well as executive control (Pennington, 1997; Russell, 1997). Both, ToM (Flavell & Miller, 1998) and EF (Carlson & Moses, 2001) abilities show substantial growth during the preschool years providing evidence to support the claim that they may be related. The development of EF can be linked theoretically to the development of ToM competence through WM, IC, and AF. Furthermore, a physiological account may provide evidence for the link between EF and ToM.

One way that EF could support ToM development is through WM. False belief understanding, which is considered the hallmark of ToM (Astington & Gopnik, 1991), imposes apparent demands on memory. For example, in the unexpected contents task, wherein a box is filled with deceiving contents in the absence of the protagonist, children must keep track of what the actual and the deceiving contents of the box are in order to correctly respond to questions regarding the protagonist's beliefs. Additionally, children must be able to hold alternative representations in the mind – what the box really holds and what the protagonist believes it holds. Thus far, the research conducted investigating the relation between ToM and WM have found mixed evidence; some studies have found a relation (Hala, Hug, and Henderson, 2003; Davis & Pratt, 1995) while others have found no relation among the two constructs (Hughes, 1998; Jenkins & Astington, 1996). It is possible that these results could be due to the lack of control for variables such as age, language, and other cognitive abilities and the use of differing measures for WM.

Another way in which executive function skills may influence ToM development is through IC. According to Carlson and Moses (2001), successful performance of ToM tasks would require well-developed IC skills. Children must be able to inhibit their own knowledge in order to be able to take another individual's perspective. For instance, on tasks such as false-belief understanding, appearance reality, and deception tasks, children need the ability to inhibit their knowledge of the current reality in order to respond in terms of the less salient representation of reality. Younger preschoolers, who generally lack the ability to inhibit their own responses, may not be able to resist the temptation to reference reality on these and related tasks. Accordingly, children who lack the ability to inhibit may perform poorly on standard ToM tasks. It may be the case then, that children do not altogether lack the mental representational ability by taking into account the false belief and misleading appearances, but instead may be acting impulsively and in turn failing to withdraw from a default response (Leslie & Polizzi, 1998; Russell, Jarrold, & Potel, 1994). Carlson and Moses (2001) suggest that as children's IC abilities advance through the preschool years, they become better at resisting interference from internal and external sources and therefore become better at performing on standard ToM tasks.

Additionally, AF ability may support the development of ToM because in order to pass standard false belief tasks, children must be able to shift their attention between their own knowledge and the protagonists' knowledge. Research has not specifically looked at this link possibly because most research has focused on the link between IC or WM and ToM development. But examination is necessary to understand the link between AF ability and ToM.

Lastly, support also exists for the link between EF and ToM at the physiological level (neuro-anatomy). Several researchers have investigated the developmental changes in the brain during the preschool years when the EF and ToM abilities begin to emerge and enhance. Results from these studies have indicated that the prefrontal cortex rapidly matures during this age period (Frith & Frith, 2001; Zelazo & Müller, 2002). Frith and Frith (2001) examined the changes in certain brain areas while performing mentalizing tasks in adults; they found the prefrontal cortex to be strongly activated while performing these tasks. Research using functional magnetic resonance imaging (fMRI) has supported the finding confirming the activation of medial regions of the prefrontal cortex while performing tasks designed to tap ToM (Gallagher, Happé, Brunswick, Fletcher, Frith, & Frith, 1999). It is possible that these two abilities may share proximal (instead of identical) neural substrates. The general findings across several studies indicating a relation between the two constructs is suggested, further investigation could lead to better understanding of the relationship.

In sum, the link between EF and ToM is evident based on several findings. First, the developmental timing of EF and ToM abilities is similar and these skills undergo significant changes between ages 3 to 5 years. Second, the ability to hold information about the mental aspects and reality may require WM capacity, the capability to inhibit their own knowledge to consider alternative perspectives, and the ability to shift attention from own to another individual's perspective. Lastly, a common brain region, the prefrontal cortex undergoes changes during preschool years and is activated when the performance on EF and ToM tasks are tested. It is possible that EF skills may support the development of ToM ability. But since ToM also has a social element, other social skills may support the development; emotion regulation is one such skill that has received little attention and therefore needs further investigation.

Emotion Regulation

In the past several years, many researchers have been interested in investigating the construct of emotion regulation (ER). Although variations in the definition exist in the current literature, ER broadly refers to the goal-directed psychological processes involved in the initiation and control of emotion, affect, and motivation (Gross, 1998). According to Thompson (1994), ER includes the intrinsic and extrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions. The ability to regulate emotions is an integral part of self-regulation (Liebermann, Giesbrecht, Müller, 2007);

emotion dysregulation has been found to be associated with later internalizing and externalizing problems in children (Calkins & Howse, 2004). Furthermore, ER has been linked to several components of social functioning, such as social competence, popularity among peers and teachers, adjustment, shyness/introversion, and sympathy, among preschool aged children (Carlson & Wang, 2007).

Emotional reactivity is an important component of emotion regulation which is often studied as part of the regulatory processes (Calkins & Hill, 2007; Gross & Thompson, 2007). Emotional reactivity is the tendency to experience frequent and intense emotional arousal. Aspects of emotion reactivity include both the ease at which individuals get emotionally aroused and the intensity of the emotional experience (Karras et al., 2006). Emotion regulation is often defined in terms of the ability to modulate the emotional reactivity (Ahadi & Rothbart, 1994). Therefore, children that are easily aroused may be more emotionally reactive and may have impairments in regulatory and coping skills.

Denham, Zoller, and Couchoud (1994) have posited that among young children, understanding of their own and others' emotions constitutes a fundamental early component of social cognition. The ability to regulate emotions has been linked to later positive social outcomes possibly because optimally regulated children can control and modulate emotions in arousing situations (Eisenberg & Fabes, 1992). The ability to understand emotions allows children to state their own feelings and receive feedback such that they can process casual relations between events and emotions (Hesse &

Ciccheti, 1982). Furthermore, this ability to understand emotions may be a powerful tool for coping and regulating during conflicting situations (Denham et, al., 1994).

ER skills being to develop during early infancy; development is dependent upon both, biological (intrinsic) processes as well as environmental (extrinsic) elements (Fox & Calkins, 2003). Thompson and Meyer (2007) have postulated that the family socialization context and children's early social interaction with the primary caregiver play a critical role in the development of ER skills (Thompson & Meyer, 2007). According to this view, from very early on in life, the interaction with parents and caregivers is critical for the emergence and growth of ER capabilities. The social context provides cues for the developing child on how to manage emotions through modeling from adult figures, reinforcement and punishment of particular emotional responses, and opportunities to control emotional arousal in arousing situations. As Sroufe (2000) points out, individual differences in attachment styles (Bowlby, 1969/1982) among adults and infants may be associated with distinct styles of ER. Children with secure attachments with their caregivers have more opportunities to seek emotional support, and to imitate the attachment figure, and have better availability and sensitivity from caregivers', and therefore, they may be able to better mask or enhance the expression of feelings (Thompson & Meyer, 2007; Calkins & Hill, 2007). From this standpoint, children raised in households with parents who have affective disorders may be at a heightened risk for developing ER problems due to the lack of available emotional support, unsystematic modeling (possibly negative attributional styles), and possibly inconsistent reinforcement schedules (Thompson & Meyer, 2007; Zahn-Waxler & Kochanska, 1990).

Biological factors within the child also contribute to the development of ER capability. According to Kopp (1989; Kopp & Neufield, 2003) innate physiological mechanisms substantially influence early ER skills. Researchers have suggested that neurological changes support the maturation of regulatory skills over the course of development; specifically the maturation of frontal lobes is considered critical for managing attention and inhibiting thoughts and behaviors (Siegler, 2006). According to Davidson, Fox, & Kalin, (2007), as the nervous system organization matures, it contributes to the development of ER; the progressive maturation and consolidation fosters greater behavioral and emotional self-control. Although biological factors contribute to the maturation of self-regulation of emotions during the first few years of life, the interaction between the child and environment could significantly alter developmental trends into divergent pathways (Thompson & Meyer, 2007; Calkins & Hill, 2007). Many elements, both internal and external to the child, influencing the maturation of ER have been explored. Cognitive components such as social referencing, internal working model, planning, and awareness have been found to play an important role in the emergence and maturation of ER (Calkins, 1997; Gross & Thompson, 2007). However, only a few studies have explored the relationship between ER and EF skills. Furthermore, the influence of ER abilities on later ToM competence is not very well understood and therefore needs further investigation. It is possible that ER may support the development of ToM skills.

Emotion Regulation and Theory of Mind

Given that both ER and EF are subcategories of self-regulatory processes, it is important to understand if various forms of regulation contribute similarly to developmental achievements. Although ER emerges earlier during development (Gross & Thompson, 2007) due to the biological underpinnings evident as early as the neonatal period of development (Calkins & Hill, 2007), evidence has indicated that the advancement of ER and ToM share a common developmental timetable. Furthermore, behavioral control has been found to be associated with ToM abilities (Jahromi, 2006).

It may be the case that children who may not have ToM abilities may also have impaired regulatory skills and may be emotionally reactive. This may cause them to act out in arousing situations and in turn become excluded from the social groups. Since social interaction with peers may be essential for the development of a mature ToM, it may be the case that this lack of opportunity to interact with peers may delay the acquisition of understanding other person's intentions, emotions, and interpretations of social cues. Further investigation of the association between these two constructs (ToM and ER) is necessary to fill in the gaps in current findings.

Emotion Regulation and Executive Function

An important issue is whether there is a relation between ER and EF skills. There is speculation that ER abilities may be necessary to succeed on EF tasks such as IC (Carlson & Wang, 2007). However, there is limited research that investigates the relation between ER and EF in young children. There is a possibility that a strong relationship exists because ER and EF are sub-categories of a broader construct of self-regulation

(Mager, Phillips, & Hosie, 2008). Self-regulation is the ability to control, modify, and adapt one's emotions, desires or, impulses (Murtagh & Todd, 2004). Self-regulation can be broken down into two subcategories namely ER (which relates to control of affect, drive, and motivation), and cognitive regulation or EF (which relates to the control of thoughts and actions responsible for planning and executing behavior). Although previous investigations have mostly studied these components separately, a few studies have found possible relations between the two (Hoeksma, Osterlaan, Schipper, 2004; Kieras, Tobin, Graziano, Rothbart, 2005; Liebermann et al., 2007). There are several reasons to speculate a link between these two components. According to Carlson and Wang (2007), it is possible that EF contributes to superior ER abilities or ER abilities contribute to better EF; the interrelation between the two is currently poorly understood.

Carlson and Wang (2007) suggest that ability to regulate emotions depends upon the development of WM and IC such that the two together may perhaps enable the suppression of unwanted emotional experience, inappropriate emotional displays, and possibly even the physiological markers of emotional arousal (e.g., Gross, 1998). Furthermore, it is possible that the IC ability prevents the individual from displaying the negative response and facilitates the substitution of a more desirable response (Liebermann et al., 2007). Both IC and ER require suppression of an impulsive response and displaying an opposite act (Carlson & Wang, 2007). For example, a child presented with a frustrating puzzle may need to inhibit his frustration: according to this claim, only those children who have successfully acquired IC would be able to act in a socially appropriate manner in this situation. If the child lacks IC, the child may not be able to inhibit his frustration and indeed may fail to regulate their emotional arousal resulting in dysregulation of emotions.

Carlson and Wang (2007) also suggest that ER could be essential for succeeding on EF tasks such as IC. It could be that the ability to regulate emotions relaxes the cognitive load, and therefore contributes to better problem solving abilities. Stated differently, the ability to regulate emotions would eliminate the added load required to suppress emotions while working towards a particular goal. When emotions are regulated without effort, the load required to regulate them would in fact be applied to regulating the task at hand. ER could therefore influence coping styles and temperamental differences. Since the emergence of ER may developmentally precede the emergence of EF abilities, there is stronger theoretical support for speculating that ER abilities support the development of EF skills.

Although the definite mechanism underlying the relation between these two constructs is yet to be elucidated, studies have found that some aspects of EF, such as IC, are correlated with ER ability (Liebermann et al., 2007; Carlson & Wang, 2007). However, these studies measured ER by observing disappointment in gift delay tasks (Kochanska, Murray, & Harlan, 2000), in which children were given an undesirable gift and their facial expression was observed upon receiving the gift, and calculated negative facial expressions such as frowning and crying, to indicate poorer ER skills. Another task, secret keeping (Carlson & Wang, 2007), required children to keep a secret about a talking gold-fish from the experimenter; children quickly revealing the secret received a lower score on ER ability. These procedures for assessing ER have certain limitations;

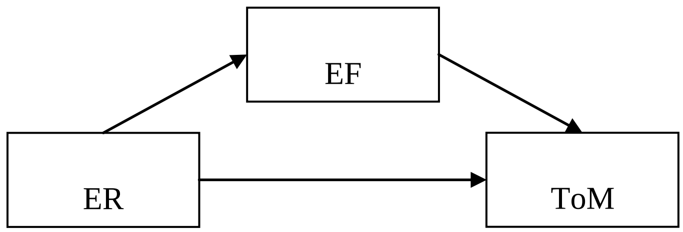
the method incorporated a specific social script requiring children to act in a certain way when faced with the situation. Measures of ER with no social script would possibly shed light on novel findings in this area, i.e. ER measures that assess children's ability to utilize internal emotional control processes such as those elicited during frustrating tasks could possibly help elucidate the relation between ER and ToM abilities.

Summary of Goals

As is evident from the current review, there are several gaps in the current research addressing the relations among EF, ER, and ToM. These constructs share a common developmental timetable (advancement in abilities during pre-school years) and possibly undergo the maturation of the same brain areas; the prefrontal cortex. Furthermore, deficits in EF and ToM evidently result in common psychopathological outcome while insufficient acquisition of EF, ER, or ToM, could possibly hinder social competence in the later years. Past research examining the relations among the three constructs have (1) used limited measures to assess EF, (2) used one aspect of measuring ER (disappointment paradigm suppressing negative emotions and secret keeping suppressing positive emotions; Carlson & Wang, 2007), and (3) lacked control variables such as age and language ability.

The current study examined various measures of ER and EF in children at 3 ½ years of age by including various components of these constructs through parental reports and performance-based measures. The present study investigated these constructs as contributors to greater ToM ability such that it in turn leads to greater social skills. The aim of the current study was to further investigate the relation between ER, EF, and ToM (Fig. 1).

Figure 1. Executive Function as a mediator for the relationship between Emotion Regulation and Theory of Mind



As illustrated in figure 1, the first question addressed is whether ER abilities support the development of ToM. It was predicted that after age and verbal ability are controlled for, children who score higher on ER tasks will score higher on ToM tasks compared to children with poor ER abilities. The second question addressed in the study is whether there is a relation between ER and EF abilities. It was predicted that children who score higher on ER abilities will score higher on EF abilities compared to children with poor ER abilities. The third question addressed is whether EF skills support the development of ToM abilities. It was predicted that children who score higher on WM, IC, and AF tasks (EF measures) will score higher on ToM tasks compared to children with poor EF abilities. The last question addressed is whether EF abilities mediate the relation between ER abilities and ToM skills. It was hypothesized that children who score higher on ER measures will better be able to perform on EF tasks and in turn have a better ToM ability. Stated differently, children who can regulate their emotions during arousing situations will have a greater working memory space, a superior inhibitory control, and greater attention flexibility such that they have an enhanced understanding of their own and others' beliefs, intentions, and knowledge.

However, given that all these tasks are assessed at the same age, we can find associations but not causal links; further longitudinal assessment is necessary to understand the developmental proceedings. It is possible that ToM supports ER or EF.

CHAPTER II

METHODS

Participants

The study used data from children who are part of an ongoing longitudinal study, the School Transition and Academic Readiness (S.T.A.R) project, examining emotional and cognitive contribution to early school success. Children were recruited from various child care centers throughout Guilford County coming from families from diverse range of incomes; the assessment was conducted at the Family Research Center at the University of North Carolina at Greensboro. Efforts were made to recruit equal numbers of male and female participants. The sample comprised of 263 3.5-year-old children (M= 41.79 months; SD = 2.41) and their mothers who participated in the first wave of data collection. Of the 263 children, two were accompanied to the lab by their fathers, three by their grandmothers, and all others by their mothers. Mothers in the study sample were 33 years of age on average (SD= 5.91), approximately 74% had a 4-year college degree or had completed higher levels of education; 74% of the respondents were married and living with their partner; and 78% were currently working outside the home. Fifty-two percent of the children were female; 58% of the children were European American, 35% African American, and 7% other ethnicities.

TABLE 1. Descriptive Statistics for Demographic Measures

Variable	N	%
Child Sex (Female)	136	51.7
Child Race (Non-White)	110	41.8
Maternal Employment Status (Working)	153	58.2
Maternal Educational Level		
Some High School	5	1.9
High School Degree	34	12.9
Attended College	61	23.2
2 Year College Degree	28	10.6
4 Year College Degree	66	25.1
Post Graduate Work	17	6.5
Graduate Degree	50	19.0
Marital Status		
Married, living together	194	73.8
Married but separated	11	4.2
Divorced	3	1.1
Not Married, living with partner	14	5.3
Single, never married	39	14.8
Widowed	1	0.4

Measures

Emotion Regulation

Three separate measures of ER including observed laboratory distress, observed laboratory reactivity, and parental report of negativity/reactivity were used. Zero-order Pearson correlation indicated a low correlation among the ER measures and therefore these measures were included in the model separately. The regulation scores on the two separate tasks were significantly correlated, and therefore the standardized scores were combined to obtain a latent emotion regulation score. The reactivity scores on the two separate tasks were significantly correlated, and therefore the standardized scores were combined to obtain a latent emotional reactivity score. Finally, the scores on Emotion regulation Checklist (ERC) were combined to obtain an ERC score.

Green Circles Task. By repeatedly asking a child to draw a perfect green circle for 3.5 minutes, an observational Impossibly Perfect Green Circles task (Green Circles; GC) measures global emotion regulation and distress (Goldsmith & Reilly, 1993). During the course of the 3.5 minutes, the experimenter gently criticizes previously drawn circles in a neutral tone. Critiques are specific, but do not provide the child with information on how to rectify the problem. For example, children were told this circle is too bumpy, this is too flat, this is too small, or this is too big. The experimenter continues to prompt, "I need the PERFECT green circle" for the duration of the task. The child is brought back to baseline (established by watching a Spot the Dog video prior to the administration of this task) with positive comments at the conclusion of the allotted time for the task.

The Green Circles task is videotaped; regulatory behaviors coded from the videotapes index the child's ability to use regulatory strategies of approach, withdrawal, or distraction. Green Circles Global Regulation was rated on a scale of 0 (unregulated) to 4 (Well-regulated). The observed scores ranged from 2 to 4. To establish reliability, approximately 25% of the videotapes (N=53) were coded by two coders. The inter-observer agreement was calculated as the number of agreements divided by the number of agreements plus disagreements. Agreement between the two coders was 67%.

Reactivity for the green circles task is coded as anger/frustration during the task, measured by latency to distress, intensity of facial and vocal distress, intensity of bodily struggle, duration of distress, and frequency of physical displays of anger/frustration (kicking, banging, hitting). Green Circles Reactivity Global Score is a global index of frustration, rated on a scale of 0 (no emotional response) to 4 (extreme distress). The observed scores ranged from 0 to 4. To establish reliability, approximately 25% of the videotapes (*N*=56) were coded by two coders; agreement 79%.

Locked Box Task. By asking a child to open a locked which they cannot open, the observational Attractive Toy in Locked Box task (Locked Box; LB) also measures global emotion regulation and distress. The child was seated at a table and was given an option to choose from two highly desirable toys. The toy that the child chose was placed in a transparent box with a padlock. The child was provided with a set of keys, none of which was the correct key to unlock the box. The child was instructed to find the right key and open the box in order to play with the toy. The experimenter then left the room for 3 minutes while the child attempted to open the box. Upon entering, the experimenter provided the right key and allowed the child to play with the toy in order to bring the child back to baseline (established by allowing the child to watch a Spot Video prior to the administration of this task).

Similar to the Green Circles task, Locked Box was videotaped; regulatory behaviors were coded to index the child's ability to use regulatory strategies of approach, withdrawal, or distraction. Global Regulation was rated on a scale of 0 (unregulated) to 4 (well-regulated). The observed scores ranged from 0 to 4. To establish reliability, approximately 25% of the videotapes (N=53) were coded by two coders; agreement 54%.

The reactivity for this measure was coded similar to the Green Circles task. Locked Box Reactivity Global Score is a global index of frustration, rated on a scale of 0 (no emotional response) to 4 (extreme distress). The observed scores ranged from 0 to 4.

To establish reliability, approximately 25% of the videotapes (*N*=56) were coded by two coders; agreement 48%.

Emotion Regulation Checklist. The Emotion Regulation Checklist (ERC) is a parent-report measure of their child's negativity and regulation (Shields & Cicchetti; 1998). The version used in this study included 24 items. Each item describes how children control their emotional states using a 4-point Likert scale ranging from 1 (Never) to 4 (Always). Previous factor analyses of the 24 emotion regulation items indicated two common factors, labeled Negativity/Lability and Emotion Regulation. Therefore, to test whether the 24 emotion regulation items fit a 2-common factor model in the current sample, a restricted oblique 2-factor model was fitted. Item 12 did not load on either factor, and therefore, was excluded. By summing the items that loaded on each factor, composite variables were created separately for each factor. Emotion Regulation Lability/Negativity Score is computed as the sum of responses to items 2, 4 (reverse scored), 5 (reverse scored), 6, 8, 9 (reverse scored), 10, 11 (reverse scored), 13, 14, 17, 19, 20, 22, and 24; the internal reliability was 0.82. The possible scores range from 15 to 60 with higher scores indicating greater lability/negativity. The observed scores ranged from 17 to 46. Emotion Regulation Score is computed as the sum of responses to items 1, 3, 7, 15, 16 (reverse scored), 18 (reverse scored) 21, and 23; the internal reliability was 0.60. The possible scores range from 8 to 32 with higher scores indicating greater emotion regulation. The level of skewness for both the scales is reasonable.

Executive Functioning

Three tasks: FIST (Jacques & Zelazo, 2001), K-ABC (Kaufman & Kaufman, 1983), and Children's Stroop task (Grestadt, Hong, & Diamond, 1994) were used to measure executive functioning ability. Since a child may need all components of EF skills to succeed on any of these tasks, responses from the tasks could be combined to obtain an EF composite score. EF ability as a whole is hypothesized to support the development of ToM, and therefore, the number of correct responses from KABC and Stroop tasks were standardized and combined to generate a summary score to represent EF ability; FIST was not included due to low variability in responses.

FIST. By asking children to identify similar patterns on picture cards, The Flexible Item Selection Task (FIST) measures child's executive control. In this study, only the first 6 (of the 16 test picture sets) each consisting of 3 pictured items that vary along some combination of stimulus dimensions (i.e., size, shape, number and color) were used. On each of the 6 test trials, the child is asked to pick two cards that are the same in one way, for example, by shape – an orange and a purple fish (selection A). Children were then asked to pick two cards that are the same but in a different way, for example, by color – an orange fish and an orange sock (selection B). Before administering the test sets, experimenters used one set to explain the task followed by two practice tests. No feedback was provided on the practice sets; if the child missed any of the four practice items (two on each set), the task was not administered and the child received a score of zero on the task. The FIST score is the number of correct responses for the Selection B choices over the 6 test trials. Findings indicate that second-selection responses have higher error rates among preschool-age children because they require children to shift their attention from one stimulus to another (Jacques & Zelazo, 2001). If a child received a zero on selection A, the child received a zero on selection B, regardless of his response. The possible scores range from 0 to 6, with higher scores indicating more attentional flexibility. The observed scores ranged from 0 to 4. The items used to create this variable had internal reliability (Cronbach's alpha) of 0.55. The level of skewness was high and therefore the necessary transformation was performed.

K-ABC Number Recall Task. By asking the child to repeat a series of numbers, the *number recall* subtest of the Kaufman Assessment Battery for Children (KABC) assesses children's WM, IC, and AF. The KABC consists of 22 sets of numbers that increase in size with the smallest set being 2 numbers (e.g. 2-3) and the largest set being 9 numbers (e.g. 9-4-3-10-8-1-4-6-2), The experimenter recited a set of numbers and asked the child to repeat them in the same order. The task was terminated once the child missed three consecutive sets. The items were scored as correct (1) or incorrect (0). The raw score is computed as the difference between the ceiling item and the total number of errors. The possible scores range from 0 to 15 with higher scores indicating increased working memory capacity. The observed scores ranged from 0 to 10. The items used to create this variable had internal reliability (Cronbach's alpha) of 0.82. The level of skewness was acceptable to assume normality.

Children's Stroop Task. By asking the child to say the opposite of what they see, the the Children's Stroop Test measures cognitive control. The Stroop was developed from the classic task (Stroop, 1935). Children were presented with 16 cards half of which were white with a sun and half were black with a moon and stars. Children were trained to say ‘day’ when they see the black cards and ‘night’ when they see the white cards. The Stroop score comprises of correct responses from the 16 trails. If the child missed any of the first two cards (practice trails), the child was provided with feedback and the two cards were administered again. The better of the two scores was used. Children were administered the test trials only if they answered at least one question correctly in two practice trials. The possible scores range from 0 to 16 with higher scores indicating stronger cognitive control or inhibition. The observed scores ranged from 0 to 16. The items used to create this variable had internal reliability (Cronbach’s alpha) of .82. The level of skewness is reasonable to assume normality.

Theory of Mind

Several standard tasks were used to measure separate components of ToM ability: unexpected contents (Astington & Gopnik, 1998), unexpected location (Baron-Cohen, Leslie, & Frith, 1985), and conceptual perspective taking (Taylor, 1988). Zero-order Pearson correlation indicated a low correlation among the ToM measures and therefore these measures were included in the model separately.

Unexpected Contents. By asking a child to identify their own and another person’s beliefs about the contents of two containers, the Unexpected Contents (UC) task, assesses a child’s false belief reasoning. The child was shown a band-aid box that contained blocks and a crayon box that contained spoons. First, the examiner presented the box and asked the child, “What do you think is in here?” The examiner then revealed the actual contents and asked, “Before we opened this, what did you think was in here?”

Then, the examiner asked the child what a friend, who had not seen the actual contents of the box, would think was inside. The possible range of scores is from 0 to 4 with higher scores indicating stronger cognitive understanding. The observed scores ranged from 0 to 4. The items used to create this variable had internal reliability (Cronbach's alpha) of .68. The level of skewness was reasonable.

Unexpected Location Task. The Unexpected Location (UL) task is a measure of the child's false belief reasoning. The child moved an object from one box to another in the absence of a person and was asked questions regarding the person's beliefs and knowledge of the location of the object. For example, "Where will she look for it" and "Where will she think it is?" Each child was administered the task twice with two sets of boxes and two different objects. The items were scored as correct (1) or incorrect (0). The possible range of scores is from 0 to 4 with higher scores indicating stronger cognitive understanding with regard to ToM. The observed scores ranged from 0 to 4. The items used to create this variable had internal reliability (Cronbach's alpha) of .57. The level of skewness was high and therefore the necessary transformation was performed.

Conceptual Perspective Taking. The Conceptual Perspective Taking (CPT) measures whether the child is able to take the perspective of others. Prior to the administration of this task, the experimenter made sure that the child could recognize whether a picture is the right side up or upside down from his/her point of view. The child is then presented with three objects (2 animal cards and one book) one at a time alternating whether they are right side up to the child or the experimenter. The child is asked his/her perspective and the experimenter's perspective on the cards and book. An additional task is administered with a card that has a cat on one side and a dog on the other. It is placed vertically between the subject and experimenter. The child is then asked what animal he/she sees and what animal the experimenter sees. All questions were scored as correct (1) and incorrect (0). The possible range of the total score is from 0 to 7. The observed scores ranged from 0 to 7. The items used to create this variable had internal reliability (Cronbach's alpha) of 0.44. The level is skewness is reasonable.

Control Variables

Demographics. Mothers completed a demographic questionnaire including family income, race, maternal marital status, marital employment status, marital educational level, and child's gender.

Peabody Picture Vocabulary Test. The Peabody Picture Vocabulary task (PPVT) Edition IIIA developed by Dunn & Dunn (1997), measures English receptive vocabulary. This measure was used as a screening test for verbal ability. For this study, 2 training items and 204 test items grouped into twelve-item sets were utilized. Each item consists of four pictures arranged on a page. The child is asked to choose the best picture of the word presented orally by the examiner. The items on the test increase in difficulty and the task is terminated once a child misses 8 items in any given set of twelve-items. The raw score is computed as the difference between the ceiling item and the number of errors made in all of the sets administered. The possible range of scores is from 0 to 204. The highest item reached by any child was item 120. Observed scores ranged from 4 to 83.

Analyses

For EF to be a mediator of ER and ToM ability (Fig. 1), four criteria, as proposed by Baron and Kenny (1998), should be met: (1) There is a significant relation between ER and ToM; (2) ER significantly correlates with EF; (3) EF and ToM are significantly correlated, and (4) the coefficient relating the ER and ToM is reduced when EF is included. Due to low correlation among ER indicators and ToM indicators, nine separate analyses were conducted.

CHAPTER III

RESULTS

Preliminary Analyses

The analyses reported below are based upon 263 children who participated in the 3.5 year laboratory visit of the S.T.A.R. project. Table 1 provides demographic data for the study participants. All the available data was used in each separate analysis. Before data analyses, variables were examined for accuracy of data entry and missing values. Missingness ranged from 0% to 8.7% and was 1.80% overall. Because the proportion of missing values was small, single imputation was reasonable and preferred to listwise deletion (Acock, 2005; Schafer, 1999a). Missing data were imputed using the NORM software (Schafer, 1999b), which uses an Expectation-Maximization (EM) algorithm to replace missing values. Preliminary analyses examined the frequencies and distributions of all study variables; Table 2 provides the descriptive statistics such as means, standard deviations, and ranges of all study variables.

TABLE 2. Descriptive Statistics for Study Variables

Measure	***N***	***M***	***SD***	***Min***	***Max***
Unexpected Location (UL)	263	0.63	0.68	0	2.00
Unexpected Contents (UC)	263	1.13	1.28	0	4.00
Conceptual Perspective (CPT)	263	2.82	1.64	0	7.00
K-ABC	263	2.75	2.48	0	10.00
FIST	263	0.07	0.16	-0.25	0.70
STROOP	263	6.59	5.45	0	16.00
Executive Functioning	263	0.0	1.68	-2.32	4.25
ERC	261	0.0	1.68	-5.96	3.46
Global Regulation (EReg)	263	0.0	1.57	-6.11	1.72
Global Reactivity (EReac)	263	0.0	1.58	-3.07	5.17

To control for possible confounding variables, the association between demographic variables including maternal education, maternal employment status, maternal marital status, child gender, child race, and child language ability, and the study variables was tested. Independent samples t-test and Pearson's correlations were used. These analyses indicated that there were differences in scores based on several demographic variables. Specifically, UC scores were higher for white (M = 1.31, SD = 1.40) compared to non-white (M =.86, SD = 1.03), $t(261) = -2.86$, $p = .005$. And CPT scores were higher for white (M = 3.03, SD = 1.79) than non-white (M = 2.54, SD = 1.35), $t(261) = -2.43$, $p = .02$. Maternal reported ERC scores were higher for girls (M = .32, SD = 1.34) compared to boys (M = -.34, SD = 1.93), $t(259) = 3.26$, $p = .001$. Also, EF composite scores were higher for girls (M = 10.17, SD = 6.77) compared to boys (M = 8.45, SD = 6.83), $t(259) = 2.05$, $p = .04$. Based on Pearson's correlation, maternal education, marital status, and children's language ability were significantly correlated with at least one of the study variables and therefore, these demographics were used as control variables for all subsequent analyses (Table 3).

Data Reduction

Given that there were several dependent and independent measures, preliminary analyses were conducted to reduce the number of variables to be used in subsequent analyses. As evident from Table 3, the Pearson's correlation among the three separate ER measures and the three separate ToM measures was low and could not be combined together. But there was high correlation among the three separate EF measures and therefore, the standardized scores from the KABC task and Stroop task were combined to represent a total EF score. Since FIST had low variability, it was not included in the summary score. Hence, 9 separate regression analyses were conducted to test whether EF mediates the relationship between ER and ToM.

TABLE 3. Zero Order Correlation Matrix for Study Variables and Demographics

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Unexpected Location	-													
2. Unexpected Contents	0.17**	-												
3. Conceptual Perspective Taking	0.05	0.08	-											
4. FIST	0.17**	0.12	0.20**	-										
5. STROOP	0.03	0.08	0.06	0.23**	-									
6. KABC	0.17**	0.06	-0.01	0.15*	0.41**	-								
7. Executive Function	0.12	0.08	0.03	0.23**	0.84**	0.84**	-							
8. Emotion Regulation (Observed)	0.08	-0.07	-0.06	0.02	0.05	0.11	0.09	-						
9. Emotion Reactivity (Observed)	-0.10	-0.01	0.06	0.10	0.04	-0.14*	-0.06	-0.67**	-					
10. ERC (maternal report)	-0.002	0.09	0.01	0.08	0.12*	0.04	0.10	0.03	-0.02	-				
11. Gender	-0.11	0.01	-0.03	-0.001	-0.12	-0.09	-0.12*	-0.07	0.05	-0.20**	-			
12. Maternal Education	0.14*	0.06	0.07	0.12	0.16**	0.18**	0.21**	0.07	-0.03	0.20**	-0.06	-		
13. Maternal Martial Status	-0.08	-0.10	-0.01	-0.04	-0.01	-0.04	-0.03	-0.07	0.08	-0.12*	-0.02	-0.34**	-	
14. Race	0.07	0.17**	0.14*	0.13*	0.12	0.01	0.07	-0.04	0.03	0.06	-0.03	0.17**	-0.37**	-
15. Language	0.15*	0.13*	0.10	0.27**	0.30**	0.38**	0.41**	0.05	-0.03	0.25**	-0.15*	0.29**	-0.22**	0.26**

$^{\dagger}p<.10$; $^{*}p < .05$; $^{**}p < .01$

Mediation Analyses

The first three analyses tested if EF mediates the relationship between observed emotion regulation and the three separate indicators of ToM; UC, UL, and CPT. As indicated by tables 4, 5, and 6, after controlling for demographic variables, observed emotion regulation did not significantly correlate with any of the three measures of ToM. This indicates that the first criterion for mediation is not met for observed emotion regulation. Furthermore, there is no significant relation between observed emotion regulation and EF (β = .07; $p > .05$). Therefore, the mediation hypothesis was not supported.

TABLE 4. Regression Analyses Testing for Executive Functioning as a mediator of the relation between Emotion Regulation (Observed Emotion Regulation) and Unexpected Contents (UC)

Predictor	*R*	R^2	*β*	*t*	*df*
1. Emotion Regulation as a predictor of UC					
Emotion Regulation	**.21**	**.04**	**-.07**	**-1.05**	**256**
2. Emotion Regulation as a predictor of EF					
Emotion Regulation	**.43**	**.19**	**.07**	**1.22**	**256**
3. Executive function as predictor of UC					
Executive Function	.20	.04	.04	.63	256
4. Executive function as a mediator					
Executive Function	.20	.04	.05	.71	255
Emotion Regulation	.21	.05	-.07	-1.10	

Note: *P <0.01; **P <0.001; Constant: Gender, Maternal Education, Maternal Marital Status, Race, and Language

TABLE 5. Regression Analyses Testing for Executive Functioning as a mediator of the relation between Emotion Regulation (Observed Emotion Regulation) and Unexpected Location (UL)

Predictor	*R*	R^2	*β*	*t*	*df*
1. Emotion Regulation as a predictor of UL					
Emotion Regulation	**.21**	**.05**	**.07**	**1.07**	**256**
2. Emotion Regulation as a predictor of EF					
Emotion Regulation	**.43**	**.19**	**.07**	**1.22**	**256**
3. Executive function as predictor of UL					
Executive Function	**.21**	**.04**	**.05**	**.78**	**256**
4. Executive function as a mediator					
Executive Function	**.21**	**.04**	**.05**	**.70**	**255**
Emotion Regulation	**.22**	**.05**	**.06**	**1.01**	

Note: **P* <0.01; ***P* <0.001; Constant: Gender, Maternal Education, Maternal Marital Status, Race, and Language

TABLE 6. Regression Analyses Testing for Executive Functioning as a mediator of the relation between Emotion Regulation (Observed Emotion Regulation) and Conceptual Perspective Taking (CPT)

Predictor	*R*	R^2	*β*	*t*	*df*
1. Emotion Regulation as a predictor of CPT					
Emotion Regulation	**.19**	**.03**	**-.05**	**-.82**	**256**
2. Emotion Regulation as a predictor of EF					
Emotion Regulation	**.43**	**.19**	**.07**	**1.22**	**256**
3. Executive function as predictor of CPT					
Executive Function.	**.18**	**.03**	**-.02**	**-.24**	**256**
4. Executive function as a mediator					
Executive Function	**.18**	**.03**	**-.01**	**-.18**	**255**
Emotion Regulation	**.19**	**.03**	**-.05**	**-.80**	

Note: **P* <0.01; ***P* <0.001; Constant: Gender, Maternal Education, Maternal Marital Status, Race, and Language

The next three analyses tested if EF mediates the relationship between observed emotion reactivity and the three separate indicators of ToM; UC, UL, and CPT. As indicated by tables 7, 8, and 9, after controlling for demographic variables, observed emotion reactivity did not significantly correlate with any of the three of measures of ToM. This indicates that the first criterion for mediation is not met for observed emotion reactivity. Second criterion is also violated because reactivity does not predict EF (β = -.05, *p*>.05). Given that no significant relationship was found among observed emotional reactivity and the three separate indicators of ToM, it is reasonable to conclude that EF does not mediate the relation between observed emotional reactivity and ToM in the current study.

TABLE 7. Regression Analyses Testing for Executive Functioning as a mediator of the relation between Emotion Regulation (Observed Emotion Reactivity) and Unexpected Contents (UC)

Predictor	*R*	R^2	*β*	*t*	*df*
1. Emotion Regulation as a predictor of UC					
Emotion Regulation	**.20**	**.04**	**-.01**	**-.12**	**256**
2. Emotion Regulation as a predictor of EF					
Emotion Regulation	**.44**	**.19**	**-.05**	**-.86**	**256**
3. Executive function as predictor of UC					
Executive Function	**.20**	**.04**	**.04**	**.63**	**256**
4. Executive function as a mediator					
Executive Function	**.20**	**.04**	**.04**	**.62**	**255**
Emotion Regulation	**.20**	**.04**	**-.01**	**-.09**	

Note: **P* <0.01; ***P* <0.001; Constant: Gender, Maternal Education, Maternal Marital Status, Race, and Language

TABLE 8. Regression Analyses Testing for Executive Functioning as a mediator of the relation between Emotion Regulation (Observed Emotion Reactivity) and Unexpected Location (UL)

Predictor	*R*	R^2	*β*	*t*	*df*
1. Emotion Regulation as a predictor of UL					
Emotion Regulation	**.22**	**.05**	**-.09**	**-1.47**	**256**
2. Emotion Regulation as a predictor of EF					
Emotion Regulation	**.44**	**.19**	**-.05**	**-.86**	**256**
3. Executive function as predictor of UL					
Executive Function	**.21**	**.04**	**.05**	**.78**	**256**
4. Executive function as a mediator					
Executive Function	**.21**	**.04**	**.05**	**.70**	**255**
Emotion Regulation	**.22**	**.05**	**-.09**	**-1.43**	

Note: **P* <0.01; ***P* <0.001; Constant: Gender, Maternal Education, Maternal Marital Status, Race, and Language

TABLE 9. Regression Analyses Testing for Executive Functioning as a mediator of the relation between Emotion Regulation (Observed Emotion Reactivity) and Conceptual Perspective Taking (CPT)

Predictor	*R*	R^2	*β*	*t*	*df*
1. Emotion Regulation as a predictor of CPT					
Emotion Regulation	**.12**	**.04**	**.06**	**.95**	**256**
2. Emotion Regulation as a predictor of EF					
Emotion Regulation	**.44**	**.19**	**-.05**	**-.86**	**256**
3. Executive function as predictor of CPT					
Executive Function	**.18**	**.03**	**-.02**	**-.24**	**256**
4. Executive function as a mediator					
Executive Function	**.18**	**.03**	**-.01**	**-.19**	**255**
Emotion Regulation	**.19**	**.04**	**.06**	**.94**	

Note: **P* <0.01; ***P* <0.001; Constant: Gender, Maternal Education, Maternal Marital Status, Race, and Language

The next three analyses tested if EF mediates the relationship between ERC (maternal report) and the three separate indicators of ToM; UC, UL, and CPT. As indicated by tables 10, 11, and 12, after controlling for demographic variables, ERC did not significantly correlate with any of the three measures of ToM. This indicates that the first criterion for mediation is not met for ERC. The second criterion stating the necessary relationship between ERC and EF is also violated due the lack of association ($\beta = -.02$, $p>.05$). Therefore, based on the findings, since no significant relationship was found among ERC and the three separate indicators of ToM, it is reasonable to conclude that EF does not mediate the relation between ERC and ToM in the current study.

TABLE 10. Regression Analyses Testing for Executive Functioning as a mediator of the relation between Emotion Regulation (Emotion Regulation Checklist) and Unexpected Contents (UC)

Predictor	*R*	R^2	*β*	*t*	*df*
1. Emotion Regulation as a predictor of UC					
Emotion Regulation	**.21**	**.04**	**.06**	**.96**	**254**
2. Emotion Regulation as a predictor of EF					
Emotion Regulation	**.43**	**.19**	**-.02**	**-.02**	**254**
3. Executive function as predictor of UC					
Executive Function	**.20**	**.04**	**.04**	**.63**	**256**
4. Executive function as a mediator					
Executive Function	**.20**	**.04**	**.04**	**.63**	**253**
Emotion Regulation	**.21**	**.05**	**.06**	**.97**	

Note: *P <0.01; **P <0.001; Constant: Gender, Maternal Education, Maternal Marital Status, Race, and Language

TABLE 11. Regression Analyses Testing for Executive Functioning as a mediator of the relation between Emotion Regulation (Emotion Regulation Checklist) and Unexpected Location (UL)

Predictor	*R*	R^2	*β*	*t*	*df*
1. Emotion Regulation as a predictor of UL					
Emotion Regulation	**.18**	**.03**	**-.07**	**-1.06**	**253**
2. Emotion Regulation as a predictor of EF					
Emotion Regulation	**.43**	**.19**	**-.02**	**-.02**	**254**
3. Executive function as predictor of UL					
Executive Function	**.21**	**.04**	**.05**	**.78**	**256**
4. Executive function as a mediator					
Executive Function	**.21**	**.04**	**.05**	**.69**	**253**
Emotion Regulation	**.22**	**.05**	**-.07**	**-1.14**	

Note: **P* <0.01; ***P* <0.001; Constant: Gender, Maternal Education, Maternal Marital Status, Race, and Language

TABLE 12. Regression Analyses Testing for Executive Functioning as a mediator of the relation between Emotion Regulation (Emotion Regulation Checklist) and Conceptual Perspective Taking (CPT)

Predictor	*R*	R^2	*β*	*t*	*df*
1. Emotion Regulation as a predictor of CPT					
Emotion Regulation	**.18**	**.03**	**-.02**	**-.27**	**254**
2. Emotion Regulation as a predictor of EF					
Emotion Regulation	**.43**	**.19**	**-.02**	**-.02**	**254**
3. Executive function as predictor of CPT					
Executive Function	**.18**	**.03**	**-.02**	**-.24**	**256**
4. Executive function as a mediator					
Executive Function	**.18**	**.04**	**.08**	**-.23**	**253**
Emotion Regulation	**.18**	**.03**	**-.02**	**-.27**	

Note: **P* <0.01; ***P* <0.001; Constant: Gender, Maternal Education, Maternal Marital Status, Race, and Language

Further analyses tested if children with any EF ability differed from those that did not have any EF abilities. Given that the EF scores were standardized, scores above a zero were re-coded to illustrate presence of EF ability while scores below a zero were re-coded to illustrate absence of EF ability. All steps of mediation analyses (Baron & Kenny, 1986) were performed. Results indicate that there was no relationship between any form of ER (regulation, reactivity, or ERC) and EF ability even among children that had presence of EF ability.

Additional analysis tested if separate measures of EF contributed to any significant findings. Results indicate that FIST is correlated with UL and CPT; KABC is correlated with UL and observed reactivity; and STROOP was correlated with ERC (maternal report). But no significant mediation relationship was found due to the lack of relationship between ER measures and ToM measures.

CHAPTER IV

DISCUSSION

The goal of the present study was to examine the social and cognitive factors within the child that may contribute to the development of social skills. As evidence has indicated, ToM competence is necessary for positive peer relation and successful school performance (Eisenberg, Hofer, & Vaughan, 2007). Therefore, identification of factors that support ToM competence may inform protective factors at earlier stages of development. Hence, this is an important area of investigation for basic researchers.

The current study used a community sample of children at pre-school age to identify emotion regulation and executive functioning as skills that support the acquisition of theory of mind abilities. The separate indicators of ToM ability were not correlated and therefore were not combined in the current study. Given that the children in this study were age 3.5, it was not surprising that the variability in responses were low for some tasks, which may have contributed to the low correlations among the three measures. Cognitive domains were identified through scores on executive function tasks. Specifically, we used the combined composite scores from two separate laboratory tasks intended to measure executive control to indicate EF ability. Social domains were identified through higher scores on emotion regulation tasks. Specifically, emotional reactivity and regulation were assessed through various laboratory tasks that were intended to illicit frustration and arousal. These scores were not combined into a composite score due to low correlation among tasks and were entered in the analyses separately. Furthermore, scores on ERC scales provided by mothers were also used as indicators of ER skills. It was expected that EF would mediate the relationship between ER and ToM. Specifically, it was predicted that children who score higher on ER measures will score higher on ToM tasks. It was also predicted that children who score higher on ER measures will score higher on EF tasks. Additionally, children who score higher on EF measures will have higher scores on ToM tasks. Lastly, it was hypothesized that EF ability would mediate the relation between ER ability and ToM performance.

The first aim of the study was to examine if ER ability supports the development of ToM. Results from the current study suggest that there is no significant association between separate components of ER and ToM. This may imply that children may not necessarily require the ability to regulate emotions independently in order to achieve ToM. Observational tasks assessed the ability to show the desirable social scripts (appear calm even in a frustrating situation) without any assistance from the caregiver while the ERC tapped in reactions of children in everyday social situations reported by the mothers where children may or may not have received guidance from caregivers. These findings could imply that since ToM has a social element, the ability to regulate emotions independently may not play a central role in the development of ToM. Instead, it may be the case that children's ability to regulate emotions in social interactions with others where they receive immediate feedback may play a more critical role in ToM. The findings are consistent with previous finding (Liebermann et al., 2007), suggesting that the relationship between ER skills and ToM is weak. However, it also may be possible that children at this age are still acquiring regulatory and coping skills and the ability to understand contradicting mental states, which may explain the weak association between ER and ToM skills in children as young as 3.5years old.

The second aim of the study was to investigate the relationship between ER and EF. The results did not support the prediction that EF scores would be higher for children that score higher on ER tasks; the association between EF and the separate measures of ER was not significant. These results are inconsistent with the previous findings that have found a positive relation between effortful control and ER (Kieras et al., 2005). In their study, Kieras (2005) and colleagues observed children's understanding of display rules upon receiving undesirable and desirable gifts. Given that their findings suggested a positive association between effortful control and regulatory skills, it may be the case that specific components of EF may be associated with ER. This may indicate that although ER skills may predict certain EF abilities (possibly inhibitory control), other aspects, such as working memory and attentional flexibility, may not necessarily predict the same outcome among children as young as age 3.5.

Additional analyses on the current data supported this claim: maternal reported ERC was significantly associated with STROOP and observed reactivity was significantly associated with KABC, but FIST was not significantly associated with either measures of ER. This finding supports the claim that children need regulatory skills in order to inhibit subdominant responses (a skill required on STROOP task). Additionally, children may need the ability to regulate emotions without effort such that the additional control required to achieve this goal may instead be applied to succeed on the cognitive task at hand such. But given that the current study assessed these skills at one time point; directional conclusions can not be drawn. It could be the case that children need inhibitory control or working memory to succeed on ER tasks. Future studies should longitudinally assess the relationship between ER and distinct components of EF in order to understand the developmental timing of the association.

The third aim of the study was to investigate the relationship between EF and ToM. Findings from the current study indicate no significant relationship between EF and separate measures of ToM. Children as young as age 3.5 years are still acquiring EF and ToM skills which may explain the low variability in responses on these tasks. But additional analyses indicate that FIST is significantly correlated with UL and CPT while KABC is significantly correlated with UL. Given that ToM has a cognitive element; children may require some aspects of EF abilities before they can successfully understand and reflect upon the mental state knowledge. Children must be able to shift between their own thoughts and processes and other peoples' mental states in order to act in a socially competent manner. Also, to understand others' thoughts, one must be aware of their own thoughts (which require working memory space). The findings may suggest that developments in EF abilities facilitate ToM advances. However, EF ability may not be the only predictor of ToM performance; instead there may be other cognitive abilities that may also contribute to the development of ToM. For instance, previous findings have indicated that children's language ability is positively correlated with ToM performance in children as young as 3.5 years (Astington & Jenkins, 1999). Furthermore, given that the present findings are based on assessment at one time point (3 ½ year-old), it is possible that ToM may support the development of EF: no causal inferences can be made from the current findings.

Finally, the hypothesis that EF would mediate the relationship between ER and ToM was not supported because the results indicated no significant relationship between ER measures and ToM measures. Emotion regulation as explained is a social construct. However, in the current investigation, the parents were specifically asked not to interact with their child while they perform the tasks that measure the regulation and reactivity skills. It is possible that children as young as 3 ½ year olds may be able to regulate their emotions with the help of their environment; mothers may have been the source of their regulation. However, since the children did not have the opportunity to interact with the social environment, the tasks used in this study may not have captured children's regulation ability as it relates to social skills. Also, given that this data was collected at a single point in time, it could be possible that ER mediates the relationship between EF and ToM; a future longitudinal study may be able to elucidate this relationship. Furthermore, it is also possible that ToM may support the development of either EF or ER, which could be better understood through longitudinal analyses. Findings do not indicate that ER independently contributes to ToM development; however, EF is significantly correlated with some ToM measure, which may indicate that EF independently supports the development of ToM ability.

ToM ability emerges around 3½ years of age and continues to mature through the preschool years. Given this developmental timing, ToM skill used as an outcome measure at 3½ years of age may have contributed to the non-significant findings. Instead, using ToM as an outcome measure at either 4½ or 5½ years of age may provide better understanding of the relationship between these skills. It is possible that at 3½ years of age, ER and EF skills may not matter for Tom, but by 5½ years of age, children may have superior ToM skills through maturation of self-regulatory skills.

There are important implications of the current findings. As indicated by the current findings, EF abilities relate to ToM skills. Therefore, it may be important for parents and care-givers to foster the development of EF abilities. EF abilities may become more sophisticated with practice. For example, parents could provide stimulating environments with ample opportunity for children to practice their skills in order to enhance their abilities such that it can facilitate socially competent outcomes.

The current study had several limitations. First, the questionnaire utilized in this study was a parental report of emotion regulation. This report may have been biased to include social desirability or extraneous characteristics that were not included in the analyses. This measure was not administered to multiple informants, which may have introduced some potential bias. Second, although multiple behavioral observations were included in the methodology, all observations were conducted in a laboratory setting. Children experience an opportunity to regulate emotions in everyday interactions with their environment. Tasks in laboratory settings may not have provided an opportunity for children to adequately execute this ability. Although it is true that laboratory setting adds consistency and uniformity across participants, given that such behaviors take place in every-day interactions, it is necessary to observe children in their natural settings in order to fully understand their ability to regulate their emotions. For instance, it may have been essential to observe children in their home setting or school setting. Third, the inter-rater reliability for the two behavioral observational tasks was very low; this may imply that the particular scale was not appropriate for measuring these variables. Instead, future investigations could use a different coding scheme to observe children's regulation and reactivity in a laboratory setting. Lastly, the contribution of cultural variation was also not included in the current investigation. Context provides many distinct opportunities for children to learn and interact with their social world. It is important to examine differences in development of ToM, EF, and ER across cultures.

It appears that both social and cognitive skills are necessary for facilitating ToM development. Although the current investigation does not support the necessity of social skills, it is important to investigate other social factors, such as emotional understanding, that may relate to the development of ToM abilities.

Future research should longitudinally assess these constructs such that the temporal precedence of the emergence of EF, ER, and ToM skills could be understood. Furthermore, future research should examine the children in several different naturally occurring environments and obtain information from multiple respondents as opposed to just mothers. Fathers, for example, could provide essential information which is otherwise not available from the mothers, especially when the children are from broken families where they spend only half of their time with the mothers. Also, it is important to consider cultural variation because context provides children with learning opportunities that are currently not well understood. And lastly, measures of emotion regulation that tap in the social aspect are essential to understand the impact on ToM skills.

This study extends the literature on preschooler's development of ToM skills in promising directions. For instance, although previous studies have separately investigated the contribution of cognitive skills and emotion regulation skills on the development of ToM, few studies have looked at the combined contribution of both, ER skills and EF skills on the development of ToM ability. Furthermore, this study is also among the first to examine EF abilites in multiple forms as they relate to ER and ToM. In conclusion the current examination indicates that although EF ability may be an important factor, the ability to regulate emotions, however, does not play a significant role in predicting performance on standard ToM tasks.

REFERENCES

Ahadi, S. A., & Rothbart, M. K., Temperament, development, and the Big Five. In: Kohnstamm GA, Halverson CF Jr, editors. *The developing structure of temperament and personality from infancy to adulthood.* Hillsdale, NJ: Erlbaum; 1994. pp. 189–207.

Anderson, V., Anderson, P., Northam, E., Jacobs, R., & Catroppa, C. (2001). Development of executive functions through late childhood and adolescence in an Australian sample. *Developmental Neuropsychology*, *20,* 385-406.

Astington, J. W., & Gopnik, A. (1991). Theoretical explanations of children's understanding of the mind. *British Journal of Developmental Psychology, 9*, 7-31

Baddeley, A. (1996). Exploring the central executive. *Quarterly Journal of Experimental Psychology:Human Experimental Psychology (Special Issue:Working Memory), 49(A)*, 5–28.

Baron-Cohen, S. (1995). *Mindblindedness*. Cambridge, MA: MIT

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173-1182.

Bartsch, K. & Wellman, H . (1995). *Children talk about the mind*. New York: Oxford University Press.

Blair, C., Zelazo, P., & Greenberg, M. (2005). The measurement of executive function in early childhood. *Developmental Neuropsychology*, *28*(2), 561-571.

Bretherton, I , McNew, S., & Beeghly-Smith, M (1981) Early person knowledge as expressed in gestural and verbal communication When do infants acquire a ‘theory of mind”‘ In M.E. Lamb & L.R. Sherrod (Eds), *Infant social cognition* Hillsdale, NJ Erlbaum.

Bowlby, J. (1969/1982). *Attachment and loss* (Vol. 1), 2nd ed. New York: Basic

Calkins, S., & Hill, A. (2007). Caregiver Influences on Emerging Emotion Regulation: Biological and Environmental Transition in Early Development. In J.J. Gross (Ed.), *Handbook of emotion regulation (pp229- 248).* New York: Guildford Press.

Calkins, S. D., & Howse, R. B. (2004). Individual differences in self-regulation: Implications for childhood adjustment. In P. Philippot & R. S. Feldman (Eds.), *The regulation of emotion* (pp. 307-332). Mahwah, NJ: Lawrence Erlbaum Associates.

Calkins, S. D (1994). Origins and outcomes of individual differences in emotion regulation. In N. A. Fox (Ed). Emotion regulation: Behavioral and biological considerations (pp. 53-72). *Monographs of the Society for Research in Child Development*, *59*(2-3, Serial No. 240)

Callaghan, T., Rochat, P., Lillard, A., Claux, M., Odden, H., Itakura, S., et al. (2005). Synchrony in the Onset of Mental-State Reasoning: Evidence From Five Cultures. *Psychological Science*, *16*(5), 378-384.

Cassidy, J. (1994). Emotion regulation: Influences of attachment relationships. *Monographs of the Society for Research in Child Development*, *59,* 228-249.

Carlson, S., & Wang, T. (2007). Inhibitory control and emotion regulation in preschoolers. *Cognitive Development, 22(4),* 489-510.

Carlson, S. M., Mandell, D. J., & Williams, L. (2004). Executive function and theory of mind: Stability and prediction from age 2 to 3. *Developmental Psychology, 40,* 1105-1122.

Carlson, S. M., & Moses, L. J. (2001) Individual differences in inhibitory control and children's theory of mind. *Child Development, 72,* 1032–1053.

Carlson, S., Moses, L., & Hix, H. (1998). The role of inhibitory processes in young children's difficulties with deception and false belief. *Child Development, 69,* 672-691

Cutting A., & Dunn, J., (1999) Theory of mind, emotion understanding, language, and family background: Individual differences and interrelations. *Child Development, 70,* 853-865.

Davidson, R., Fox, A., & Kalin, N. (2007). Neural Bases if Emotion Regulation in Non-human primates and Humans. In J.J. Gross (Ed.), *Handbook of emotion regulation (pp.47-68).* New York: Guildford Press.

Davis, H. & Pratt, C. (1995). The development of children's theory of mind: The working memory explanation. *Australian Journal of Psychology, 47,* 25-31.

Diamond, A, (2006). *Lifespan cognition: Mechanisms of change*. Bialystok, Ellen (Ed); Craik, Fergus I. M. (Ed); pp. 70-95.

Denham, S. (1986). Social Cognition, Prosocial Behavior, and Emotion in Preschoolers: Contextual Validation. *Child Development, 57,* 194 -201.

Denham, S., Zoller, D., & Couchoud, E. (1994). Socialization of preschooler's emotion understanding. *Developmental Psychology, 30*, 928-936.

Dunn, J. (1991). Understanding others: Evidence from naturalistic studies of children. In Whitten, Andrew (Ed), *Natural theories of mind: Evolution, development and simulation of everyday mindreading*, pp. 51-61. Cambridge, MA, US: Basil Blackwell.

Dunn, L., & Dunn, L. (1997). *The peabody picture vocabulary test (third ed.)*. Circle Pines MN: American Guidance Service.

Eisenberg, N., & Fabes, R. A. (Eds.). (1992). *Emotion and its regulation in early development. San Francisco*: Jossey-Bass/Pfeiffer.

Eisenberg, N., Hofer, C., & Vaughan, J. (2007). Effortful control and it's socioemotional consequences. In J.J. Gross (Ed.), *Handbook of emotion regulation (pp287-306).* New York: Guildford Press.

Flavell, J.H., & Miller, P.H. (1998). Social cognition (Pp. 851-898). In W. Damon, ed. *Handbook of Child Psychology*, Volume 2: Cognition, Perception and Language, 5th edition. New York: Wiley.

Flynn, E., O'Malley, C., & Wood, D. (2004). A longitudinal, microgenetic study of the emergence of false belief understanding and inhibition skills. *Developmental Science, 7,* 103–115.

Fox, N., & Calkins, S. (2003). The development of self-control of emotion: Intrinsic and Extrinsic Influences. *Motivation and Emotion, 27,* 7-26.

Frith, U., & Frith C. (2001). The Biological Basis of Social Interaction. *Psychological Science, 10(5)*, 151-155.

Frye, D., Zelazo, P, & Pilfai, T. (1995). Theory of mind and rule-based reasoning. *Cognitive Development, 10,* 468-483.

Gallagher, H., Happé, F., Brunswick, N., Fletcher, P., Frith, U., & Frith, C. (1999). Reading the mind in cartoons and stories: an fMRI study of 'theory of mind' in verbal and nonverbal task. *Neuropsychologia, 38,* 11-21.

Garon, N., Bryson, S., & Smith, I. (2008). Executive Function in Preschoolers: A Review Using an Integrative Framework. *Psychological Bulletin, 134(1),* 31-60.

Goldsmith, H. & Reilly, G. (1993). *Laboratory assessment of temperament.* Madison, WI: University of Wisconsin.

Grestadt, C., Hong, Y., & Diamond, A. (1994). The relationship between cognition and action: Performance of Children 3 ½ -7 years old on a Stroop-like day-night test. *Cognition, 53,* 129-153.

Gross, J., & Thopmson, R. (2007). Emotion Regulation: Conceptual Foundations. In J.J. Gross (Ed.), *Handbook of emotion regulation (pp.3-24).* New York: Guildford Press.

Gross, J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2,* 271–299.

Hala, S., Hug, S., & Henderson, A. (2003). Executive function and falsebelief understanding in preschool children: Two tasks are harder than one. *Journal of Cognition and Development, 4,* 275–298.

Hala, S. & Chandler, M. (1996). The role of strategic planning in accessing false-belief understanding. *Child Development, 67,* 2948-2966.

Happé, F., & Frith, U. (1996). Theory of Mind and social impairment in children with conduct disorder. *British Journal of Developmental Psychology, 14,* 385-398.

Hess, P. & Ciccheti, D. (1982). Toward and integrative theory of emotional development. *New directions for Child Development, 16,* 3-48.

Hoeksma, J. B., Oosterlaan, J., & Schipper, E. M. (2004). Emotion regulation and the dynamics of feelings: A conceptual and methodological framework. *Child Development, 75,* 354-360.

Hongwanishkul, D., Happaney, K. R., Lee, W. S., & Zelazo, P. D. (2005). Assessment of hot and cool executive function in young children: Age-related changes and individual differences. *Developmental Neuropsychology, 28,* 617-644.

Hughes, C. (1998). Finding our marbles: Does preschoolers' strategic behavior predict later understanding of mind? *Developmental Psychology, 34,* 1526–1539.

Hughes, C., & Ensor, R. (2007). Positive and protective: Effects of early theory of mind on problem behaviors in at-risk preschoolers. *Journal of Child Psychology and Psychiatry, 48(10),* 1025-1032.

Jacques, S., & Zelazo, P. (2001). The flexible item selection task (FIST): A measure of executive function in preschoolers. *Developmental Neuropsychology, 20(3),* 573-591.

Jahromi, L. (2006). Individual differences in inhibitory control: Relations across domains and predictions to theory of mind. *Dissertation Abstracts International: Section B: The Sciences and Engineering, 67,* 1730.

Jenkins, J. & Astington. J. (1996). Cognitive factors and family structure associated with theory of mind development in young children. *American Psychological Association, 32*, 70-78.

Karrass, J., Walden, T. A., Conture, E. G., Graham, C., Arnold, H. S., Hartfield, K. N., et al. (2006). Relation of emotional reactivity and regulation to childhood Stuttering. *Journal of Communication Disorder, 39(6)*, 402-423.

Kaufman, A. S., & Kaufman, N. L. (1983). *Kaufman Assessment Battery for Children (K-ABC).* Circle Pines, MN: American Guidance Service.

Kimberg, D. Y., D'Esposito, M., & Farrah, M. (1997). Cognitive functions in the prefrontal cortex—Working memory and executive control. *Current Directions in Psychological Science*, *6*, 185–192.

Kieras, J. E., Tobin, R. M., Braziano, W. G., & Rothbart, M. L. (2005). You can't always get what you want: Effortful control and children's responses to undesriable gifts. *Psychological Science, 16,* 391-396.

Kochanska, G., Murray, K. T., & Harlan, E. T. (2000). Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology*, 36, 220-232.

Kopp. C. B., & Neufeld, S. J. (2003) Emotional Development during Infancy. In R. Davindson, K. R. Scherer, & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 347-374). Oxford, UK: Oxford University Press.

Kopp, C. B. (1989). Regulation of distress and negative emotions: A developmental view. *Developmental Psychology, 25,* 343–354.

Landry, S. (2008). The Role of Parents in Early Childhood Learning. In: Tremblay RE, Barr RG, Peters RDeV, Boivin M, eds. *Encyclopedia of Early Childhood Development* [Online]. Montreal, Quebec: Center of Excellence for Early Childhood Development; 2008: 1-6. Available at: http://www.child-encyclopedia.com/documents/LandryANGxp.pdf. Accessed 9/15/2008.

Lalonde, C., & Chandler, M., 1995. False belief understanding goes to school: On the social-emotional consequences of coming early or late to a first theory of mind. *Cognition and Emotion, 9,* 167-185.

Leslie, A., & Polizzi, P. (1998). Inhibitory processing in the false-belief task: Two conjectures. *Developmental Science, 1,* 247–254.

Leslie, A. (1994). ToMM, ToBY and agency: Core architecture and domain specificity. In L.Hirschfeld & S.Gelman (Eds.), *Mapping the mind: Domain specificity in cognition and culture* (pp. 119–148). Cambridge, England: Cambridge University Press.

Liebermann, D., Giesbrecht, G., & Müller, U. (2007). Cognitive and emotional aspects of self-regulation in preschoolers. *Cognitive Development, 22,* 511-529.

Mager. E., Phillips, L., & Hosie, J. (2008). Self-regulation and risk-taking. *Personality and Individual Differences, 45*, 153-159.

Milner, B. (1964). Some effects of frontal lobectomy in man. In J. M. Warren & K. Akert (Eds.), *The frontal granular cortex and behaviour* (pp. 313-334). New York: McGraw-Hill.

Murtagh, A., & Todd. S. (2004). Self-regulation: A challenge to the strength model. *Journal of Articles in Support of Null Hypothesis, 3,* 19-51.

Monsell, S. (1996). Control of mental processes. In V. Bruce (Ed.), *Unsolved mysteries of the mind* (pp. 93–148). Hove: Erlbaum.

NICHD Early Child Care Research Network. (2005). Predicting individual differences in attention memory, and planning in first graders from experiences at home, child care, and school. *Developmental Psychology, 41,* 99-114.

Pennington., B. (1997). Dimension of executive functions in normal and abnormal development. In N. Krasnegor, G. Lyon & P. Goldman-Rakie (Eds.), *Development of prefrontal cortex: Evolution, neurobiology, and behavior* (pp. 265-282). Baltimore: Brooks Publishing.

Peterson, C. (2000). Influence of siblings' perspective on theory of mind. *Cognitive Development, 15,* 435-455.

Perner, J., Lang, B., & Kloo, D. (2002). Theory of mind and self-control: More than a common problem of inhibition. *Child Development, 73,* 752-767.

Perret, E. (1974). The left frontal lobe of man and the suppression of habitual responses in verbal categorical behaviour. N*europsychologia, 12*, 323-330.

Roberts, A. & Pennington, M. (1996). An interactive framework for examining prefrontal cognitive processes. *Developmental Neuropsychology, 12,* 105-126.

Rothbart, M., & Posner, M. (1985). Temperament and the Development of Self-Regulation. In L. Hartlage & C. F. Telzrow (Eds.), *The Neuropsychology of individual differences: A developmental perspective* (pp. 93-123). New York: Plenum.

Russell, J. (1997). How executive disorders can bring about an inadequate 'theory of mind.' In J. Russell (Ed.), *Autism as an executive disorder,* Oxford, UK: Oxford Univer. Press. Pp. 256-304.

Russell, J. (1996). *Agency: Its role in mental development*. Hove, UK: Erlbaum

Russell, J., Jarrold, C., & Potel, D. (1994). What makes strategic deception difficult for children--the deception or the strategy? *British Journal of Developmental Psychology, 12,* 301-314.

Ruffman, T., Slade, L., Devitt, K., & Crowe, E. (2006). What mothers say and what they do: The relation between parenting, theory of mind, language and conflict/cooperation. *British Journal of Developmental Psychology, 24,* 105-124.

Salisch, M. (2001). Children's Emotional Development: Challenges in their relationships to parents, peers, and friends. *International Journal of Behavioral Development, 25(*4), 310-319.

Shields, A. M., Cicchetti, D., & Ryan, R. M. (1994). The development of emotional and behavioral self-regulation and social competence among maltreated school-age children. *Development and Psychopathology, 6,* 57-75.

Shields, A. & Cicchetti, D. (1998). Reactive aggression among maltreated children; The contributions of attention and emotion dysregulation. *Journal of Child Clinical Psychology, 27*(4), 381-395.

Siegler, Robert (2006). *How Childred Develop, Exploring Child Develop Student Media Tool Kit & Scientific American Reader to Accompany How Children Develop*. New York: Worth Publishers.

Sroufe, L. A., (2000). Early relationships and the development of children. *Infant Mental Health Journal, 21,* 67-74.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology,18,* 643-661.

Stuss, D. T., Eskes, G. A., & Foster, J. K. (1994). Experimental neuropsychological studies of frontal lobe functions. In F . Boiler, & J. Grafman (Eds.), *Handbook of Neuropsychology* (Vol. 9, pp. 149-185). Amsterdam: Elsevier.

Taylor, M. (1988). Conceptual perspective taking: Children's ability to distinguish what they know from what they see. *Child Development, 59,* 703-718.

Thompson, R., & Meyer, S. (2007). Socialization of Emotion Regulation in the Family. In J.J. Gross (Ed.), *Handbook of emotion regulation (pp 249-268).* New York: Guildford Press.

Thompson, R. A. (1994) Emotion regulation: a theme in search of definition. *Monographs of the Society for Research in Child Development*, 59, 25-52.

Wellman, H. M. (1990). The child's theory of mind, MIT Press.

Wolf, C. D., & Bell, M. A. (2007). Sources of variability in working memory in early childhood: A consideration of age, temperament, language, and brain electrical activity. *Cognitive Development, 22,* 431-455.

Zahn-Waxler, Kochanska, G. (1990). Patterns of guild in children of depressed and well mothers. *American Psychological Association, 26,* 51-59.

Zelazo, P. D., & Müller, U. (2002). Executive function in typical and atypical development. In U. Goswami (Ed.), *Handbook of childhood cognitive development* (pp. 445-469), Oxford, England: Blackwell.

Zelazo, P. D., Carter, A., Reznick, J. S., & Frye, D. (1997). Early development of executive function: A problem-solving framework. *Review of General Psychology*, 1, 198–226.