SELF-REGULATION IN PRESCHOOL CHILDREN: HOT AND COOL EXECUTIVE CONTROL AS PREDICTORS OF LATER CLASSROOM LEARNING BEHAVIORS

by

Todd M. Wyatt

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Committee:

_____ Dissertation Director

_____

_____

_____ Department Chairperson

_____ Program Director

_____ Dean, College of Humanities and Social Sciences

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George Mason University

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By

Todd M. Wyatt
Bachelor of Arts
Lee University, 2002

Director: Susanne A. Denham, University Professor
Department of Psychology

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George Mason University
Fairfax, VA

Dedication

I dedicate my dissertation work to all of my friends and family. A special feeling of gratitude goes to my parents, Roma and Carol whose encouragement and patience raising a rabble-rouser like me have made who I am today. To my wonderful sister, Kimberly for never leaving my side growing up, you a very special to me.

I also dedicate this dissertation to my mentor and friend, Dr. Susanne Denham. Your dosages of equal parts support, encouragement, wisdom, and sternness have made this possible - I will never forget it. I will always appreciate you and everyone at the Child Development Lab for helping me develop as a scholar.

Ultimately, I dedicate this work with special thanks and admiration to my beautiful wife, Emily Beth. Your endless patience and support have enabled me to get through the darkest of days, and thrive on the brightest ones. When I married you, I never realized that I hadn't only married the smartest and most powerful woman I've ever met, but I also married my #1 cheerleader, thank you.

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List of Abbreviations

AP	Attention Persistence
ATL	Attitude Towards Learning
AVE	Average Variance Extracted
CM	Competence Motivation
Cool EC	Cool Executive Control
Hot EC	Hot Executive Control
LV	Latent Variable
MA	Maturity
OTI	On-task Involvement
PLBS	Preschool Learning Behavior Scale
PLS	Partial Least Squares
PO	Positive Orientation
PSRA	Preschool Self-Regulation Assessment
TRSSA	Teacher Rating Scale of School Adjustment

Abstract

SELF-REGULATION IN PRESCHOOL CHILDREN: HOT AND COOL EXECUTIVE CONTROL AS PREDICTORS OF LATER CLASSROOM LEARNING BEHAVIORS: A DISSERTATION

Todd M. Wyatt Ph.D.,

George Mason University, 2013

Dissertation Director: Dr. Susanne Denham

Over the last several years, researchers and practitioners have paid increasing attention to the areas of self-regulation, classroom involvement and classroom learning behaviors and how these domains relate to concurrent and subsequent social and academic success. Although there has been an emphasis on promoting learning behaviors that promote positive classroom outcomes, there remains a large proportion of students who develop negative attitudes and poor scholastic habits early on and suffer the negative social and academic consequences throughout their school career. The current investigation attempts to better understand the association between preschooler's self-regulation, and learning behaviors within the preschool and kindergarten classroom. The investigation will also take into account the mediating/moderating effects of the

child's on-task involvement, gender and socioeconomic differences on the relations between self-regulation and classroom learning behaviors.

Chapter 1: Introduction

Children's self-regulatory abilities are critical skills that have a significant influence on their subsequent academic and relational success (Calkins & Howes, 2004; Denham, 1998). As children begin school, they are increasingly expected to be able to regulate their attention and impulsive behavior, along with their emotions, while engaging in learning experiences with teachers and classmates (Blair & Razza, 2007; Raver, 2004). Acquiring these effective regulatory skills is essential in a preschool classroom because they play a crucial role in a child's classroom adjustment and learning (Blair, 2002; Raver 2002).

Children's self-regulation is a cognitive process that encompasses their inhibitory control, attentional flexibility and resistance to interfering stimuli. In general, the processes of self-regulation have been found to be foundational for children's classroom success (Birch & Ladd, 1997; Carlson, 2005; Izard, 2009), by playing a significant role in predicting concurrent and subsequent wellness (Birch & Ladd, 1997; Blair & Dennis, 2010; Cole, Michel & O'Donnell Teti, 1994). Those who are able to better manage their behavior, emotions and attention have also been found to be better equipped to successfully negotiate complex interpersonal exchanges (Izard, 2009; Saarni, 1990), demonstrate increased classroom involvement (Miller, Fine, Gouley, Seifer, Dickstein &

Shields, 2004) and exhibit more positive classroom learning behaviors, such as a child's attention/ persistence, attitude towards learning, and competence motivation (Schaefer & McDermott, 1999; Spinath & Spinath, 2005).

These associations between a child's developing self-regulatory abilities, on-task involvement and classroom learning behaviors are apparent throughout early childhood (Graziano, Reavis, Keane, & Calkins, 2007; Halberstadt et al., 2001; Miller, Gouley, Seifer, & Shields, 2004). For example, a child's regulatory capacity has been found to be an important component in children's achievement of classroom goals such as maintaining attention and sustaining positive peer interactions in preschool, kindergarten and into primary school (Adelman & Taylor, 1991; Graznio et al., 2007; Miller et al., 2004; Miller, Fine & Gouley, 2006). In addition, a child's ability to alternately shift and focus attention, inhibit impulsive responding in classroom situations is linked to their early academic achievement (Graziano et al., 2007; Valiente, Lermery-Chalfant, Swanson, & Reiser, 2008). This finding may be, at least partially, attributable to results suggesting that young children who struggle with certain aspects of self-regulation – those who are persistently disruptive or uninvolved – tend to receive less instruction from teachers, have fewer opportunities for learning from peers, are less positive, less engaged, and less motivated as active learners (Arnold et al., 2006).

These findings further bolster the view that self-regulatory abilities are critical, even in the face of the commonly held assumption that intelligence generally plays the primary role in children's early academic achievement (Arnold et al., 2006; Blair & Razza,

2007). In fact, these findings seem to suggest that interactive classroom experiences and adjustment to those experiences cannot be separated from children's individual self-regulation skills (Halberstadt et al., 2001; Saarni, 1990).

Self-regulatory abilities do not develop in a vacuum; instead, these abilities are impacted by a variety of environmental factors. A child's socio-economic status is one environmental factor that has been found to have a particularly significant impact on children's social, emotional and academic success. As a result, any investigation of children's self-regulation must be considered within the context of the environment they are in. Previous research has clearly shown us that children facing early adversity, and experience early psychosocial stress, such as living in low-income environments with poor care and support structures in place, are at increased risk for social and academic difficulty. Moreover, children living in impoverished environments have repeatedly been found to be at increased risk for developing a variety of social, emotional and behavioral difficulties, while at the same time having limited access to counseling and psychological services (Fantuzzo et al., 1999). Self-regulatory abilities may be particularly diminished for these children in comparison to their more fortunate peers, as a result of increased vulnerability to negative environmental effects. These diminished abilities put this child at increased risk for problems with adjustment to school, and putting them at increased risk for early school failure (Gilliam & De Mesquita, 2000; Raver, 2004; Raver et al., 2009; Welsh, Nix, Blair, Bierman, & Nelson, 2010). For example, Conger and colleagues (2002) suggest that early, low-quality

support and caregiving may serve as a source of stress for children and also inhibit the child from acquiring self-regulation abilities. However, in spite of these potential dire outcomes, recent investigations suggest that children in high stress, low-income environments may benefit from having early self-regulation skills, potentially mitigating the negative impact of their environment, over and above their more fortunate peers (Garner & Spears, 2000; Raver & Spagnola, 2003; Shultz, Izard, Ackerman, & Youngstrom, 2001; Smith-Donald, Raver, Hayes, & Richardson, 2007; Welsh et al., 2010). As a result of these findings, it is clear that a deeper discussion is necessary, in order to tease out the direct and indirect relations between self-regulation, and success in the classroom. In addition to the role that socioeconomic status plays in the development of self-regulation in children, previous research has found that there is significant variation across gender– particularly in regards to a child's attentional flexibility and inhibitory control (Carlson & Moses, 2011; Ponitz et al., 2008). A variety of investigations have uncovered that girls have the tendency to exhibit higher-quality self-regulation abilities early on (Carlson & Moses, 2001; Stifter & Spinrad, 2002). The next section aims to examine what the previous literature has established regarding the development of self-regulation, its impact on academic outcomes as well as the role that individual differences of socioeconomic status and gender have on these outcomes. This examination will be used to develop a comprehensive model of how each of these components interact during a child's development.

Chapter 2: Literature Review

The first goal of this section is to review the constructs of self-regulation, and then move towards a discussion regarding how these constructs relate with a child's classroom adjustment and learning. This discussion will show that self-regulation competencies emerge and grow in complexity throughout early childhood. In addition, acquiring these abilities is absolutely critical to successfully negotiating the classroom environment, namely interpersonal interaction – that is, the child's sustained positive engagement with peers, marked by positive, regulated behavior and emotions – increasing the likelihood of prosocial behavior, and decreasing externalizing behavior problems, as well as on-task classroom involvement, attention, and motivation (Denham, Blair, & DeMulder, 2003; Denham et al., 2000; Eisenberg et al., 1998; Miller et al., 2006; McDowell, Kim, O'Neil, & Parke, 2002; Weinfield, Ogawa, & Egeland, 2002; Rose-Krasnor, 1997). To understand these relations, however, we must operationalize each construct individually. First, it is necessary to clearly lay out the domain of self-regulation and discuss its relations with academic aspects of a child's development, namely classroom adjustment and learning behaviors. Finally, the review of past literature will consider all of these domains through the lens of the gender as well as across type of school in which the child is currently enrolled –Head Start or private child

care – which will be used as a proxy to compare children who are at socioeconomic risk versus their more economically fortunate peers. Throughout this literature review, the reader should remain aware that each of these components are intended to be part of an overall model where self-regulation predicts classroom learning behaviors while taking into account the moderating effects of gender and socioeconomic status (For the full model, see figure1).

Self-Regulation

The domain of self-regulation includes managing, modulating, inhibiting, and enhancing attention, behavior, and emotions. These components are fundamental processes that experience rapid growth in early childhood (Calkins & Howes, 2004) and significantly contribute to concurrent and subsequent social and academic success (Blair & Razza, 2007; Gottman, Katz, & Hooven, 1996; Raver & Zigler, 1997; Rimm-Kaufman et al., 2000). In fact, there is growing evidence that all aspects of children's self-regulation are uniquely related to their academic abilities, over and above their intelligence (Blair, 2002; Gottman et al., 1996; Konold & Pianta, 2005; Welsh et al., 2010).

Although much of the previous research on self-regulation has revolved around the regulation of emotions, the picture is far more complex than that; emotions regulate attention, thinking and behavior, but are also regulated by attention, thinking and behavior (Blair & Razza, 2007; Cole, Martin, & Dennis, 2004; Kochanska, Coy, & Murray, 2001; Miller et al., 2004). As a result, any measurement of behavioral regulation or attention should also take into account emotion and vice versa. There is still rich,

ongoing debate regarding the interplay of attention, behavior and emotions in self-regulation, with little consensus on the definition of the construct itself (Eisenberg et al., 1998; Raver et al., 2009). However, for the purposes of the current investigation, I will define self-regulation as the internally-directed capacity to regulate attention, affect and behavior with the goal of responding effectively to both environmental and internal cues and social demands (Blair & Razza, 2007; Calkins & Fox, 2002; Calkins & Howse, 2004; Raver et al., 2009). This definition stems from previous work on early emotion regulation (Eisenberg et al., 1998; McClelland, Morrison, & Holmes, 2000; Rimm-Kaufman, Pianta, & Cox, 2000; Tobin & Graziano, 2000), but also more generally applies to the construct of self-regulation (Baumeister, Leith, Muraven, & Bratslavsky, 1998).

Although there has been some common ground found regarding the impact of self-regulation on classroom and academic outcomes, there remains significant debate over how the facets of self-regulation are best conceptualized (Zelazo, Qu, & Kesek, 2010). Up to this point, much of the self-regulation literature has often emphasized three distinct facets of self-regulation: effortful control, executive control and compliance (Baumeister et al., 1998; Calkins & Marcovitch, 2010). However, recent concern has been expressed regarding the accuracy of these theoretical conceptions, because these conceptualizations neither sufficiently nor clearly address the discrete cognitive *and* affective functions of self-regulation.

To assist in this discussion, the disparate literatures for the study of regulation and executive control have begun to unite, acknowledging the interdependence between

these self-regulatory functions (Calkins & Marcovitch, 2010). As a result, some investigators have suggested that a child's regulatory ability may be more simply conceptualized as cognitive control, or "executive control" (Blair & Razza, 2007; Carlson, 2005; Hongwanishkul, Happaney, Lee, & Zelazo, 2005; Zelazo & Müller, 2002), while also giving attention to the role emotion plays in executive control. The current investigation will heed this suggestion, and attempt to take into account the role that both cognition and emotion play in the processes of self-regulation via differentiation of cognitive control into "cool" and "hot" executive control. When considering the existing research, it seems likely that both cool and hot executive control involve the same basic cognitive processes – namely, attention and inhibitory prepotent responses – and most situations necessitating self-regulation require a combination of hot and cool executive control. The distinction between the two is a matter of degree, where the nature of executive control varies from being mostly cognitive in nature, gradually including motivational and affective responses (Manes et al., 2002). Although hot and cool executive control are related, the unique aspects of each differentially predict emotional, behavioral, and temperamental characteristics in children, suggesting a distinction is useful (Hongwanishkul et al., 2005; Zelazo et al., 2010).

Cool executive control. Cool executive control includes the processes "required for the conscious control of thought and action" (Happaney, Zelazo, & Stuss, 2004, p. 1). Hence, the cool regulatory processes of executive control are thought to involve monitoring and inhibiting behavior, planning, and problem solving (Carlson, 2005;

Hongwanishkul et al., 2005; Welsh et al., 2010; Zelazo & Müller, 2002). More specifically, cool executive control is thought to be elicited when a child is engaged in solving abstract, de-contextualized problems (e.g. balance beam task; tower building task; taken from Blair, 2002; Brumfield & Roberts, 1998; Diamond & Taylor, 1996; Murray & Kochanska, 2002). However, the specific role each process plays in regulating behavior is still being debated (Bronson, 2000; Barkley, 1997; Campos & Barrett, 1985; Denham et al., 2001; Fabes et al., 2003; Posner & Rothbart, 2005). Some researchers emphasize the importance of working memory over attention, suggesting that it allows children to remember and follow directions and helps them plan solutions to a problem, making it a central facet of executive control (Kail, 2003). Other researchers have emphasized attentional processes as foundational for maintaining focus on activities or interactions, carrying out behaviors and problem solving allowing children to access working memory, and complete tasks (McClelland, Cameron, Connor, Farris, Jewkes, & Morrison, 2007; Rothbart & Posner, 2005). Finally, inhibitory control has also been suggested to be the primary facet of cool executive control, which is said to help children stop using prepotent incorrect solutions to solve a problem and carry out more functional adaptive responses (Diamond, Kirkham, & Amso, 2002; Dowsett & Livesey, 2000; Rennie, Bull, & Diamond, 2004).

Thus, cool executive control includes a wide array of organizing cognitive processes that help children's behavior and emotion to be regulated in response to many complex tasks considered essential for school readiness (Blair, 2002; Diamond, 2006; Rimm-

Kaufmann et al., 2000). In fact, research has found that cool executive control remains a critical aspect of readiness and classroom functioning well into primary school and beyond (Blair, 2002; Gathercole & Pickering, 2000; Fabes et al., 2003; Kurdek & Sinclair, 2000; Rimm-Kaufmann et al., 2000).

Hot executive control. Early research on executive control typically focused on only the cool, or wholly cognitive, processes of executive control (Zelazo et al., 2010), while neglecting the consideration that there are scenarios where executive control is not fully captured by cognitive processes in certain, more emotionally-charged experiences (Frye, Zelazo, & Palfai, 1995; Hongwanishkul et al., 2005; Walden & Smith, 1997; Zelazo et al., 2010). Recently, there has been growing focus on children's self-regulation in situations that are emotionally or motivationally significant, involving meaningful, relevant rewards and punishers (Hongwanishkul et al., 2005; Zelazo & Cunnigham, 2007; Zelazo et al., 2010), thus necessitating the consideration of a hot executive control distinction.

Hot executive control can be referred to as a continuation of cool executive control with the inclusion of motivational or emotional reaction to stimuli (Carlson, 2007; Hongwanishkul et al., 2007; Kochanska, Murray, & Harlan, 2000; Murray & Kochanska, 2002; Rothbart & Ahadi, 1994). Hot executive control takes on a more emotional flavor than cool executive control, and is thought to be elicited by problems that involve the delaying of gratification, voluntarily inhibiting or activating behavior, resisting negative or socially unpopular emotions or reappraising the motivational significance of a

stimulus (e.g. Snack Delay, Gift Wrap tasks; taken from Kochanska, Murray, & Harlan, 2000; Rothbart & Bates, 2006).

In addition, hot executive control processes have been linked to the successful development of early math and literacy skills independent of general intelligence and specific knowledge of a problem or its solutions (Blair & Razza, 2007; Fabes, Martin, Hanish, Anders, & Madden-Derdich, 2003; Raver & Zigler, 1997; Rimm-Kaufman et al., 2000). Further,investigations by Mischel, Shoda and colleagues have found that this predictive relation with verbal and intellectual ability persists over time, far into children's later academic career (see Rodriguez, Mischel & Shoda, 1989; Shoda, Mischel, & Peake, 1990). These findings have been confirmed by educators who suggest that the ability to regulate in the midst of emotionally arousing stimuli is a particularly important ability (Shonkoff & Phillips, 2000). In fact, difficulties with hot executive control – disruptive or externalizing problem behavior, for example – in the preschool years has a significant negative impact on a child's learning in elementary classrooms (Raver & Zigler, 1997; Rimm-Kaufman et al., 2000; Shonkoff & Phillips, 2000).

Integrating facets of self-regulation. It is clear that self-regulation is not a single, static domain but is comprised of controlling, directing, and planning attentional, emotional, and behavioral regulation; and this interrelated set of abilities has been found to contribute to competent functioning over the entire life span (Bronson, 2000; Posner & Rothbart, 2000). It has been determined that stress plays a crucial role in determining whether hot or cool system of executive control are more prominently

"activated". The current framework maintains that the cool executive control system is cognitive, deliberate, goal-sensitive system, which has been found to be negatively impacted by increases in emotionally intense or stressful environments (Friedman & Thayer, 1998). However, some investigations have suggested that hot executive control is a more emotional and less flexible system, which has been found to be associated with reduced self-control (Lovallo & Thomas, 2000; Metcalfe & Mischel, 1999). Within most scenarios however, hot and cool executive control work together to interpret information and experiences that contain both cognitive and emotional information. As a result, it's critical to understand how the constructs of hot and cool executive control come together (Blair, 2002; Murray & Kochanska, 2002; Raver, 2004).

As already stated above, cognition and emotion have long been studied as two distinct entities, but recent investigations from a variety of disciplines have confirmed that there is, in fact, no emotion without cognition, and no cognition without emotion (see Cole, Martin, & Dennis, 2004; Cunningham & Zelazo, 2007; Frye, Zelazo & Palfai, 1995; Kochanska, Coy, & Murray, 2001; Lovallo & Thomas, 2000; Miller et al., 2004; Zelazo et al., 2010). In particular, the neural functioning literature has contributed in making this case, by discovering that the cool executive control system can be linked to the hippocampus, which is involved with the intake of sensory input and memory formation. The hot executive control system can be linked to pathways stemming from the amygdala, which plays a significant role in emotional processing (Lovallo & Thomas, 2000; Zelazo et al., 2010). These two regions however, are not entirely distinct from

each other, instead, together the functioning of the hippocampus and the amygdala comprise a central nervous system component that is activated by sensory input (i.e., external stimuli) and internal/emotional information such as fear, anger or joy (Charmandari, Tsigos, & Chrousos, 2005; Metcalfe & Jacobs, 1998; Miller et al., 2004; Zelazo et al., 2010). A potential linkage of these systems might stem from the anterior cingulate cortex (ACC), which has been historically shown to function as the brain's error and correction device. More specifically, the ACC serves as a component of attention that works toward controlling cognitive and affective features of one's regulatory experience (Bush, Luu, & Posner, 2000).

Many of the findings from the neuroscience literature are easily translated into an applied developmental perspective. For example, although cool executive control is more likely to be elicited by relatively abstract, decontextualized problems, both hot and cool executive control are required for problems that involve the regulation of motivation (Zelazo & Cunningham, 2007). Consequently, we find that hot executive control primarily comes into play when a child really *cares* about the problems they are attempting to solve. Both hot (control processes centered on reward) and cool (higher-order processing of more abstract information) executive control play a significant role in a child's self-regulation in such situations.

Another group of theorists have attempted to better understand the foundations of self-regulation through the lens of a child's early classroom experience. Although the roots of self-regulation are still being debated, it is commonly understood that the

beginning of preschool or child care is a transition that significantly tests a young child's regulatory ability. From very early on, preschoolers' hot and cool executive control abilities are almost completely dedicated to ensuring success with their peers and the adults within their new environment (Thompson, 1994). Children have to learn very quickly that there is a high social cost of dysregulation with both teachers and peers. Almost every aspect of play with peers and interaction with teachers in the preschool setting necessitates self-regulation of some sort (e.g. initiating, maintaining, and negotiating play, and earning acceptance; Rimm-Kaufman, 2000; Raver et al., 1999; Raver & Zigler, 1997).

Further, it is understood that children enter school with differing levels of regulatory abilities (Lin, Lawrence, & Gorrell, 2003; Rubin et al., 2003). In fact, some have suggested that there is a substantial proportion of children who appear to not demonstrate these regulatory skills early-on; they are simply not able to interact with peers, follow directions, participate in group activities, sit still, or work independently without becoming agitated or distracted (McClelland, Morrison, & Holmes, 2000). Consequently, these children are put at far greater risk for concurrent and subsequent peer rejection, decreased levels of academic achievement, and psychopathology (Ladd, Birch, & Buhs, 1999; Sroufe, Schork, Motti, Lawroski, & LaFreniere, 1984). However, through a great deal of trial and error, and adult support, most children do obtain the skills necessary to regulate or amplify the emotions and behaviors that are necessary and helpful for successful functioning in the classroom, to calm those that are not

helpful, and to suppress those that are simply counter-productive or irrelevant to their current situation (Aspinwall, 1998; Blair & Razza, 2007; Denham, 2006; Gottman et al., 1997; Halberstadt et al., 2001; Howes & Smith, 1995; Izard et al., 2001; O'Neil, Welsh, Parke, Wang, & Strand, 1997; Pianta, 1997).

On-Task Involvement

Clearly identifying a student's on-task involvement and tying it to their academic success has long been understood as a substantial gap in our current educational system (Denham, Lydick, Mitchell-Copeland, & Sawyer, 1996). This gap persists although there is research pointing to the critical importance of children's on-task classroom involvement for early school and social success (Adelman & Taylor, 1991; Alexander & Entwisle, 1988; Shields et al., 2001). On-task involvement can be defined as the ability to engage in appropriate classroom tasks (Entwisle, 1995; Perry & Weinstein, 1998). Being involved with the daily classroom milieu has been found to be associated with a child's academic achievement, school absences and overall academic success (Ladd, Birch, & Buhs, 1999; Valiente et al., 2007). Fantuzzo, Sekino and Cohen (2004) have also shown that children who are more involved in classroom activities are significantly less likely to start fights, disturb others, display inattentive behavior, show lethargic behavior, and demonstrate greater independent involvement in activities. In addition, previous research by Bronson and colleagues (1995) found that prekindergarten children who spent more time uninvolved in the classroom had difficulty with rules and scored lower on a standardized achievement assessment. These children also had more risk indicators

such as family problems, lower parental education, and behavioral or emotional problems (Bronson et al., 1995). Although the risk indicators were not controlled for when examining the impact of children's learning-related skills on achievement, this study underscores the need to focus on the relation between on task involvement and early school success (Ladd et al., 1999).

On-task classroom involvement and self-regulation. Previous research has not only drawn relations between on-task classroom involvement and success in the classroom, but on-task classroom involvement has also been demonstrated to have significant associations with self- regulation. In particular, the more affectively charged, or hot, aspects of regulation have been demonstrated to have significant relations with on-task classroom involvement. For example, children need to resist working on an engaging activity because the class is collectively engaged in another activity. Research by Miller and colleagues (2006) found that that children's regulation of emotion in the classroom significantly and positively predicted teachers' views of their overall classroom cooperation and involvement. This possibility is further confirmed by Mathieson and Banerjee (2010), who showed that a child's self-regulation, particularly the facet of hot executive control, uniquely predicts teacher scores of a child interacting well with others and demonstrating on-task involvement. More specifically, they found that children with higher levels self-regulation were more likely to play in an interactive, on-task, and socially competent manner.

Classroom Learning Behaviors

In order to properly understand the impact that self-regulation has on a child's overall academic success, it is necessary to also understand the impact of self-regulation on a child's classroom learning behaviors, such as motivation and attitude towards learning, and their attitude/persistence toward classroom tasks. Some researchers and teachers suggest that these social and task-related classroom learning behaviors, paired with cognitive ability, are more predictive of later academic success, (defined by meeting academic benchmarks; e.g. grades assigned by classroom teachers and scores on standardized achievement tests), than measuring academic performance alone (Schaefer & McDermott, 1999; Spinath & Spinath, 2005). As a result, it is important to understand these classroom learning behaviors, over and above traditional conceptions of IQ and assessment-based cognitive ability to get a more complete picture of a child's success in the classroom. For the current investigation children's learning behaviors encompass a child's motivation to acquire competence, their attitude towards learning new information, as well as their attention/ persistence in acquiring new information (Matthew, Ponitz, & Morrison, 2009; McClelland & Morrison, 2003). To maintain and promote these learning behaviors, children need exposure to positive classroom circumstances.

Classroom learning behaviors and self-regulation. Some previous research has suggested a connection between self-regulation and classroom success (Bronson, Tivnan, & Seppanen, 1995; Hughes & Kwok, 2006; Wentzel, 1999; Wigfield, Eccles,

Schiefele, Roeser, & Davis-Kean, 2006). In fact, McClelland and Morrison (2003) suggested that early classroom cooperation, attention and motivation "sets the stage" for academic success by providing the foundation for learning (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002). In particular, the more affectively charged, or hot, components of regulation have been demonstrated to have significant relations with some classroom learning behaviors (Dweck, 1989; Gottfried, Fleming, & Gottfried, 1994; Mathieson & Banerjee, 2010). For example, when a child needs to resist working on an engaging activity because the class is collectively engaged in another activity, the need for the child to self-regulate, particularly in these more "hot" scenarios, is said to uniquely predict children's positive interactions with others and positive classroom learning behaviors. In fact, children with higher levels of hot executive control were more likely to play in an interactive, on-task, and socially competent manner (Mathieson & Banerjee, 2010). These findings are further confirmed by Miller and colleagues (2006), who found that that children's regulation of emotion in the classroom significantly and positively predict teachers' views of their overall classroom cooperation, attention and involvement.

The previously discussed construct of on-task involvement and classroom learning behaviors are not entirely distinct. Previous theorists have argued that on-task classroom involvement may in fact reflect internal motivation and learning-goal orientation that dictates one's behavior toward classroom tasks and demands (Dweck, 1989; Gottfried, Fleming, & Gottfried, 1994). Others have theorized that classroom

participation may partially mediate the relations between the facets of self-regulation, and classroom learning behaviors, where children who are not engaged are likely to have difficulty maintaining motivation and capitalizing on learning opportunities (Bronson, Tivnan, & Seppanen, 1995; Hughes & Kwok, 2006; Wentzel, 1999; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). McClelland and Morrison (2003) suggested that early classroom involvement "sets the stage" for academic success by providing the foundation for positive classroom learning behavior (Betts & Rotenberg, 2007; Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002).

Environmental impact on classroom learning. Some children demonstrate difficulty with maintaining attention, motivation and a positive attitude towards learning in a classroom environment. Much of this difficulty is due to the fact that some children simply attend low quality classrooms, in addition to facing adversity outside the classroom - at home and in their neighborhood. One investigation found that some teachers reported at least 50% of children entering kindergarten did not have the basic learning behaviors, as described here, that are needed to succeed in school (Rimm-Kaufman et al., 2000). These children who enter school with poor learning behaviors often develop a variety of problems, including peer rejection, behavior problems, and low levels of academic achievement (Alexander, Entwisle, & Dauber, 1993; McClelland, Morrison, & Holmes, 2000). If not addressed early on, these problems have been found to persist over time as well. Recently, a longitudinal investigation found that children who were rated as having poor learning-related skills in school entry remained

significantly behind their peers in math and reading all of the way into sixth grade, with the gap widening over time (McClelland et al., 2000).

In addition to classroom learning behaviors, we have discussed other facets of a child's development and their classroom experience that are thought to play an important role in their success, such as self-regulation, and on-task involvement. All of these variables are thought to be impacted by a child's environment. However, many of the previous investigations on self-regulation, on-task involvement and classroom learning behaviors has been relatively homogenous, where investigations refrain from including a child's gender or socioeconomic status in the investigation. Instead, previous investigations have often been conducted with a gender-neutral population of children from typical, economically normative, private child care populations, or from more economically disadvantaged Head Start populations, with little overlap. In the next section I discuss the importance of including both gender and socioeconomic risk into any current model of self-regulation and classroom learning behaviors.

Gender & Socioeconomic Risk

Gender. The physiological and gender-related socialization literature suggests that gender plays a significant role in the development of self-regulation. For example, enduring gender differences are found when considering self-regulation, with girls found to exhibit higher self-regulatory ability than boys during preschool and kindergarten (Stifter & Spinrad, 2002). Kochanska and colleagues (2000) suggested that these gender differences can be detected earlier than the preschool period; it was

found that at 22 and again 33 months of age, girls demonstrated more advanced cool executive control compared to boys. Ponitz and colleagues (2008) also found that preschool girls demonstrate increased higher self-regulation, especially in terms of their cool executive control. (see also Carlson & Moses, 2001).

Additionally, previous investigations are relatively clear that girls are at a greater advantage in terms of hot executive control tasks (Bassett, Denham, Wyatt, & Warren-Khot, in press; Keenan & Shaw, 1997; Li-Grining, 2007; McCabe & Brooks-Gunn, 2006). Because it appears that girls have been shown to be at a noted advantage in terms of hot and cool executive control, it is necessary to include gender in the current investigation in an effort to better identify and intervene with children with the greatest need.

Socioeconomic risk. The relations between self-regulation, on-task involvement and learning behaviors need to be considered within the context of the child's economic environment. Understanding these relations is not only theoretically but empirically important, because impoverished children have been found to begin school with significantly poorer academic skills than their more affluent peers (Alexander & Entwisle, 1988; Webster- Stratton & Hammond, 1998). For example, an investigation of third graders' academic performance, poverty actually accounted for largest amount of variance in third grade academic outcomes (Rauh, Parker, Garfinkel, Perry, & Andrews, 2003). This is also an important area of investigation due to the fact that there are high rates of within group variability in child outcomes among children from impoverished

environments, which may be further explained by mechanisms such as self-regulation (McLoyd, 1998; Miller et al., 2006; Raver, 2004). Although there is some consensus that these findings are a problem that needs to be addressed, researchers still know little about how self-regulation predicts school readiness and low achievement in these children (Howse, Lange, Farran, & Boyles, 2003).

For these low income children, whose home, neighborhood, and school environments may expose them to higher levels of stress (McLoyd, 1998; Raver, 2004); self-regulation skills may play a significant role in their social and classroom success. For example, self-regulatory ability has been found to be a key factor in distinguishing resilient from non-resilient children from low income families (Buckner, Mezzacappa, & Beardslee, 2003). Additionally, Kupersmidt, Bryant and Willoughby (2000), among others, have found that exposure to the risks associated with poverty are directly associated with increased risk for emotion dysregulation and diminished social skills. Blair and Razza (2007) also found a strong link that suggests tasks requiring inhibitory control of attention significantly predict preschool children's numeracy skills after controlling for IQ for children from low income families.

In addition to relations with self-regulation, previous research has found that poverty is predictive of a variety of cognitive, social and emotional outcomes that need to be considered. For example, poverty has shown to be predictive of lower cognitive assessment scores, higher rates of externalizing and internalizing problems, as well as increased incidence of physical aggression (Raver, 2004). Howse and colleagues (2003)

have also shown that, although preschool self- and-teacher-reported motivation levels were comparable for at-risk and not-at-risk children, at-risk children showed poorer self-regulatory abilities, as well as diminished academic achievement. This finding has been further bolstered by other investigations that have found that many of the necessary components of a child's preparedness to enter school (e.g. self-regulatory ability, social-emotional competence, the absence of behavior problems, teacher support) are significantly impacted by socio-economic status (Eisenberg et al., 2001; Kupersmidt, Bryant, & Willoughby, 2000; Ladd, Birch & Buhs, 1999; Pianta, & Walsh, 1998; Webster-Stratton, Reid, & Stoolmiller, 2008).

Many teachers cite children's "readiness to learn" and "teachability" as marked by enthusiasm, and ability to regulate emotions and behaviors (Buscemi et al., 1995; Rimm-Kaufman et al., 2000). It is important to point out that although there is a positive relation between poverty and negative emotional and academic outcomes, most socioeconomically at-risk children who receive adequate social support are found to develop effective regulatory and classroom functioning skills (Garner & Spears, 2000). Although the psychosocial stressors that are associated with poverty are pervasive, not all children and families are found to be affected in the same way (Blair, Granger, & Razza, 2005).

More specific to the current investigation, understanding the role self-regulation plays in on-task involvement and learning behaviors among economically at-risk and not-at-risk children is absolutely necessary. Although there is a strong body of evidence

to suggest that there is noted socioeconomic disparity in terms of the development of a child's self-regulation (McLoyd, 1998; Miller at al., 2006), very few investigations have attempted to lay out a comprehensive model of the variation of hot and cool executive control and its impact on classroom learning behaviors. Through the current investigation, I hope to provide further understanding of the differences between children who are economically at-risk versus those who are not in terms of their self-regulation, and demonstrated learning behaviors, while also discussing how these constructs relate with each other.

Differential susceptibility. When considering the degree to which children are impacted by socioeconomic risk, it is important to consider Belsky's differential susceptibility hypothesis (Belsky, 1997a, 1997b). This notion suggests that there is variation in how individuals are impacted by their environment or experiences – specifically stemming from their temperament, physiology, and behavioral characteristics. The concept of plasticity in this context has been referenced within the framework of the Diathesis-Stress model, where the more "plastic" a child is, the more susceptible they are to be impacted by environmental influences, good-or-bad (Belsky, 1997a; Bakermans-Kranenburg, & van IJzendoorn, 2007). Within this conceptual framework a child's genetic constitution and environment, both predict the magnitude of environmental impact. For example, imagine two children who are immersed in the same high-risk or impoverished environment. One child may demonstrate a high level of negative outcomes, such as stress, poor self-regulation, or social-emotional

incompetence, whereas the other child may demonstrate relative resilience in terms of the same outcomes. Throughout this investigation it is important to consider how constitution and environment interact, where socioeconomic risk may play a more interactive role with self-regulation for some children, and less for others.

Chapter 3: Statement of Problem

Over the last several years researchers and practitioners have demonstrated increasing attention to areas of self-regulation, on-task involvement, and classroom learning behaviors (Shonkoff & Phillips, 2000; McClelland et al., 2007). However, many of these areas of research and practice remain disjointed, failing to integrate with other areas of the field to make a cohesive model that clearly explains these relations, and synthesize these findings for broader application (Valiente et al., 2008). Although there is a developing picture in the literature regarding the connection between self-regulation and classroom learning behaviors in the early childhood classroom, there are still major gaps in our understanding. For example, there are an abundance of investigations of children's regulatory capacity and their social and academic outcomes. However, research pertaining to the associations between the various facets of self-regulation, on-task involvement and classroom learning behaviors remain rare in this population (for an exception see Blair & Razza, 2007). Even fewer studies have looked at these items as a cohesive model while also taking into account the mediating effects of the child's classroom involvement as well as the moderating effects of the child's gender and socioeconomic differences (for an exception see Weinberg, Tronick, Cohn, & Olson, 1999). As a result, a primary purpose of this investigation is to begin to fill this gap in the

literature on the aspects of self-regulation that are related to children's classroom learning behaviors, where self-regulation has a direct influence on children's developing classroom learning behaviors.

Although many young children readily display regulatory skills early on in their childhood, there are some who fail to demonstrate the self-regulation necessary to adequately demonstrate classroom learning behaviors. For example, it is clear that many children struggle to demonstrate a motivation to acquire competence, positive attitude towards learning new information, or attention/ persistence in acquiring new information (Buscemi et al., 1995; McClelland et al., 2007; Rimm-Kaufman et al., 2000). For example, Borkowski and Thorpe (1994) found that children who demonstrate difficulty with self-regulation will likely have difficulty with using appropriate classroom learning behaviors and being involved in the daily classroom milieu.

As previously mentioned, within the current study, I will attempt to integrate all of the above mentioned variables, to develop a clear model of how self-regulation predicts classroom learning behaviors (For the full model, see figure 1). In addition, the current investigation takes into account the effects of the child's on-task classroom involvement, which is an important facet of this investigation. This consideration stems from the fact that a child's involvement in classroom activities may actually play a significant mediating role between self-regulation, and classroom learning (Bronson, Tivnan, & Seppanen, 1995; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). Finally, based on the previous, yet still unclear, patterns of findings regarding the

potential gender and socioeconomic differences that play a role in a child's classroom experience (Howse et al., 2003; Schaefer et al., 2004; Weinberg et al., 1999). The moderating effects of gender and socioeconomic status will be taken into account. Although a child's gender will be classified directly, the determination of whether the child is attending private child care or Head Start will be used as a proxy for socioeconomic risk.

Given the consequences of having difficulties with children's self-regulation and classroom learning behavior –particularly with children living in poverty – paired with researchers' and policy makers' increasing attention to these consequences, this a particularly critical time to better understand and target children who are demonstrating difficulty with self-regulation and consequently at risk for academic failure (Raver et al., 2009). Understanding the specific functioning of this current model will provide researchers and those involved with early education an increased likelihood of readily identifying adjustment difficulties early on in preschool by being able to use self-regulatory difficulties early on as indicators of future academic difficulty (Webster-Stratton & Hammond, 1998). In addition, this model may provide researchers and practitioners with a better understanding of how each of these facets of classroom functioning are related with each other as opposed to only understanding each of them separately.

This clearer understanding of the predictors of effective classroom behaviors may assist researchers and practitioners in the development of more effective identification

and intervention programs for these students based upon a 'fuller' model of classroom functioning (Trentacosta et al., 2006; Valiente et al., 2008). For example, practitioners and teachers may use this information to be more aware that children's problems of classroom functioning may be in part due to difficulties with self-regulation or emotions. So, curriculum or programming that is focused on promoting classroom learning behaviors might be improved by integrating material on self-regulation to help promote these outcomes (Greenberg & Snell, 1997).

Empowering teachers and parents to quickly and accurately identify children who are struggling their self-regulatory ability is important because the high risk child now has the potential to transition to a more promising developmental trajectory by fostering enthusiasm for education and positive classroom learning behaviors (Ladd, Buhs, & Seid, 2000; McLoyd, 1998; Pianta, 1997).

Chapter 4: Research Questions

Research Question 1: Is there a direct relation between child self-regulation (hot and cool executive control) in preschool and their later classroom learning behaviors?

The characteristics that comprise self-regulation (hot and cool executive control) are thought to have an impact on a child's learning behaviors (Blair & Razza, 2007; Lange et al., 1999), but one concise model connecting regulation and learning behaviors has yet to be developed. Only limited work has examined the relation of hot and cool executive control to early learning behaviors and school success. This deficiency is particularly true for children at increased risk for early school failure such as those from low-income homes (Blair & Razza, 2007; Fabes, Martin, Hanish, Anders, & Madden-Derdich, 2003; Raver & Zigler, 1997; Rimm-Kaufman et al., 2000 Rodriguez, Mischel, & Shoda, 1989; Shoda, Mischel, & Peake, 1990). Accumulating evidence suggests, however, that children's self-regulation abilities enhance learning behaviors in preschool and kindergarten (e.g., Howes et al., 1999; Zimmerman, 1998). More specifically, learning behaviors such as a child's motivation for competence, attitude towards learning, along with their persistence and absence of distractibility have been

found to be moderately related to their early self-regulatory abilities (Arnold et al., 2006; Normandeau, & Guay, 1998; Rothbart & Jones, 1998). Based upon previous commentary and research, my first hypothesis is that there will be a direct positive correlation between each of the independent facets of self-regulation (hot and cool executive control) in preschool and the independent facets of kindergarten classroom learning behaviors (competence motivation, attitude towards learning, attention/persistence; see figure 2).

Research Question 2: Within this model, are the relations between self-regulation and positive learning behaviors fully/partially mediated by on-task involvement?

Children who are not involved and on-task in the classroom are going to have difficulty acquiring and utilizing the proper learning behaviors necessary for academic success (Hughes & Kwok, 2006). In addition, previous investigations have found that children's hot and cool executive control may predict learning beyond the more general effects of intrinsic motivation (e.g. Zimmerman, 1998). Cool executive control in particular, has been found to play a significant role in knowledge acquisition associated with on-task classroom involvement and classroom learning behaviors (Blair, 2002; Diamond, 2006; Gathercole & Pickering, 2000; Fabes et al., 2003; Kurdek & Sinclair, 2000; McLean & Hitch, 1999; Rimm-Kaufmann et al., 2000; Swanson, 1999). Furthermore, evidence also suggests that on-task classroom involvement is related to

children's demonstration of learning behaviors, as well as success with math and reading (Ladd, Birch, & Buhs, 1999; Valiente et al., 2007). As a result of these relations between regulation and classroom involvement and learning behaviors, it is important to investigate whether or not self-regulation is partially mediated by the child's on-task classroom involvement, where the child is engaged with their peers and involved with daily activities.

The previous work by Ann Shields and her colleagues (see Shields & Cicchetti, 1997, 1998; Shields et al., 2001; Shields, Ryan & Cicchetti, 2001) suggests that early self-regulatory abilities predict concurrent and subsequent classroom adjustment. Further, Coolahan, Fantuzzo, Mendez, and McDermott (2000) found that children who demonstrated low levels of classroom adjustment problems, namely negative involvement in the classroom and with peers, also exhibited increased levels of classroom learning behaviors (attention/persistence and attitude toward learning). Valiente and colleagues (2008) have advanced this notion, by pointing out that the present body of research suggests that students' classroom involvement is associated with their academic success and their on-task involvement might actually mediate the connection between facets of emotional competence and learning. As a result, I hypothesize that on-task involvement will play a partial mediating role through which self-regulation impacts later classroom learning behaviors (see figure 5).

Research Questions 3: Within this model are the relations between self-regulation and classroom learning behavior moderated by gender?

As already discussed, self-regulation is a proximal factor that predicts classroom learning behaviors (Blair, 2002). Despite strong evidence associating self-regulation with a variety of academic outcomes, few investigations have sufficiently incorporated gender as a central focus. However, some have stressed the importance of considering gender and socioeconomic factors, among others, as moderators of the pathways between children's self-regulation and classroom learning behaviors (Eisenberg et al., 1998; Izard et al., 2008a; Izard et al., 2008b).

There is little research that helps in explaining these relations within the moderating context of gender. However, previous research is available on the *main* effects of gender in relation to the constructs being dealt with in the current investigation. There is also some evidence that there are gender differences in terms of children's classroom learning behaviors. For example, investigation by Birch and Ladd (1997, 1998), as well as Valeski and Stipek (2001), have found that girls display greater competence motivation, positive attitude towards learning and persistence than do boys during kindergarten (Birch & Ladd, 1997, 1998; Valeski & Stipek, 2001). Further, enduring gender differences are found when considering self-regulation, with girls found to exhibit higher self-regulatory ability than boys during preschool and kindergarten (Stifter & Spinrad, 2002). In addition, an investigation conducted by

Kochanska and colleagues (2000) suggests that these gender differences start even earlier than the preschool period; it was found that at 22 and again 33 months of age, girls demonstrated more advanced cool executive control over compared to boys. Regarding the aforementioned gender differences in classroom learning behaviors, most investigations have only established mean gender differences within the variables of interest. However these previous investigations shed light on the possibility of gender impacting the strength of the relationship between executive control and classroom learning behaviors as opposed to only establishing a simple difference between the two groups.

Consequently, in the current investigation I will explore the potentially moderating effects of gender on the relation between preschool self-regulation and classroom learning behaviors in kindergarten. It is expected that I will find significant gender differences across the relations between self-regulation and classroom learning behaviors. I expect to find that girls will not only exceed boys on hot and cool executive control, but also that the relation between their self-regulation and learning behaviors will be stronger than that for boys (although the relation for boys may be significant).

Research Question 4: Within this model, are the relations between self-regulation and classroom learning behaviors moderated by school type?

The already difficult task of successfully negotiating the transition into preschool or child care becomes even more difficult in the context of economic hardship. As already discussed, children from economically disadvantaged homes often begin school with significantly poorer regulatory skills, diminished on task involvement and inadequate classroom learning behaviors than do their more affluent peers; consequently they are at a much greater risk for difficulties academically and socially (e.g., Alexander & Entwisle, 1988; Bronson, 2000; Howse et al., 2003).

Regarding self-regulation and its relations with classroom behavior, previous investigations have found socioeconomic variation, indicating that self-regulation skills may act as a significant protective factor, particularly for children at higher socioeconomic risk (Raver & Spagnola, 2003; Smith-Donald, Raver, Hayes, & Richardson, 2007). In fact, some research has suggested that individual differences in low-income children's self-regulatory prowess (despite its overall mean difference with more advantaged children) may function as a protective factor, predicting decreased levels of distress, and higher social and academic functioning (Garner & Spears, 2000; Shultz, Izard, Ackerman, & Youngstrom, 2001).

In terms of classroom learning behaviors, the previous literature suggests that early achievement difficulties may stem from motivational factors (Alexander & Entwisle, 1988; Stipek & Ryan, 1997), and that these motivational factors appear to vary between children who are living in poverty and those who are not (Cicchetti & Sroufe, 2000; Duncan, Brooks- Gunn, & Klebanov, 1994; Fantuzzo, 2002). Additionally, children living

in poverty are more likely than their more fortunate peers to demonstrate early classroom adjustment problems, such as difficulty with on-task involvement (Duncan et al., 1994; Entwistle, Alexander, & Olson, 2007; Fantuzzo, 2002) and diminished classroom learning behaviors (Fantuzzo, 2004; Shonkoff & Phillips, 2000).

In regards to on-task involvement, few studies have investigated how self-regulation relates to a child's ability to remain on-task while taking into account economic status (Miller et al., 2006). However, already-cited findings suggest that economic status does play a significant role in self-regulation, and classroom learning behaviors but further investigation is necessary to better understand how economic status plays a role in moderating the pathways between these variables. As a result, a central goal of the current investigation is to understand children's self-regulation and its relations with classroom learning behaviors in the context of a child's poverty status. It is hypothesized that hot and cool executive control will play a more impactful role for children who are at increased socioeconomic risk – as indicated by a larger direct impact on on-task involvement and classroom learning behaviors.

Chapter 5: Method

Participants (Population and Sampling Procedures)

Data for the present investigation stems from a larger study focused on establishing valid and reliable assessment tools for the social and emotional aspects of school readiness. Assessments were made at three time points, Time 1 was during the early part of the preschool year in the fall of 2006, Time 2 was during the spring of 2007, and the last data collection time point occurred during the early part of the kindergarten school year, in the fall of 2007. Children in the study had a mean age of 49.11 months at the start of data collection and 50.2% are female. All children were recruited from private child care centers in greater northern Virginia, or from Head Start classrooms also in the greater northern Virginia area (N_{total} = 318, $N_{Head\ Start}$ = 143). Of the initial time 1 population, 108 of the participants remained through the kindergarten assessment ($N_{Head\ Start}$ = 60; See table 1).

It is important to reiterate that in the current investigation, Head Start will be used as a proxy for children who are at socioeconomic risk. Historically, many researchers have attempted to understand the differences between at-risk and not-at-risk children in terms of their development within a preschool classroom context by measuring children within the Head Start population (e.g. Howse et al., 2003; Izard et al., 2008a;

Miller et al., 2004). I am confident that this is a reliable assumption due to the fact that Head Start uses consistent federal poverty guidelines for enrollment, where the vast majority of children enrolled are either from households in which family income is below the poverty line as defined by federal poverty thresholds or are eligible for Head Start because in the absence of child care, family income would be below the poverty line (Raver, et al, 2009; Van Horn & Ramey, 2003).

Measures

The measures in this investigation will capture child attitudes and behaviors through a variety of data collection methods across the three time points (see figure 1). Assessments and questionnaire completion and observer data collection were conducted in the either the classroom, or on school grounds during normal school hours. Teacher questionnaires of child behavior were distributed to preschool and kindergarten head teachers to complete at their convenience. A modest incentive of twenty dollars per completed child questionnaire was offered to the teachers to increase the probability of questionnaire completion.

Preschool Self-regulation Assessment (PSRA). A frequent concern cited in the developmental literature is the need for increased accuracy in the description and measurement of self-regulation (Blair, 2002). In an attempt to address this issue, the current investigation will utilize the Preschool Self-Regulation Assessment (PSRA; Smith-Donald, Raver, & Richardson, 2007) at the first time point (time 1), which is a measure specifically designed to assess self-regulation in behavior, emotion and attention. The

assessment consists of a structured battery of age appropriate tasks and paired with a more global assessor report of children's behavior to be completed by the assessor subsequent to the battery (Smith-Donald et al., 2007). This assessment stems from laboratory findings that suggest that when children are expected to exert self-control they are able to actively utilize adaptive behavioral strategies such as self-distraction and soothing to alleviate the desire de-regulate and attend to a desirable stimulus (Blair, 2002; Murray & Kochanska. 2002). The assessment consists of seven tasks to tap two components of children's self-regulation, Cool and Hot executive control (see Appendix 1; Denham, Warren, Bassett, Wyatt, & Perna, 2010; Basset et al., in press; Smith-Donald et al., 2007). For purposes of this investigation, cool executive control includes the balance beam, pencil tap and tower turn-taking, all of which originate from a previous investigation by Murray and Kochanska (2002). The tasks included to asses hot executive control are the toy wrap (peek & wait), snack delay and tongue task (Denham et al., 2010). The PSRA was administered by 12 trained and certified research assistants who live coded performance on each of the seven tasks.

As the PSRA begins, the trained adult assessor suggests to the child the following: "let's stretch, take a little break, and play some extra games" before returning to class. To assess cool executive control, the child is first asked to complete three rounds of pretending to walk on the "balance beam" (which is simply masking tape placed on the floor; The child is asked to walk the beam once and then asked to walk the beam, but slowly (Murray & Kochanska, 2002). In the balance beam task, the child is assessed by

the difference between the slow and regular trials. Once that task is completed the child is then asked to return to the table to complete several other "games", which include a "tapping" game with unsharpened pencils, where the child is given instructions to tap their pencil once when the assessor tapped twice, and tap twice when the assessor tapped once (Blair, 2002). This task is measured by the percent of correct of responses, and inhibitory control. Once the pencil task is completed the child is handed a variety of multi-colored wooden blocks and asked to take turns with the assessor to build a tower, measuring the level of turn-sharing. Next, the child is asked to pick up all of the blocks and put them in a bag (Murray & Kochanska, 2002).

To assess hot executive control at time 1, the preschool child is asked to perform a variety of tasks that involve non-affective, rote control of behavior. First, the child remains seated and asked not to peek while the assessor noisily wraps a toy in tissue paper for 2 minutes, and this "gift wrap" task is simply assessed by a measure of the child's latency to their first peek. The wrapped gift is then placed in front of them and they are asked to wait for a period of 1 minute before opening the gift, which is measured by the child's latency to touching the surprise (Murray & Kochanska, 2002). Continuing the assessment, the child is next asked to play several "waiting" games with treat of Skittles® (or Goldfish® crackers, if the child is allergic to the candy, and/or not allowed by parents to have the candy for other health or religious reasons). The child is asked to hold the treat on their tongue to see how well children can handle their emotions and behaviors during the brief delays (10, 20, 30 and 60 seconds of delay;

Denham et al., 2010). In addition to there being a wide range of variability in children's performance for most tasks, internal consistency between assessors has been found to be moderately high to high on all tasks (inter-rater correlations ranging from $\alpha = .57$ to .97, with an average $\alpha = .87$; Denham et al., 2010).

In sum, the PSRA is put in place to measure a child's assessed self-regulatory abilities, defined within the subtypes of hot and cool executive control, in order to understand how their cognitively and affectively oriented regulation skills impact our outcome variable of classroom learning behaviors.

Teacher Rating Scale of School Adjustment (TRSSA). One of the most frequently used measures of teacher-reported classroom adjustment is the TRSSA (Ladd, Birch, & Buhs, 1999; Ladd, Kochenderfer, & Coleman, 1997; Valeski & Stipek, 2001). The original form of the TRSSA included a 52-item measure that contained five subscales: School Liking, School Avoidance, Co-operative Participation, Self-Directiveness, and Independent Participation.

The original conceptualization of this measure has elicited two main concerns. First, the psychometric properties of the measure are unknown. For example, the results of a factor analysis have not been reported (Betts & Rotenberg, 2007; Birch & Ladd, 1997; Kochenderfer & Ladd, 1996). Second, Betts and Rotenberg (2007) point out that the original five scales of the TRSSA do not adequately conceptualize the basic domains of children's adjustment and instead would be better described by three basic domains: (a) social competence or maturity in the classroom (e.g. The child notices

when other kids are absent, seeks challenges, is a mature child, enjoys "playing school"; imitates the teacher, interested in teacher as a person; Miller et al., 2002); (b) on-task classroom involvement (e.g. The child follows teacher's directions, uses classroom materials responsibly, listens carefully to teacher's instructions and directions, is interested in classroom activities, responds promptly to teachers requests, if child's activity is interrupted, he/she goes back to the activity); and (c) positive orientation to school activities (e.g. The child is cheerful at school, approaches new activities with enthusiasm, laughs or smiles easily, is comfortable approaching the teacher, is slow to warm up to the teacher; Betts & Rotenberg, 2007; Ladd et al., 2000; Valeski & Stipek, 2001; See Appendix 2).

The revised factor structure for the three TRSSA subscales was as follows: On-Task Classroom Involvement (OTI; $\alpha = .88$), Maturity (MA; $\alpha = .80$), and Positive Orientation (PO; $\alpha = .80$; Betts & Rotenberg, 2007). For the current investigation, I will utilize these data to capture preschool children's OTI at time 2. I was able to replicate the high reliability for OTI ($\alpha = .87$) using the data from the current investigation. The primary purpose for focusing on this one factor stems from the fact that OTI is regarded by many psychologists as the most relevant to school success; children who are engaged in classroom-appropriate tasks have been found to demonstrate increased academic performance (Alexander & Entwistle, 1988).

The Preschool Learning Behavior Scale (PLBS). The previous literature has clearly established that learning behaviors are observable, teachable and malleable

(McDermott & Beitman, 1984; Schaefer & McDermott, 1999). Learning behaviors have been found to contribute beyond an academic achievement (McDermott & Beitman, 1984); they have also been found to be significantly tied to a decreased risk of serious academic difficulties and inter and intrapersonal problems (Schaefer & McDermott, 1999).

The PLBS is a 29-item teacher-report rating instrument that was developed in order to better understand preschool children's approaches to learning in a classroom environment (McDermott, Leigh, & Perry, 2002; see Appendix 3). The PLBS was developed with two nationwide samples (a normative sample of 100 and a cross-validation sample of 170), as well as a local Head Start sample of 55 children for purposes of assessing interrater reliability. In addition, high internal consistency estimates from a national standardization sample were also found for the three learning behavior dimensions (α = .87, .88, and .78, respectively). Test-retest stability across three weeks was also high (McDermott, et al, 2002). Multi-method, multi-source validity analyses further substantiated the PLBS dimensions for preschool children, and reliability estimates were similar for both Caucasian and non-Caucasian portions of the sample (Fantuzzo, Perry & McDermott, 2004). Convergent and divergent validity for the scale has been established by correlating the PLBS dimensions with factors of the Differential Abilities Scales (Elliott, 1990), Social Skills Rating System (Gresham & Elliott, 1990), and Penn Interactive Peer Play Scale (Fantuzzo & Hampton, 2000).

The measure yields three reliable learning behavior dimensions: Competence Motivation (e.g. The child shows a lively interest in the activities), Attention/ Persistence (e.g. The child sticks to an activity for as long as can be expected for a child of this age), and Attitude Towards Learning (e.g. The child doesn't achieve anything constructive when in a sulky mood) were found to be adequately reliable (α = .79 to .89) with high overall internal consistency (α = .92; Bassett et al., 2012). It's critical to point out that the 'Attention/ Persistence' factor may bear some resemblance to the 'On-task involvement' factor (see TRSSA factor above; Ladd, Birch, & Buhs, 1999). As a result, it's important to distinguish the two. The 'Attention/Persistence' factor attempts to understand a child's level of restlessness, concentration and distractibility, whereas the 'On-task involvement' factor attempts to capture more of the child's sense of responsibility, and ability to follow teacher instructions. Hence, for the current investigation, all three sub-scales (Competence motivation, Attention/persistence, & Attitudes towards learning) will be used individually to measure child learning behaviors in kindergarten.

Analysis

Within the current investigation, Partial Least Squares (PLS; Espozito Vinzi, Chin, Henseler, & Wang, 2010; Ringle, Wende, & Will, 2005) analysis are performed to evaluate relations in the model, as well as the possible moderating interactions in the model that involve gender and school type (enrollment in a private child care or Head Start classroom), and also the mediating influence of classroom involvement. For a

visual representation of the overall model used in this study (*see figure 1*). To determine whether the various facets of self-regulation, on-task involvement, and moderating effects of gender and school have a predictive influence on classroom learning behaviors in kindergarten a series of PLS models will be developed.

PLS allows one to estimate constructs or Latent Variables (LVs) based on the shared variance of the manifest variables; individual variable residuals and unreliability associated with measurement error are minimized. That is, scores for the composite LVs are computed from principal components weights, derived from analyses of the manifest variables. Thus, a smaller set of theoretical variables is created, whose relations can be investigated without sacrificing information from the larger group of manifest variables. PLS is a method for modeling relations between sets of observed variables by means of latent variables, where a measurement (outer) model and a structural (inner) model is specified. Outer models demonstrate psychometric reliability of our latent variables. Whereas the inner models allow for estimation of predictivity utilizing both the inner and outer models, which allow us to test for discriminant validity when LVs are compared to the square root Average Variance Extracted (AVE), which represent the variance extracted by the LV from its indicator items (Esposito Vinzi, et al., 2010).

It is favorable to use PLS in the current investigation because it allows for the creation of multiple linear regression path models without imposing the restrictions employed by other analyses, such as structural equation modeling, discriminant

analysis, and principal components regression. In fact, PLS is probably the least restrictive of the various multivariate extensions of multiple linear regression, and its flexibility allows it to be used in situations where the use of traditional multivariate methods is severely limited, such as when the data is assumed to be non-normal, where there is a smaller than desirable sample size, or there are fewer observations than predictor variables. SmartPLS software will be used to run the PLS analysis (Ringle, Wende, & Will, 2005).

Measurement Models.

For Hypothesis 1 (H1), self-regulation is measured by hot and cool executive control. The tasks that function as the observed indicators for hot executive control include: Toy peek task, Snack delay task, Tongue snack task and Toy wrap task. The tasks that function as the observed indicator for cool executive control include: Balance beam task, Pencil tap task, Tower building task. Teacher report of classroom learning behaviors, with the sub-constructs of competence motivation, attitude towards learning and attention/ persistence will be used as our criterion variable. The analysis of H2 is an effort to understand whether the relation from model H1 is partially mediated by on-task involvement. Considering the moderating effects of the model, H3 and H4 suggest that the relations between self-regulation and positive learning behaviors moderated by gender and school type.

Chapter 6: Results

Overall model

Early in this investigation, paths were estimated from previously stable factors around self-regulation, on-task involvement, and classroom learning behaviors. Some of these LVs and manifest variables are no longer included in the model. The elimination of these variables stemmed from the recommendation of Esposito Vinzi and colleagues (2010), where it was stated that an acceptable LV is one that has an AVE of .50 or above, composite reliabilities of .60 or above, and factor loadings of .60 or above (note: some authors suggest a more conservative factor loading standard of .70 or above, however in the current investigation the standard will be set at $\geq$ .60 in order to not eliminate theoretically important measurement items.) Using these criteria, the quality of the outer model was examined and some manifest variables as well as LVs were removed, which resulted in the current structural model (see Figure 1).

Outer model. It is critical that the outer model fit certain key criteria. Primarily, 1) the manifest variables need to sufficiently load into the LV and be internally consistent, and 2) the manifest variables need to represent enough average variance within the construct to demonstrate compelling levels of explained variance (Esposito

Vinzi, et al., 2010). Without satisfying these outer model criteria, determining the path relations within the inner model becomes far more difficult and less theoretically defensible. Within the current full model, sufficient AVE, reliability and factor loadings are demonstrated across all key areas of the investigation. As mentioned previously, all of the LVs in the model stem from factors that have been established in the research literature. However, a few of the original manifest variables did not meet one or more of the reliability and factor loading criteria, and were consequently removed from the model. For hot executive control, what was previously referred to as the 'tongue task' was removed from the model. In regards to cool executive control the 'balance beam task' was removed from the model. Other items that were removed pertained to the factors of classroom learning behaviors. The majority of item rejection occurred within the competence motivation factors, where the items eliminated were: "seems to take refuge in helplessness", "bursts into tears when faced with difficulty", "is very hesitant in talking about his/her activity", and "shows a lively interest in activities". In regards to the factor of attitude towards learning, the items "shows desire to please you", "is unwilling to accept help even when an activity proves too difficult", and "is willing to be helped", all struggled with loading reliably. Finally, for the attention/ persistence factor we found that all items loaded well enough to be included into the outer model.

Although the above mentioned variables have previously demonstrated stability with other sample populations, they served as a detriment to the reliability and validity

of the model in this investigation. The decision to remove the aforementioned variables, led to increased reliability and factors loadings with the remaining manifest variables. The results of the outer model examination of the LVs hot and cool executive control, on-task involvement, competence motivation, attitude towards learning, and attention/ persistence can be found in table 2.

Inner model. Examining both the Average Variance Extracted (AVE) and the correlations among LVs are the first steps in understanding the inner model. These results help determine discriminant and convergent validity. Discriminant validity indicates the extent to which an LV is significantly different from other LVs, which is determined by the AVE. According for Fornell and Larcker (1981), a score of .50 for the AVE demonstrates an acceptable level. The current model meets this criterion (see table 2). Additionally, the comparison of square root of AVE (see diagonal values in table 3) compared with the correlations among the reflective constructs should indicate the all constructs are more strongly correlated with their own measures than with any other construct (Esposito Vinzi, et al., 2010) which suggests both discriminant and convergent validity.

The LV correlations found in table 3 also serve as initial indicators of the hypothetical relations between LVs. The results in table 3 suggest that hot executive control only demonstrates a significant relation to cool executive control and a child's on-task involvement, and not directly related to any of the classroom learning

behaviors. However, cool executive control was found to be related to on-task involvement as well as the competence motivation factor. On-task involvement appears to have moderate, significant relation with all of the classroom learning behaviors, competence motivation, attitude towards learning, and attention/persistence.

Path model. The final PLS path model (see figure 2) depicts the structured model with the path coefficients, which are simply standardized beta regression coefficients. Figures 3a, 3b, 4a, and 4b represent the same model while also considering the moderating effects of gender and school type. Across all of these models, significance levels are determined by running a bootstrapping resampling algorithm (Esposito Vinzi, et al., 2010). In order to cover each component of the models, each of the aforementioned hypotheses will not be reviewed.

Hypothesis Testing

Hypothesis 1. The first hypothesis proposed that there will be a direct positive relation between each of the independent facets of self-regulation (hot and cool executive control) in preschool and the independent facets of kindergarten classroom learning behaviors (competence motivation, attitude towards learning, attention/persistence). The significant direct effects (indicated by the dark bolded lines) are very similar to the associations found in the correlation table (table 3) where hot executive control is only related to on-task involvement, and not any of the classroom learning behaviors. Cool executive control was, however, found to have a direct relation

with hot executive control, and a child's competence motivation .As a result, it can be concluded that with the overall sample population there is only a minimal direct relation between self-regulation and classroom learning behaviors.

Hypothesis 2. The next hypothesis suggested that on-task involvement may play a partial mediating role through which self-regulation impacts later classroom learning behaviors. On-task involvement was found to significantly predict all three components of classroom learning behaviors - competence motivation, attitude towards learning, and attention/ persistence. According to the overall model this hypothesis can be confirmed for hot executive control, but not for cool executive control.

Hypothesis 3. Third, it was hypothesized that there will be significant gender differences across the overall path model. The model was first run with the data filtered to only include the males in the investigation (see figure 3a). Very similar to the overall model, we found that hot executive control only predicted on-task involvement directly. However, for male students the relation between on-task involvement and classroom behavior was quite strong. Male's on-task involvement significantly predicted competence motivation, attitude towards learning, and attention/persistence.

Next, it was necessary to re-run the analysis with only the female population. The results indicated that there is significant difference between males and females in terms of the relations between self-regulation and classroom learning behaviors (see figure 3b). For males, on-task involvement fully mediated the relationship between self-regulation and classroom learning behaviors. However for females, that mediating role

diminished, where on-task involvement only minimally predicted attitude towards learning, and attention/ persistence.

Alternatively, the direct effects of self-regulation on classroom learning behaviors appear to be playing a significant role for females. Hot executive control was found to significantly predict female's attitudes towards learning, as well as on-task involvement. Cool executive control significantly predicted all three components of classroom learning behaviors, competence motivation, attitude towards learning, and attention/persistence.

In order to confirm that the significance of variation between males and females in this model, the pooled estimator for variance t-test was calculated for each pathway (see table 4). It was determined that of the variations listed above, the key significant relations were between cool executive control and competence motivation, attitude towards learning, and attention/persistence. This information suggests that females' cool executive control, unlike their male counterparts', appears to have a direct predictive influence on their classroom learning behaviors.

Additionally, we find that the mediating influence of on-task involvement is also moderated by gender. There were significant gender difference in the relations between on-task involvement and competence motivation and attitude towards learning, and attention/persistence. This set of findings reveals that on-task involvement appears to be playing a more significant role in male's classroom learning behaviors than for females.

Hypothesis 4. Finally, another moderating model was hypothesized where there would be significant differences across the entire model, comparing children enrolled in private day care versus those enrolled in head start. The model was first run with the data filtered to include children enrolled in private day care (see figure 4a). Interestingly, many of the significant pathways found in the overall model fall out when filtered by private day care children. The only significant pathways found were cool executive control to competence motivation, and only moderately significant relations with attitude towards learning, and attention/persistence. Also, hot executive control was found to significantly predict on-task involvement; and on-task involvement significantly predicted attention/persistence. These findings do not necessarily suggest that self-regulation is unimportant for children in private day care, but only that the relation between self-regulation, on-task involvement, and classroom learning behaviors pale in significance when compared to their less economically fortunate peers.

The next cohort to examine is the group of students enrolled in Head Start. The results appear to be vastly different from the private day care cohort, with many significant relations not previously detected. Both cool and hot executive control were found to significantly predict on-task involvement. Cool executive control was also found to have a direct predictive relation with competence motivation. Similar to the overall, un-moderated model, on-task involvement had a significant relation with all competence motivation, attitude towards learning, and attention/ persistence. In reference to the aforementioned literature on socioeconomic risk, it should be noted

that although self-regulation is important for *all* children's social, emotional and academic success, it may be more critical for children who are struggling with poverty over and above their peers who are not.

In order to accurately conclude that these moderating differences are indeed significant, the pooled estimator for variance t-test was once again conducted on each pathway (see Table 5). First, the relation between cool executive control and on-task involvement was moderated by school type, where the pathway was significant only for children in a Head Start program. Additionally, children in Head Start were found to demonstrate a stronger connection between on-task involvement and competence motivation, attitude towards learning and attention/persistence. There was also a significant moderating effect for the relation between hot executive control and competence motivation, however this seems to be an anomaly, for neither path for private day care or Head Start cohorts were significant (the path for the Head Start group was only marginally significant).

Chapter 7: Discussion

The present investigation focused on building a structured model that demonstrates the linkage between self-regulation and classroom learning behaviors. This investigations was an attempt to shed light on how a child's early capacity to regulate their behavior plays a role in how successful they are with classroom learning behaviors later on, and how a child's on-task involvement early on might help predict those relations. Another key goal of the investigation was to understand if there are any important distinctions across gender and school type that should be considered in future investigations.

Model Structure

Outer Model. Before the results of the PLS model are discussed the stability of the outer model must be addressed. We found that the constructs of hot and cool executive control, on-task involvement, competence motivation, attitude towards learning, and attention persistence demonstrated sufficient reliability and discriminant validity. As mentioned above, in the very early stages of this investigation a number of manifest variables within the included LVs, did not perform well, and were eliminated

from the current model. Although there was a theoretical justification for their inclusion, a key assumption of PLS modeling is that, in addition to the path structure of the inner model, the outer model must demonstrate stability in order to move forward with the investigation.

Hypothesis 1. In regards to the inner model, the analysis revealed some novel and compelling results. As opposed to there being clear, direct relations between hot and cool executive control with classroom learning behaviors, it was found that the only direct effect was between cool executive control and the learning behavior competence motivation. Hot executive control only had a significant direct path to on-task involvement. All other relations stemmed from the mediating role of on-task involvement. These findings are somewhat confirmatory in regards to the previous research literature which suggests that hot executive control may have a stronger relation to on-task involvement over and above cool executive control (Mathieson & Banerjee, 2010; Miller et al., 2006). The current investigation suggests that children with increased levels self-regulation when the situation is emotionally charged appear to be more likely to be involved in the classroom and on-task.

Hypothesis 2. As it was discussed in the literature review, on-task involvement and classroom learning behaviors are not entirely distinct. However, previous research has found some distinction, where children who are not engaged/ involved are likely to then have difficulty with motivation and negative attitudes towards learning (Bronson et al., 1995; Wentzel, 1999; Wigfield et al., 2003). It was found in the current investigation

that a child's on-task involvement indeed plays a strong predictive role on classroom learning behaviors. Children who demonstrate the ability to stay on-task and be involved in the classroom milieu are significantly more likely to be motivated, with a positive attitude towards learning and ability to persist with difficult tasks.

Hypotheses 3 & 4. Many of the more compelling findings were revealed during the moderational analyses of gender and school type. Based on the previous research, girls exceed boys on hot and cool executive control, to add-on to this finding it was hypothesized that the relation between girls' self-regulation and learning behaviors will be stronger than that for boys. Interestingly, the analysis revealed that female's cool executive control directly predicted each facet of classroom learning behaviors, whereas that was not the case for their male counterparts. Instead, for males, it appears that the relation between self-regulation and classroom learning behaviors is indirect, fully mediated by on-task involvement.

Females' hot executive control was also mediated by on-task involvement, just not to the degree that males experienced. It was also determined that females' hot executive control directly predicted their attitude towards learning. Overall it appears that the relation between self-regulation and classroom learning behaviors is much more direct and significant for females. This finding confirms our hypothesis, and suggests that both rote and emotionally complex forms of self-regulation appear to be playing a more important role for a female's classroom success.

In addition to the moderation of gender, observing the data through the lens of school type revealed some interesting findings. It was hypothesized that self-regulation may actually play a more impactful role for children who are at increased socioeconomic risk (Head Start children, for example). More specifically, it was tested whether or not self-regulation has a larger impact on the classroom learning behaviors of children at increased socioeconomic risk (e.g. Garner & Spears, 2000; Raver & Spagnola, 2003; Shultz et al., 2001). First, cool executive control was found to have a direct impact on the competence motivation for both private day care and Head Start children. However, for private day care children, cool executive control significantly predicted attention/ persistence as well. Hot executive control was indirectly related to classroom learning behaviors for private day care children. Second, it was found that for Head Start children, there was a strong mediating relationship between self-regulation and classroom learning behaviors via on-task involvement. In fact, the mediating influence of on-task involvement predicting classroom learning behaviors was one of the most statistically significant findings of the investigation. This result may suggest that the previous research showing a link between self-regulation and classroom success for children at socioeconomic risk may not actually be a direct relation, but instead is mediated by a child's ability to remain on-task in the classroom.

Chapter 8: Study Limitations

Although through this investigation there is now a clearer understanding of the self-regulation construct in the context of academic and school readiness outcomes, there remains a clear need for further investigation which attempts to take an even longer longitudinal perspective, with a larger, more diverse sample on self-regulation and its influence on academic success. Although this investigation has many advantages stemming from its multi-method, multi-source approach, there are a few potential limitations that remain.

It must be stated the a proportion of the relation between on-task involvement and classroom learning behaviors may not be the result of the construct having a theoretical tie, but from the fact that the child's teacher completed both measures, and thus risks single-rater bias. For future investigations, taking a multi-source and multi-method approach wit of on-task involvement and classroom learning behaviors would be optimal.

As noted in the methodology, there was a significant decrease in child participation between the initial measurement in preschool and the population's matriculation into kindergarten. The vast majority of the drop off can be attributed to either the child not moving onto kindergarten by the time researchers we collecting time 3 data, or the

child no longer being affiliated with the schools in the measurement pool. In order to confirm that the strength of the current findings are not impacted by attrition of a confounding population, future investigations should attempt to source data from a more stable sample population or be inclined to track children outside of the schools in the measurement pool.

Finally, another potential limitation pertains to the sampling. Although the sample size of this investigation certainly meets the minimum established requirements for structural analysis, it would have been ideal if the sample were larger and more diverse. Regarding diversity, any analysis with the current data using race/ethnicity as a demographic variable is confounded by school type, due to the fact that the majority of Caucasian children are in the private day school, and all other races/ethnicities are better represented in the Head Start classroom. As a result, future work will need to expand the analysis to include investigation across race/ethnicity to fully understand how the model functions for more ethnically diverse samples.

Chapter 9: Implications and Conclusions

Our primary purpose in this study was to begin to help move the field forward in regards to understanding the relation between self-regulation and children's school success. Students who perform poorly often develop negative attitudes and poor scholastic behaviors early on in their school careers; thus, a better understanding of the regulatory and social factors that are related to academic achievement early on may inform intervention programs for these students.

Much of the previous research reviewed in the current investigation suggests that, in general, most children eventually show satisfactory competence in classroom learning behaviors. However, competence does not occur automatically or by accident, and many fundamental biological and environmental factors need to fall into place for the child to be emotionally and socially successful. Interactions with parents and peers, as well as a child's intrapersonal behavior, have the potential to act as protective factors against emotional and social difficulties. Children who do not have the aforementioned protective factors in place are fundamentally at risk for future academic, emotional and social adversity. In an effort to help piece together what components of a child's early life most significantly predict their classroom success, the current investigation

produced a model linking self-regulation and classroom learning behaviors through on-task involvement and varying across gender and socioeconomic status.

This investigation used multiple methods to examine the individual differences in children's self-regulation as predictors of classroom learning behaviors. The model attempted to provide confirmation that the children who are at the most risk are ones who are behaviorally and emotionally unregulated, and unable to maintain classroom involvement with their peers and overall classroom tasks. These at-risk children may consequently be individuals who have difficulty establishing adequate learning behaviors that have been shown to be predictive of academic and social success (Blair, 2002; Denham, 2001; Kurdek & Sinclair, 2000; Raver & Zigler, 1997; Rimm-Kaufman et al., 2000; Shonkoff & Phillips, 2000). In addition, it was essential to investigate the interaction between regulation and classroom learning behaviors within the context of socioeconomic status, and gender as these factors appear to play an integral role in the development of school readiness skills (McDermott, 1984; McDermott & Beitman, 1984; Stipek & Ryan, 1997).

For future investigations, the current model may benefit from the consideration of a child's level of committed compliance (Kochanska, 2002), which takes into account a child's eagerness and willingness to comply with teacher control. Previous research does suggest that a child's level of committed compliance significantly predicts internalization of control, moral development and classroom social success (Kochanska, 2002). As a result it's necessary to understand how committed compliance may be

actually function as another or more powerful mediator over and above on-task involvement when understanding the relation of self-regulation and classroom success.

The results presented suggest that both hot and cool executive control and on-task involvement have a significant impact on children's classroom learning behaviors- and theoretically their academic success. This suggests that these items are fundamental competencies that ought to be integrated into teacher training, classroom curriculum, and specialized intervention programming for very young children. These competencies are fundamental because they are directly related to school readiness (e.g. classroom learning behaviors) and it was also demonstrated that these linkages vary across the important demographic factors of gender and socioeconomic status.

There are a few key additional moderators that are important to consider for future investigations, namely a child's race by socioeconomic status interaction, as well as a child's race by gender interaction. It has been documented significant racial differences are present very early on in terms of a child's self-regulation and classroom adjustment. As a result, in an investigation with a less racially biased sample in each sample population (e.g. majority of Head Start sample were children of color) it will be important to understand how race significantly accounts for the variance is detected in the current model. On that note, previous research has also found that there may be a race by gender interaction that may be accounting for some of the variance detected here. Minority boys have been found over and above their female minority peers to

demonstrate difficulty with self-regulation and on-task involvement. In the future, it will be necessary to pursue this avenue to strengthen the model.

With these findings researchers, practitioners and instructors can now seek to understand the level of a child's hot executive control and cool executive control and on-task involvement and integrate that knowledge into their work with the goal of better supporting children's early behavioral and academic development. For example, these findings could be integrated into competency-based intervention and prevention programming around self-regulation and on-task involvement. Currently, there is very little programming specifically dedicated to self-regulation in preschool, and the early evaluation results from the existing self-regulation programming, such as Tools of the Mind (Bodrova & Leong, 2007) system, has not shown stellar results. This program has not shown any significant effects on self-regulation, teacher ratings of classroom behaviors, or academic performance; nor was it found to be consistently more or less effective with certain demographic subgroups (Farran, Lipsey & Wilson, 2011).

One reason for these negative, albeit preliminary, results may be a result of the fact that this program does not look at self-regulation through the lens of hot and cool executive control. Adapting a program to one that took these two components into account might allow teachers and practitioners to separate and identify problem areas more quickly (e.g. a child that is having more trouble with emotionally driven aspects of self-regulation) and consequently address potential problems before they arise. This programming adjustment might be particularly beneficial for a few specific demographic

subgroups, namely boys and children from impoverished households. Up to this point, the reasoning behind the dearth of effective programming around self-regulation might be a result of the perception that the central components of a child's regulatory abilities are simply explain the manner in which children behave within their social environment. This perspective fails to consider that the current investigation clearly indicates that self-regulation is absolutely predictive of classroom learning behavior – which theoretically has a predictive influence on academic success itself. As a result, it is necessary to reformulate our understanding of the role of self-regulation, and note that it does not function in a social vacuum, but it serves as a tool for an individual to effectively act upon their social, emotional and academic environment (Denham, 2001; Izard, 1984; Sroufe et al., 1984).

We are currently living in a time where increased academic standards are constantly being promoted and high-stakes testing has become the norm. It is not unheard of for teachers to feel forced to sacrifice arts, music, crafts, social-emotional curriculum along with other interactive components of the preschool and kindergarten classroom, only to rely solely on language and STEM (Science, Technology, Engineering and Mathemtaics) skills. Consequently, we seem to be fostering a culture of "drill and practice" with little room for education and programming that teaches self-regulation, as well as the fostering of staying on-task and involved and teaching adequate classroom learning skills. However, the current investigation, the many others before it and those to come, stand to not only clarify the relations between self-regulation and

academic success, but to demand that social, emotional and behavioral education in the early classroom is an absolute priority for the well-being of our children and their success academically

Table 1

Summary of child characteristics at preschool and kindergarten

	Overall	Private	Head Start
Average Age at Preschool (in months)	49.1	48.1	50.2
% Gender			
Male	49.8%	51.8%	48.5%
Female	50.2%	48.2%	51.5%
% Race/Ethnicity			
African-American	38.6%	19.2%	58.0%
Caucasian	40.3%	62.7%	17.8%
Hispanic or Latino	11.9%	9.3%	14.3%
Sample population at Preschool	318	175	143
Sample population at Kindergarten	108	48	60

Table 2

Outer Model and Final R^2s for Latent Variables (LV): Preschool to Kindergarten Classroom Executive Control, Involvement and Learning Behaviors

		LV		*Manifest Variable Loading*
Manifest Variable	*AVE*	R^2	*Composite Reliability*	
Hot Executive Control (Hot EC)	*.70*	---	*.82*	
Snack Delay Task				*.838*
Toy Peek Task				*.831*
Cool Executive Control (Cool EC)	*.66*	---	*.79*	
Pencil Tap Task				*.922*
Turn Taking Task				*.688*
On task Involvement (OTI)	*.61*	*.07*	*.90*	
Follows teachers directions				*.855*
If child is interrupted, goes back to activity				*.613*
Uses classroom materials responsibly				*.782*
Listens carefully to teachers instructions…				*.882*
Is interested in classroom activities				*.691*
Responds promptly to teachers requests				*.835*
Competence Motivation (CM)	*.55*	*.05*	*.91*	
"Shows little determination…"				*.895*
"Uses headaches or other pains…"				*.617*
"Is too lacking in energy…"				*.613*
"Accepts new activities without fear…"				*.750*
"Is dependent on adults for what to do…"				*.774*
"Says task is too hard without much effort.."				*.813*
"Is reluctant to tackle new activity"				*.791*

"Adopts don't care attitude…"				*.775*
Attitude Towards Learning (ATL)	*.61*	*.06*	*.86*	
"Cooperates in group activities"				*.773*
"Gets aggressive or hostile…"				*.738*
"Pays attention to what you say"				*.747*
"Doesn't achieve anything constructive…"				*.811*
Attention/Persistence (AP)	*.59*	*.07*	*.92*	
"Acts without taking sufficient time…"				*.845*
"Cooperates in group activities"				*.657*
"Is distracted too easily…"				*.836*
"Cannot settle into an activity"				*.864*
"Shows little determination…"				*.754*
"Pays attention to what you say"				*.810*
"Tries hard but concentration soon fades…"				*.679*
"Sticks to an activity…"				*.679*
"Adopts a don't-care attitude…"				*.736*

Table 3

Inner Model LV Correlations: Preschool to Kindergarten Classroom Executive Control, Involvement and Learning Behaviors

		1.	2.	3.	4.	5.	6.
1.	Hot Executive Control	**.83**					
2.	Cool Executive Control	.45***	**.81**				
3.	On-task Involvement	.27***	.15**	**.78**			
4.	Competence Motivation	.08	.17**	.17**	**.74**		
5.	Attitude Towards Learning	.12	.11	.22***	.68***	**.78**	
6.	Attention / Persistence	.12	.13*	.25***	.80***	.79***	**.77**

Note. Square root of AVE (Average Variance Extracted) appear in bold on the diagonal; LV (Latent Variable) correlations appear below the diagonal.

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 4

Significance of Moderating Effects: Pooled Estimation of Variance for Gender

		Gender			
Path	**Path coefficient^{Male}**	**Path coefficient^{Female}**	**SE^{Male}**	**SE^{Female}**	**t score**
Hot EC → OTI	*.224*	*.250*	*.071*	*.056*	*-.28*
Hot EC → CM	*.006*	*.020*	*.106*	*.057*	*.90*
Hot EC → ATL	*.013*	*.186*	*.086*	*.059*	*-1.65+*
Hot EC → AP	*.096*	*.059*	*.080*	*.058*	*.39*
Cool EC → OTI	*.058*	*.013*	*.069*	*.061*	*.48*
Cool EC → CM	*.073*	*.280*	*.080*	*.041*	2.32*
Cool EC → ATL	*.021*	*.173*	*.067*	*.053*	-2.27*
Cool EC → AP	*.006*	*.218*	*.068*	*.052*	2.63**
OTI → CM	*.242*	*019*	*.055*	*.066*	*2.60***
OTI → ATL	*.252*	*.101*	*.055*	*.045*	*2.13**
OTI → AP	*.278*	*.163*	*.050*	*.056*	*1.54+*

*+ = <.10 * = < .05; ** = <.01; *** = < .001*

Key:
Hot EC = Hot Executive Control
Cool EC = Cool Executive Control
OTI = On-task Involvement
CM = Competence Motivation
ATL = Attitude Towards Learning
AP = Attention/Persistence

Table 5

Significance of Moderating Effects: Pooled Estimation of Variance for School Type

	School Type				
Path	**Path coefficient^{Private}**	**Path coefficient^{HS}**	**SE^{Private}**	**SE^{HS}**	**t score**
Hot EC → OTI	*.233*	*.313*	*.059*	*.054*	*.99*
Hot EC → CM	*-.049*	*.006*	*.065*	*.080*	*3.49****
Hot EC → ATL	*-.000*	*.108*	*.052*	*.075*	*1.18*
Hot EC → AP	*.041*	*.058*	*.052*	*.078*	*-.18*
Cool EC → OTI	*.003*	*.163*	*.054*	*.053*	*2.21**
Cool EC → CM	*.188*	*.277*	*.088*	*.059*	-.84
Cool EC → ATL	*.101*	*.139*	*.087*	*.054*	-.39
Cool EC → AP	*.128*	*.201*	*.076*	*.068*	-.71
OTI → CM	*.041*	*.363*	*.081*	*.065*	*-2.98***
OTI → ATL	*.095*	*.399*	*.079*	*.057*	*-3.09***
OTI → AP	*.214*	*.368*	*.048*	*.052*	*-2.16**

*+ = <.10 * = < .05; ** = <.01; *** = < .001*

Key:
Hot EC = Hot Executive Control
Cool EC = Cool Executive Control
OTI = On-task Involvement
CM = Competence Motivation
ATL = Attitude Towards Learning
AP = Attention/Persistence

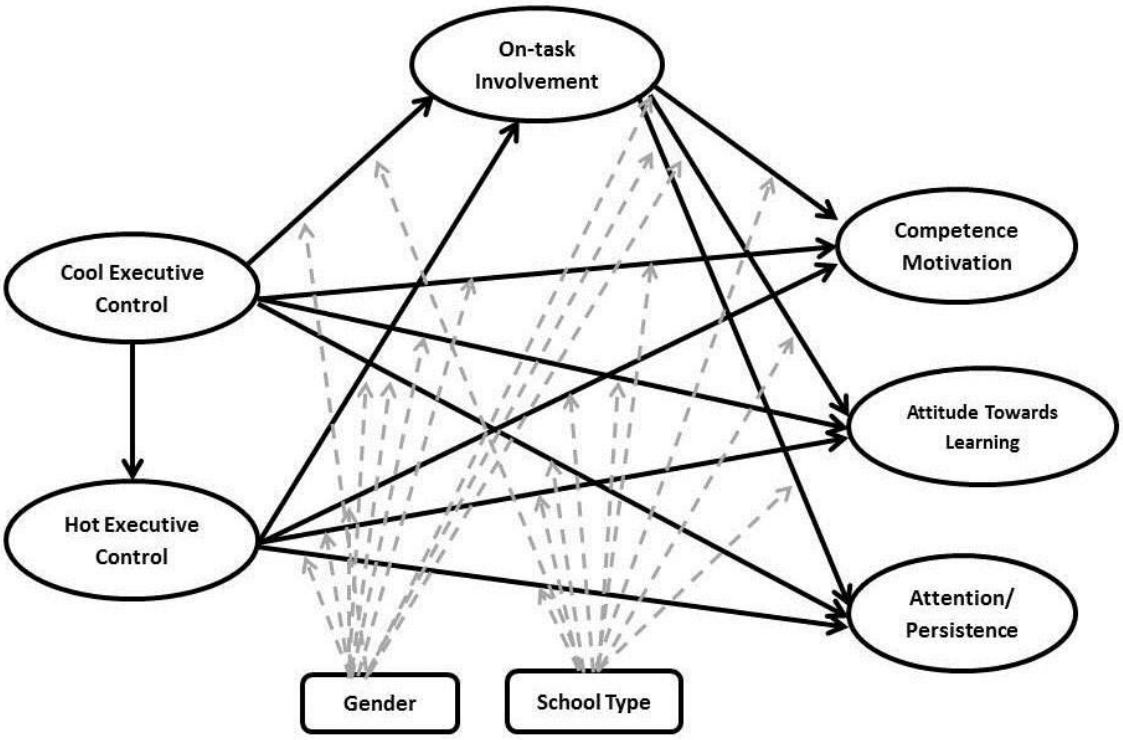
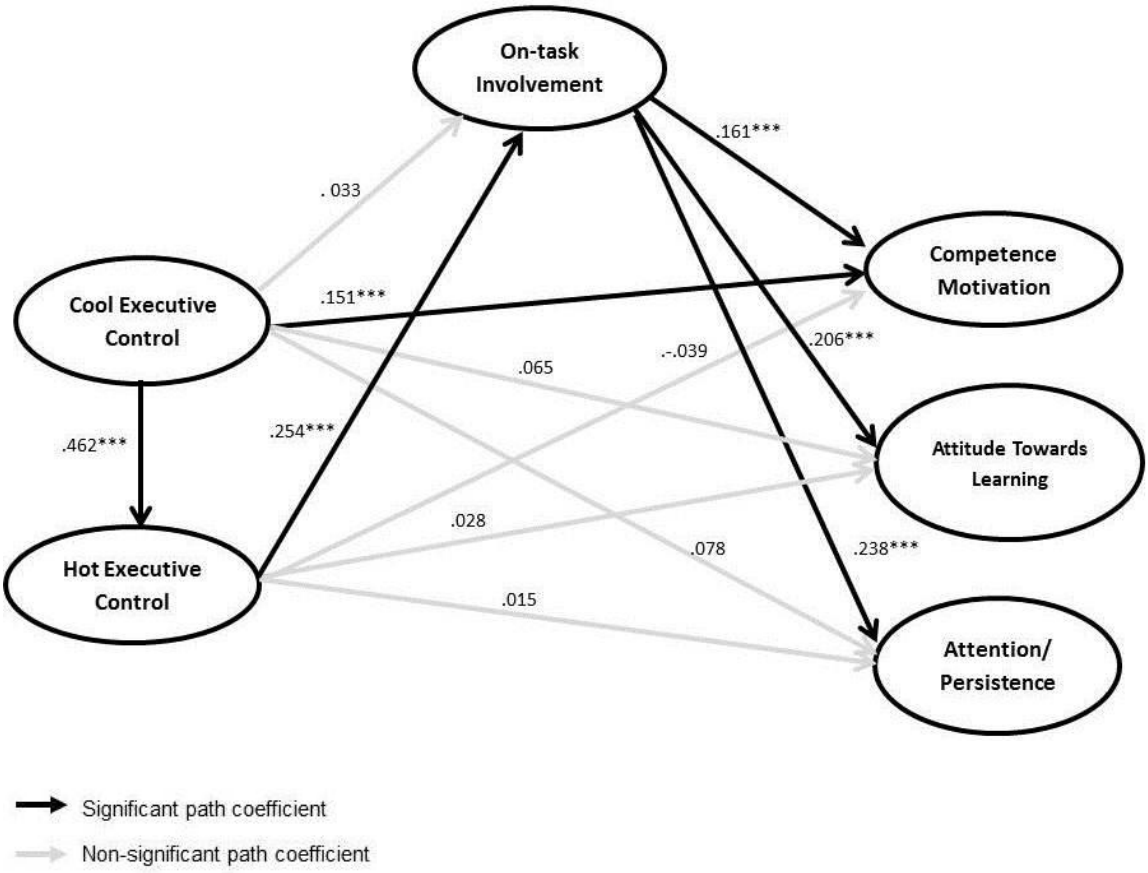
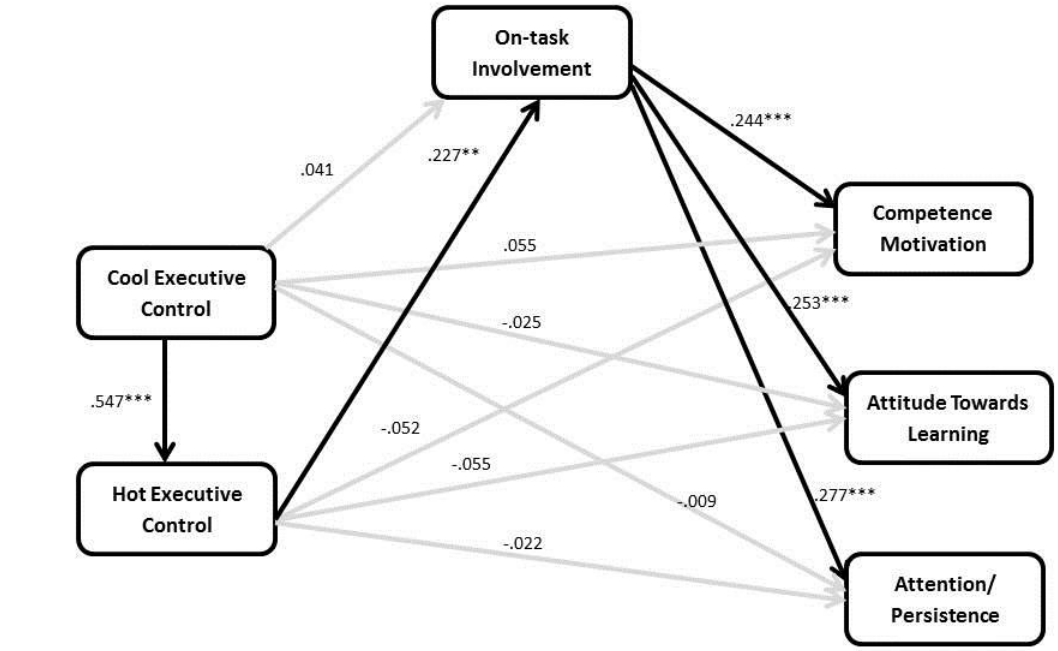


Figure 1: Theoretical model of the interrelations of Hot and Cool executive control and learning behaviors, moderated by gender and school type, and mediated by on-task involvement



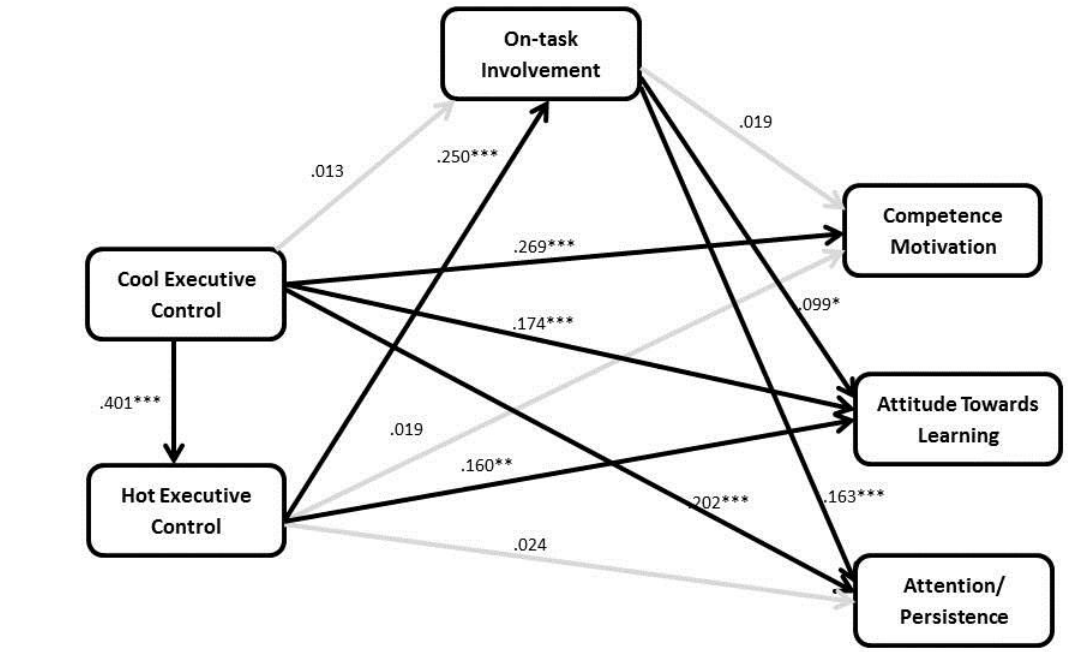
Note. Path coefficients are interpreted as beta regression coefficients. . Levels of significance determined by *t*-values from bootstrapping procedures and may vary according to the standard error of the path coefficient. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

Figure 2: Final partial least squares inner model



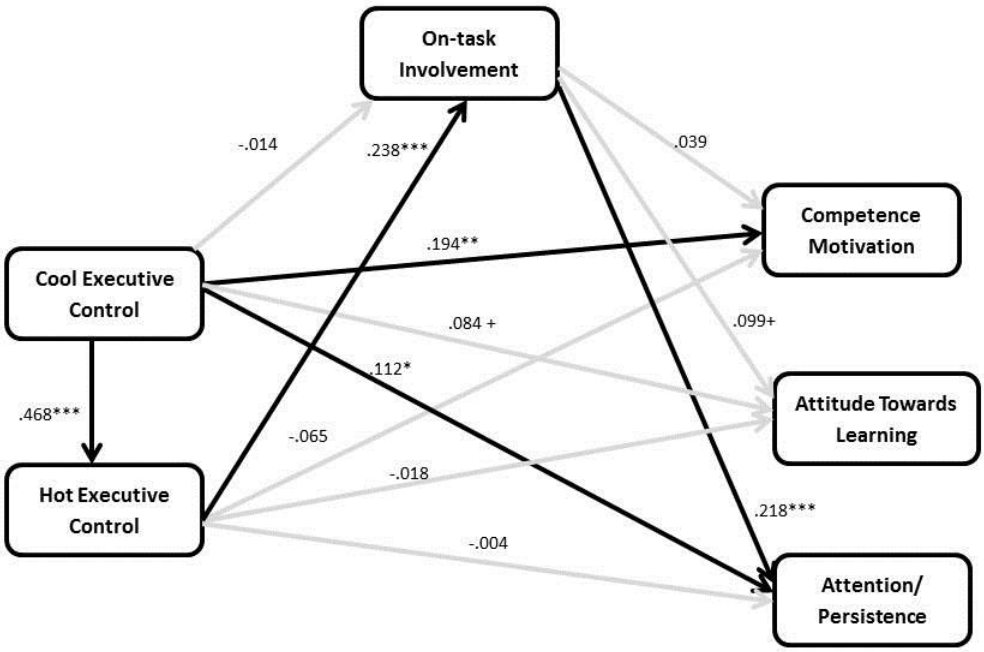
Note. Path coefficients are interpreted as beta regression coefficients. . Levels of significance determined by *t*-values from bootstrapping procedures and may vary according to the standard error of the path coefficient. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

Figure 3a: Moderated Model – Male



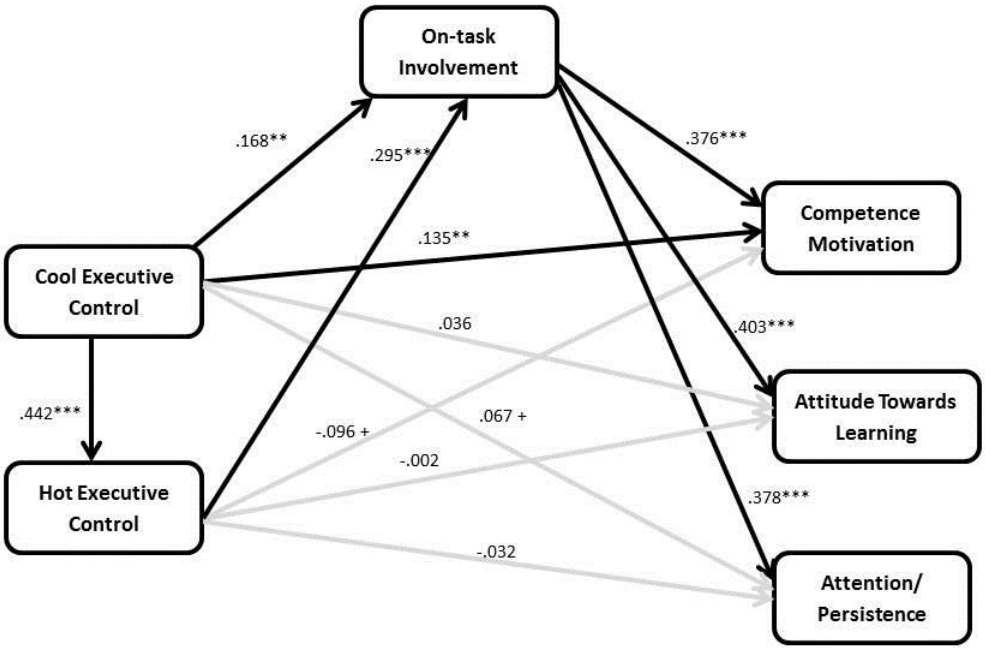
Note. Path coefficients are interpreted as beta regression coefficients. . Levels of significance determined by *t*-values from bootstrapping procedures and may vary according to the standard error of the path coefficient. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

Figure 3b: Moderated Model – Female



Note. Path coefficients are interpreted as beta regression coefficients. . Levels of significance determined by *t*-values from bootstrapping procedures and may vary according to the standard error of the path coefficient. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

Figure 4a: Moderated Model – Private Day care



Note. Path coefficients are interpreted as beta regression coefficients. . Levels of significance determined by *t*-values from bootstrapping procedures and may vary according to the standard error of the path coefficient. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

Figure 4b: Moderated Model – Head Start

Appendix 1: Preschool Self-Regulation Assessment Script

A. BALANCE BEAM 

"I have some games we can play together. I'm very happy you are going to play my games today. Let's start over here." *Guide the child over to the line of masking tape.*

 **STOPWATCH/COUNTUP:** *Begin when the child places one foot on the starting end of the tape; stop timing as soon as ONE foot steps off of the other end of the tape onto the floor. Record times on code sheet after each trial.*

BALANCE BEAM – 3 Trials

TRIAL 1: "We're going to pretend this is a balance beam. I'd like you to walk the balance beam, okay?"

→ *If child starts walking before you are ready:* **"Hold on. Wait until I say 'Go'."**

→ *If child runs, skips, or hops on the line, do not correct him/her.*

Once the child is in position: **"Ready, go."**

When the child steps ONE foot off the end of the tape: **"OK."** ✎ *Record the time.*

TRIAL 2: "Okay, let's try that again. Let's see how slow you can walk the balance beam."

Once the child is in position: **"Ready, go."**

When the child steps off the end of the tape: **"OK."** ✎ *Record the time.*

TRIAL 3: "Okay, I want you to do it one more time, as slooooow as you can go." *Draw out and emphasize the word "slow".*

When child is in position: **"Ready, go."**

When the child steps ONE foot off the end of the tape: **"OK."** ✎ *Record the time.*

"Thank you. Now let's go back and sit at the table." *Guide the child over to his/her seat at the table.*

B. PENCIL TAP

Take out two unsharpened pencils from the assessment kit.

Give one to the child.

Showing fingers and tapping: **"Now, for this game, when I tap my pencil one time, you tap your pencil two times. And when I tap my pencil two times, you tap your pencil one time, okay? Let's try."**

PENCIL TAP – Teaching Trials

Use your non-writing hand to tap the pencil so child's response can be entered on the code sheet with the other hand.

TEACHING TRIALS *(use responses below to praise or correct child):*

1. Tap pencil on table once → child should tap twice.

→ *Correct:* **"Very good, you did it just right. Let's try again."**

→ *Incorrect (too many or not enough taps):* **"Almost, but that's not quite right. When I tap (one/two) time(s), you should tap**

(two/one) time(s). Let's try again. I tap (one/two) time(s)," *(tap pencil and show fingers)* **"so you tap…"** *(wait for the child to tap).*

- *If child taps correctly:* **"Good. Let's try again."** *Move on to next trial.*
- *If still incorrect say:* **"Almost, but that's not quite right. When I tap (one/two)time(s), you should tap (two/one)time(s) – like this."** *Take child's hand and tap his/her pencil the correct number of times while you say "like this." Move on to next trial.*

2. Tap pencil twice → child should tap once.

3. Tap pencil twice → child should tap once.

Up to 6 teaching trials are allowed.

✎ *Record the number of practice trials.*

PENCIL TAP – Scored Trials

Showing fingers and tapping: **"Okay, now we're going to do it a lot of times. Remember, when I tap one time, you tap two times; and when I tap two times, you tap one time.**

✎ *Record the child's response on code sheet after each trial as "0", "1", "2" or "3".*

****Do not score as correct/incorrect!*

Do not correct or praise the child.

1) 2 taps	*5) 1 tap*	*9) 2 taps*	*13) 1 tap*
2) 1 tap	*6) 2 taps*	*10) 1 tap*	*14) 2 taps*
3) 1 tap	*7) 1 tap*	*11) 2 taps*	*15) 2 taps*

4) 2 taps *8) 2 taps* *12) 1 tap* *16) 1 tap*

→ *If the child is distracted and does not tap: code as "0", say* **"Please pay attention"** *and move on to next trial.*

→ *If the child is tapping repeatedly, interrupt:* **"Okay"**, *code as "3", move on to next trial.*

→ *If it is unclear how many times the child tapped, note that on the code sheet.*

PENCIL RETURN

"Nice job. Now we're going to do something else; I'll put the pencils away."

Hold out your hand for the pencil.

→ *If child does not return pencil:* **"Please give me the pencil so we can do the next activity."**

→ *Still noncompliant: Pull out the next activity (blocks):* **"Let's move on to the next activity."** ---

No need to time, but check if the child returns pencil immediately without additional request.

C. TOWER TASK – Teaching Trial

Take out the container of blocks. Take 6 blocks out of the container.

"Okay, now we're going to play a game with these blocks; we can build a tower.

We'll take turns adding blocks to the tower. First I put one on, then you put one on, and then I put one on and you put one on. That's how we take turns and that's how we play this game.

Let's practice one."

Place the first block.

Alternate turns until the tower is 6 blocks high.

→ *Child starts to take an extra turn, gently interrupt:* **"Remember, now it's my turn."**

→ *Child is not taking his/her turn:* **"Okay, now you put a block on the tower."**

→ *Child places block somewhere else or knocks them over before tower is complete:*
"Remember, we're trying to build a tower. Put the blocks in one stack, like this."
If child continues, do not repeat instruction and move on to actual trial.

TOWER TASK – Transition

"See, we made a tower together."

Slide the practice tower out of the way.

→ *If the child knocks the tower down or the tower falls, calmly say,* **"Oops"** *and slide the blocks out of the way. Make no other comment and do not clean up the blocks.*

TOWER TASK – Actual Trial

Dump out the rest of the blocks (12 blocks).

"Okay, now let's build a really tall one. You go first."

Each time the child places a block, pause and wait for a signal from the child that it is your turn (e.g., child says, "your turn", waits for you, puts his/her hands together).

→ *If the child does not take his/her own turn:* **"Okay, it's your turn now"**. *Do not take an extra turn.*

→ *If the tower falls (6 blocks or less)* → *fix it and continue (7 blocks or more)* → *go to next task (Tower Cleanup).*

Do not remind the child to give you a turn.

"That was fun, thanks for playing."

D. TOWER CLEANUP 

Gesture to both towers: **"Please put all the blocks back into the container."**

 **STOPWATCH/COUNTUP:** *Time for 2 minutes. Record on code sheet how long it takes for the child:*

✎ *to put the first block away*

and

✎ *to clean up all the blocks.*

→ *If child is not cleaning at any point during task for 1 full minute:* **"Remember, you need to clean up all the blocks so we can move on to the next activity"**. *Do not repeat prompt.*

→ *After 2 minutes, help the child clean up any remaining blocks:* **"I'll help you finish up so we can move on to the next activity."**

"Thank you."

E. TOY SORTING 

Toys should be mixed together in two bins before testing begins.

"Okay, now I have something else to show you." *Take out the 4 sorting bins and mixed-up toys.*

"Oh no, the toys are all a mess." *Dump the toys out onto the table, close to the child. Be sure to leave space on the table for the sorting bins to fit behind the mixed up toys (from the child's perspective).*

"We can't play right now, but please clean up this mess and put the toys where they go."

Line up the bins on the table. From the child's perspective, the bins should be equidistant from the child, within reach, and behind the toys. Point to the picture on each bin: "**See, the cars go in here, the dinosaurs go in here, the bugs go in here, and the beads go in here."**

 **STOPWATCH/COUNTUP:** *Time for 2 minutes. Time:*

✎ *how long it takes for the child to start sorting the toys*

and

✎ *amount of time to complete the task*

→ *Sorting incorrectly: repeat directions and point to the sorting bins one last time:* **"Remember, the cars go here, the dinosaurs go here, the bugs go here, and the beads go in here."**

- *If the child continues to sort incorrectly, do not repeat directions.*

- *If the child asks if s/he is sorting correctly (e.g., asks directly or looks at you and pauses before placing the object) respond with nod or* **"That's fine."**

→ *Not sorting: If child is not sorting or stops sorting, wait one full minute. Then say:* **"Remember, put all the toys where they go so we can do the next activity."** *Do not demonstrate if child is not picking up toys. Do not repeat prompt.*

When child is done or after 2 minutes: **"Okay. Now we're going to do something different."**

Put any remaining toys into the bins (do not sort), and put toys away.

F. TOY WRAP – "Wrapping" 

"Now I have a surprise to show you, but I don't want you to see it. I want to wrap it first. Please turn around so you won't see it."

Turn child's ***chair*** *90^{o} so the side of the chair faces the table. You will have to physically place the child and the chair in the proper location before starting this task, even if the child turns self and/or chair around in any manner.*

"Please stay in your chair and try not to look or peek while I wrap it. I'll tell you when I'm done."

 **STOPWATCH/COUNTUP**: *Time for 1 minute. Take out wrapping materials and pre-wrapped toy (do not let child see that toy is already wrapped).*

Noisily pretend to wrap while watching child's behavior.

✎ *Record the time of the child's first peek.*

→ *Each time child turns around or peeks say,* **"Remember, no peeking. I'll tell you when I'm done."**

After 1 minute: **"Okay, I'm all done, you can turn around now."** *Leave the wrapped gift on the floor, away from the child's reach. Help the child turn the chair back around.*

→ *REMEMBER - Help the child turn his/her chair back around.*

TOY WRAP – Waiting

"I need to finish this up. Please don't touch the surprise."

Clean up wrapping materials, toys from other tasks, or do paperwork to look busy.

 **STOPWATCH/COUNTUP:** *Time for 1 minute.*

✎ *Record the time of the child's first touch.*

→*If child asks if s/he can open the gift:* **"Please wait until I'm finished."**

→*If child touches gift but does not open it, do not say anything.*

→*If child starts to open gift:* **"Okay, you can open it now and see what it is."**

After 1 minute: **"Okay, you can open it now and see what it is."**

G. TOY RETURN 

After child unwraps toy: **"You can play with it for a little while before we do the next activity."**

 **STOPWATCH/COUNTUP**: *Time for 1 minute.*

→ *If child does not play with toy, encourage him/her:* **"You can play with it – it's pretty cool."** *If child still does not play with toy, demonstrate once with an upbeat tone:* **"See? Pull on the string – it's fun!""**

→ *If child asks for help, demonstrate:* **"You pull on the string to make the ball move like this."**

→ *If child offers you a turn:* **"Thanks"**, *take a turn and return the toy.*

Hold out hand: **"Okay, please give me the toy so I can put it away."**

 **STOPWATCH/COUNTUP**:

✎ *Record how long it takes the child to return the toy. Stop timing after 2 minutes.*

→ *If child refuses or stalls in any other way wait 1 full minute. Then say:* **"Ok, it's time for the next activity. Please give me the toy."** *(Hold out hand.)*

→ *If the child has not returned the toy after 2 minutes, move on to next task (Snack Delay).*

H. SNACK DELAY **  **

"Okay. Now we're going to use M&Ms/Skittles to play a game. Here, you can try one." *Give child one. Make sure child has completely finished eating before continuing.*

"Good, right? Okay, for this game keep your hands here, flat on the table." *(If necessary, show the child how to place his/her hands.)*

"I will hide an M&M/a Skittle under this cup." *Point to first "delay" cup.*

When I beep the timer and say 'Time', you can get the candy and put it in this cup for later." *Show second cup off to side.*

SNACK DELAY – Teaching Trial

**  ** **TIMER/COUNTDOWN**: *Set the timer for 10 seconds.*

Place an M&M under the delay cup.

**  ** **TIMER/COUNTDOWN**: *Start the timer. When it beeps, say:* **"Time."** *Let the child get the M&M.*

→*If the child reaches for the candy before 10 seconds:* **"Remember, you need to wait for me to beep the timer."** *(Place your hand on top of the cup, if necessary, to keep the child from taking the candy.)*

→*If child does not take the candy at the end of the trial:* **"I beeped the timer, so you can get the candy now."**

→*If the child eats the candy, do not comment, but make sure s/he finishes it before starting the next trial.*

"Please put the candy in here until we're all done." *Have the child put the candy in the second cup and place the cup out of the way.*

H. SNACK DELAY – Trial 1 (10 sec)

"Ok, that's how you play. We're going to do it again. Keep your hands flat on the table. Remember to wait until I beep the timer and say 'Time' before you look for the candy."

**  ** **TIMER/COUNTDOWN**: *Set the timer for 10 seconds and place it on the table.*

Hide a new candy under the cup.

**  ** **TIMER/COUNTDOWN**:

After 5 seconds, pick up timer and bring it towards you, but do not beep it.

After 10 seconds, when timer beeps, say **"Time."**

→ *If child takes candy before you beep the timer,* **"You couldn't quite wait that time, could you?"**

→ *If child waits for the timer,* **"Nice job."**

Let child get candy and place it in the second cup.

Do <u>not</u> stop child from trying to get the candy. Do <u>not</u> place your hand on the cup.

SNACK DELAY – Trial 2 (20 sec)

"Let's do it again. Keep your hands flat, and remember to wait for me to beep the timer."

<u>REMEMBER</u>: *The child should not eat the candy until end of all the tasks. If child does eat any candy, don't comment, but <u>be sure to wait until child's finished</u> before administering the next trial.*

**  ** **<u>TIMER/COUNTDOWN</u>**: *Set the timer for 20 seconds and place it on the table.*

Hide a new candy under the cup.

**  ** **<u>TIMER/COUNTDOWN</u>**:

→ *If child takes candy before you beep the timer,* **"You couldn't quite wait that time, could you?"**

→ *If child waits for the timer,* **"Nice job."**

Let child get candy and place it in the second cup.

Do <u>not</u> stop child from trying to get the candy. Do <u>not</u> place your hand on the cup.

SNACK DELAY – Trial 3 (30 sec)

"Let's do it again. Keep your hands flat, and remember to wait for me to beep the timer."

REMEMBER: *The child should not eat the candy until end of all tasks. If child does eat any, don't comment, but be sure to wait until child is completely finished eating before administering the next trial.*

**  ** **TIMER/COUNTDOWN**: *Set the timer for 30 seconds and place it on the table.*

Hide a new candy under the cup.

**  ** **TIMER/COUNTDOWN**:

After 15 seconds, pick up timer and bring it towards you, but do not beep it.

After 30 seconds, when timer beeps, say **"Time."**

→ *If child takes candy before you beep the timer,* **"You couldn't quite wait that time, could you?"**

→ *If child waits for the timer,* **"Nice job."**

Let child get candy and place it in the second cup.

Do not stop child from trying to get the candy. Do not place your hand on the cup.

SNACK DELAY – Trial 4 (60 sec)

"Let's do it again. Keep your hands flat, and remember to wait for me to beep the timer."

REMEMBER: *The child should not eat the candy until end of all tasks. If child does eat any, don't comment, but be sure to wait until child's finished before administering the next trial.*

**  ** **TIMER/COUNTDOWN**: *Set the timer for 60 seconds and place it on the table.*

Hide a new candy under the cup.

**  ** **TIMER/COUNTDOWN**:

After 30 seconds, pick up timer and bring it towards you, but do not beep it.

After 60 seconds, when timer beeps, say **"Time."**

→*If child takes candy before you beep the timer,* **"You couldn't quite wait that time, could you?"**

→ *If child waits for the timer,* **"Nice job."**

Let child get candy and place it in the second cup.

Do not stop child from trying to get the candy. Do not place your hand on the cup.

TONGUE TASK 

Goldfish crackers may be used if child is allergic to chocolate or says s/he does not like M&Ms.

"Okay, now we're going to play one more game. For this last game we're going to use the M&Ms/Skittles again.

We're going to see who can hold a candy on their tongue the longest without chewing it, sucking it, or swallowing it."

I. TONGUE TASK – Teaching Trial

"Here's yours, and this is mine. Let's put it on our tongue and try not to eat it. Keep your mouth open so I can see." *Hand child one candy..*

Hold your tongue out and place the candy on it at the same time as the child. Leave your mouth open so the child can see the candy..

 **STOPWATCH/COUNTUP**: *Let timer run for 10 seconds.*

→*If child eats (or sucks) M&M before the end of the trial, eat your candy:* **"It's a tie! We both ate it at the same time."**

→*If child closes mouth for 3 seconds or more, eat your candy:* **"Remember, you need to keep your mouth open so I can see."** *Record this behavior as 'eating the candy'.*

→*If one of you drops the candy:* **"Oops, that's okay."** *Move on to the actual trial.*

→*If child waits the full length of the trial, eat your candy:* **"You win!"**

TONGUE TASK – Actual Trial

After child finishes candy from practice trial: **"Okay, let's do it one more time. Remember to keep your mouth open so I can see."**

 **STOPWATCH/COUNTUP:** *Let timer run for 40 seconds.*

→*If the child eats M&M or closes mouth for 3 seconds before the end of the trial, eat your candy:* **"It's a tie! We both ate it at the same time."**

✎ *Record the time until the child eats candy.*

→*If one of you drops the M&M*

- *Before 35 seconds into the trial:* **"Oops, that's ok."** *Re-administer the trial one time.*
- *After than 35 seconds into the trial, or for the second time:* **"That's okay, you did a good job. Here's another M&M/Skittle; you can eat it now."**

✎ *Record the actual length of trial..*

→ *If child waits the full length of the trial, <u>eat your M&M</u> and say,* **"You win!"**

"Thank you. You did a nice job today. We're all done. You can eat your candy now."

<u>END OF ASSESSMENT</u>

Appendix 2: Teacher Rating Scale of School Adjustment: Highlighted survey items correspond to On-task Involvement (OTI) factor

Note: Shaded variables indicate items included in the On-task involvement factor

Variable name	Item Description	Scale
adjust1	Follows teacher's directions.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust2	Makes up reasons to go home from school.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust3	Uses classroom materials responsibly.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust4	Likes to come to school.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust5	Listens carefully to teacher's instructions and directions.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust6	Dislikes school.	0 = Doesn't Apply 1= Applies Sometimes

		2= Certainly Applies
adjust7	Is easy for teacher to manage.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust8	Is interested in classroom activities.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust9	Responds promptly to teacher's requests.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust10	Asks to see school nurse.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust11	Has discipline problems.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust12	Has fun at school.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust13	Tends to play in the same activity center.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust14	Participates willingly in classroom activities.	0 = Doesn't Apply 1= Applies Sometimes

		2= Certainly Applies
adjust15	Is cheerful at school.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust16	Complains about school.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust17	Feigns illness at school.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust18	Approaches new activities with enthusiasm.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust19	Is slow to warm up to teacher.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust20	Easily makes transition from one activity to another.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust21	Clings to teacher.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust22	Notices when other kids are absent.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies

adjust23	Accepts teacher's authority.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust24	Seeks challenges.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust25	Aware of classroom rules.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust26	Likes being in school.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust27	Helps others without needing teacher recognition	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust28	If child's activity is interrupted, he/she goes back to the activity.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust29	Needs lots of structure.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust30	Seems unhappy at school.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust31	Asks to leave the classroom.	0 = Doesn't Apply

		1= Applies Sometimes 2= Certainly Applies
adjust32	Accepts responsibility for a given task.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust33	Laughs or smiles easily.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust34	Is a self-directed child.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust35	Is comfortable approaching teacher.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust36	Seems bored in school.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust37	Seeks constant reassurance.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust38	Is a mature child.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust39	After an absence of many days or a holiday, it takes time for this child to readjust to school routines.	0 = Doesn't Apply

		1= Applies Sometimes 2= Certainly Applies
adjust40	Works independently.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust41	Enjoys most classroom activities.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust42	Enjoys "playing school;" imitates teacher.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust43	Asks how long it is until it is time to go home.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust44	Needs lots of help and guidance.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust45	Interested in teacher as a person.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust46	Is a confident child.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust47	Can't find things to do during free choice time.	0 = Doesn't Apply 1= Applies Sometimes

		2= Certainly Applies
adjust48	Initiates conversations with teacher.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust49	"Tuned in" to what's going on in the classroom.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust50	Groans or complains about suggested activities.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust51	Needs constant supervision.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies
adjust52	Flexible; adjusts easily to change in routine.	0 = Doesn't Apply 1= Applies Sometimes 2= Certainly Applies

Appendix 3: Preschool Learning Behavior Scale (PLBS): Items that correspond to factor loadings are listed

Factor Loading	Item Description	Scale
Attitude towards learning, Attention/ Persistence	Pays attention to what you say.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Competence Motivation	Says task is too hard without making much effort to attempt it.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Competence Motivation	Is reluctant to tackle a new activity.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Attention/ Persistence	Sticks to an activity for as long as can be expected for a child of this age.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies

Attention/ Persistence	Adopts a don't-care attitude to success or failure.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
N/A	Seems to take refuge in helplessness.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
N/A	Follows peculiar and inflexible procedures in tackling activities.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
N/A	Shows little desire to please you.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
N/A	Is unwilling to accept help even when an activity proves too difficult.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Attention/ Persistence	Acts without taking sufficient time to look at the problem or work out a solution.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies

Attitude Towards Learning Attention/ Persistence	Cooperates in group activities.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
N/A	Bursts into tears when faced with a difficulty.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
N/A	Has enterprising ideas which often don't work out.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Attention/ Persistence	Is distracted too easily by what is going on in the room, or seeks distractions.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Attention/ Persistence	Cannot settle into an activity.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Attitude Towards Learning	Gets aggressive or hostile when frustrated.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies

N/A	Is very hesitant in talking about his or her activity.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Competence Motivation, Attention/ Persistence	Shows little determination to complete an activity, gives up easily.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Competence Motivation	Uses headaches or other pains as a means of avoiding participation.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
N/A	Is willing to be helped.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Competence Motivation	Is too lacking in energy to be interested in anything or to make much effort.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
N/A	Relies on personal charm to get others to find solutions to the problems he or she meets.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies

N/A	Invents silly ways of doing things.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Attitude Towards Learning	Doesn't achieve anything constructive when in a mopey or sulky mood.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
N/A	Shows a lively interest in the activities.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Attention/ Persistence	Tries hard but concentration soon fades and performance deteriorates.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
N/A	Carries out tasks according to own ideas rather than in the accepted way.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies
Competence Motivation	Accepts new activities without fear or resistance.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies

Competence Motivation	Is dependent on adults for what to do, and takes few initiatives.	0= Doesn't Apply 1= Sometimes Applies 2= Most Often Applies

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Curriculum Vitae

Todd M. Wyatt graduated from Dayton Christian High School in Dayton, Ohio in 1998. He earned a Bachelors of Arts degree in Human Development Psychology from Lee University in Cleveland, Tennessee in 2002. Todd has directed the research program at EverFi, Inc. since 2008, and is also an adjunct lecturer in the Department of Psychology at Georgetown University.