

Predicting Children's Early School Outcomes from their Social-Regulatory Profiles: A
Person-Centered Approach

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Abstract

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Social information processing (SIP) and self-regulation skills have been widely examined as predictors of concurrent and long-term outcomes for children. Although aspects of SIP and self-regulation have been shown to differentially predict academic and behavioral outcomes for children, few studies have examined the development of these areas of functioning in early childhood using person-centered analytic techniques. This study utilized secondary data analysis and a person-centered approach to identify profiles of children's social-regulatory processing prior to kindergarten entry and examine profile associations with individual and contextual predictors as well as first-grade academic and behavioral outcomes. Results supported four social-regulatory classes. Class membership was associated with early cognitive ability and maternal sensitivity, and classes differed significantly on first grade academic achievement outcomes. A group with higher functioning across SIP and self-regulation variables earned higher first-grade reading and math scores than a group with lower functioning across the same variables. Additionally,

the group with higher overall SIP and self-regulation functioning performed better on math achievement than a group with lower attribution scores and moderately low self-regulation, and a group with higher SIP and moderate regulation performed better in math than the group with low SIP and self-regulation. No differences were found between groups for indicators of first grade behavioral adjustment. Results are discussed within the context of prior research and current educational practice, and recommendations for future person-centered study of SIP and self-regulation factors are presented.

To my mom, Dr. Marsha Nader Cotton, who always saw the best in others, and then made it so.

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Chapter 1: Introduction

Children entering kindergarten in the United States today face higher expectations for learning than ever before. Between 1998 and 2006, the percentage of kindergarten teachers nationally who expect to teach their students to read increased from one-third to two-thirds, and teachers reported increasing time spent on literacy-related instruction by 25 percent over the same time period (Bassok & Rorem, 2013). These increasingly rigorous classroom expectations require that young children enter school with a repertoire of learning behaviors such as the ability to sustain attention, control impulses, and follow structured instructional activities. Additionally, children are expected to engage in social behaviors that facilitate learning, including participating cooperatively in groups, problem solving conflicts, and complying with teacher requests. Indeed, children's behavioral readiness and adaptation to the school environment has been shown to have critical importance, with substantial evidence that children with stronger self-regulation and social cognitive skills upon school entry are more likely to experience subsequent academic and social success (Blair & Razza, 2007; Denham, Bassett, et al., 2012; Duncan et al., 2007; Ponitz, McClelland, Matthews, & Morrison, 2009). Given the importance of these factors for children's proximal and distal outcomes, full understanding of the ways in which self-regulation and social cognitive skills impact school success is critical.

Self-regulation in early childhood has been increasingly examined as a predictor of adjustment and academic outcomes (Post, Boyer, & Brett, 2006; Schmitt, Pratt, & McClelland, 2014). Broadly defined, self-regulation encompasses the intentional regulation of attention and emotions and corresponding execution of behaviors that are consistent with attaining a desired goal or outcome (Blair & Raver, 2012). Self-regulation

related to behaviors such as paying attention while ignoring distractions, waiting for a turn, and remembering and following instructions becomes increasingly relevant as children engage in formal instructional experiences. Although many children successfully navigate the behavioral expectations necessary for the transition to school, a substantial percentage demonstrate difficulties upon school entry, with 46 percent of kindergarten teachers in a large, national sample reporting that more than half of the students in their classroom lacked the self-regulation required for adequate learning (Rimm-Kaufman, Pianta, & Cox, 2000). Children with higher levels of socio-demographic risk are likely to enter preschool with lower levels of self-regulation compared with their more advantaged peers, and evidence suggests that these differences persist across the transition to kindergarten and first grade (Mistry, Benner, Biesanz, Clark, & Howes, 2010; Wanless, McClelland, Tominey, & Acock, 2011) with long-term implications for academic, social, and health outcomes (Fergusson, Boden, & Horwood, 2013; Moffitt & Arseneault, 2011; Shoda, Mischel, & Peake, 1990). Indeed, the longstanding and pernicious achievement gaps that exist between minority and White students can be partially attributed to the increased exposure to adverse experiences that hinders the development and use of self-regulation in the context of learning (Blair & Raver, 2014; Raver, Blair, & Willoughby, 2013).

Although conceptualizations of self-regulation have varied across disciplines, recent research has explored the validity and differential predictive value of hot (emotion-activated) versus cool (emotion-neutral) constructs of self-regulation. Emerging research demonstrates that hot self-regulation in preschoolers is associated with behavioral outcomes, while cool self-regulation is associated with early academic performance

concurrently (Willoughby, Kupersmidt, Voegler-Lee, & Bryant, 2011) and longitudinally (Kim, Nordling, Yoon, Boldt, & Kochanska, 2013). These findings indicate the potential value of examining hot and cool factors of self-regulation as distinct components of young children's school readiness profiles, with direct implications for educational programming.

Despite the value of self-regulation research for predicting outcomes across the transition to school, measures of self-regulation do not capture and account for differences in social cognitive functioning that may influence young children's performance in school settings. As schools are inherently social places, consideration of social mechanisms that support successful adaptation is indicated. Indeed, children with better social competence at school entry have been shown to have better long-term outcomes across domains of education, employment, criminal activity, substance use, and mental health (Jones, Greenberg, & Crowley, 2015). Substantial research addressing children's social cognitive development has been conducted according to the social information processing (SIP) model. The SIP model proposes that children's reactions to social scenarios are determined by a sequence of steps including encoding of social cues, making attributions about the intentions of others, and selecting and enacting a social response (Crick & Dodge, 1994). Research with preschool children indicates that SIP steps are predictive of concurrent and distal behavioral functioning (Denham, Way, Kalb, Warren-Khot, & Bassett, 2013), with evidence that discrete steps may differentially predict behavioral outcomes (Lansford et al., 2006). For example, research has demonstrated that children who attribute hostile intent to others in ambiguous conflict scenarios demonstrate more general externalizing behaviors including aggression

(Feldman & Dodge, 1987; Runions & Keating, 2007), internalizing problems (Bell-Dolan, 1995) and are more likely experience peer rejection (Schulz, Izard, & Ackerman, 2000). Furthermore, preschool children who generate more socially competent solutions to conflict scenarios have been shown to demonstrate better social-emotional adjustment in kindergarten (Denham et al., 2013). As research on SIP and self-regulation has broadened over the past decade, adapted SIP models have included self-regulation as a factor that may influence children's development of and change in SIP processes over time (Denham, Bassett, et al., 2012; Lemerise & Arsenio, 2000) with evidence that these processes contribute interactively to child outcomes (Denham et al., 2014; Goldweber, Bradshaw, Goodman, Monahan, & Cooley-Strickland, 2011). For example, children who demonstrate SIP deficits and lower self-regulation engage in more aggressive behavior than children who demonstrate deficits in areas of SIP or self-regulation alone (Ellis, Weiss, & Lochman, 2009).

Statement of Problem

Recently, SIP and self-regulation have been studied concurrently in children, with theoretical and empirical evidence that these processes interrelate to impact behavioral and academic outcomes for children. However, the vast majority of research addressing these processes has been conducted through variable-centered study (Denham et al., 2014; Ellis et al., 2009). While variable-centered study has yielded valuable findings regarding self-regulation and social information processing in young children, variable-centered approaches focus on these processes as abstracted from the individual, without consideration of meaningful patterns of functioning within individuals (Hart, Atkins, Fegley, Robins, & Jessica, 2013). Person-centered study, in contrast, allows for

examination of the relationship and organization of skills within individuals, with recognition that self-regulation and SIP skills may occur in interconnected patterns that allow for forming of meaningful subgroups of individuals with similar patterns. Given that numerous early childhood social-emotional preventive interventions target aspects of hot self-regulation (Raver et al., 2011), cool self-regulation (Diamond, Barnett, Thomas, & Munro, 2007; Tominey & McClelland, 2011), SIP processes (Conner & Fraser, 2011), or a combination of the above (Greenberg, 2006; Upshur, Wenz-Gross, & Reed, 2013) to improve children's school adjustment and performance, better understanding of common profiles of functioning in these areas may have implications for curricular design, intervention planning, and differentiation based on student needs. Although evidence suggests that self-regulation and SIP may be impacted through school-based intervention, effect sizes for such interventions are typically modest to moderate and at times difficult to replicate (Diamond & Lee, 2011; Farran & Wilson, 2014; Shaheen, 2014).

Furthermore, self-regulation and SIP have been shown to contribute uniquely or interactively to each of the five competency clusters (self-management, self-awareness, responsible decision-making, relationship skills, and social awareness) recommended for inclusion in social-emotional learning programs by leading practice and policy advisory groups (Adrian, Lyon, Oti, & Tininenko, 2010; Denham, Bassett, Zinsser, & Wyatt, 2014; Dusenbury, 2014). Better understanding of the patterns in which self-regulation and SIP processes occur in children may reveal opportunities to predict social-emotional learning needs and develop more precise interventions that can be tailored to children's needs in order to enhance child outcomes.

Gaps in the Research

Although the prevalence of research examining self-regulation and SIP components has increased in recent years, no person-centered study to date has examined aspects of hot and cool regulation alongside SIP components. Existing research has examined self-regulation and SIP concurrently from a variable-centered approach in middle-grade children and in preschool-age children and found evidence that these processes interact to influence child outcomes. In a study of middle-grade boys, Ellis and colleagues (2009) found that boys aged 9 - 12 with typical SIP performance showed no relation between self-regulation and aggression, whereas self-regulation was increasingly linked to aggression as SIP deficits increased (Ellis et al., 2009). Self-regulatory functioning in middle-grade children has also been shown to mediate change in SIP factors over time. In longitudinal study, Goldweber and colleagues found that children aged 7 -13 with SIP deficits but higher self-regulation were shown to be more likely to improve in SIP over the course of one year than children with similar SIP profiles but lower self-regulation (Goldweber et al., 2011) Recently, study of SIP and self-regulation has been extended to focus on children's functioning in early childhood. In study of preschool children, Denham and colleagues (2014) found associations between SIP factors and hot and cool self-regulation, and these factors were found to contribute directly to kindergarten classroom adjustment and academic readiness (Denham, Bassett, Zinsler, & Wyatt, 2014). In a related study, Denham and colleagues demonstrated that while hot and cool self-regulation were both related to children's social problem solving choices, only hot self-regulation was associated with "angry" emotional response for

social conflict scenarios (Denham et al., 2014), possibly indicating differential relationships between hot and cool self-regulation and discrete SIP steps.

One study to date has examined self-regulation and SIP factors concurrently using person-centered design. Denham and colleagues (2012) used *k*-means cluster analysis to identify profiles of preschool children according to aspects of SIP and self-regulation. Results indicated one class characterized as high risk across SIP and self-regulation factors and two classes characterized as socially competent (expressive and restrained). Compared with other classes, children in the high risk class demonstrated poorer classroom adjustment and early academic skills in kindergarten than either of the competent groups, whereas the two competent groups did not differ from one another on kindergarten outcomes.

The aforementioned studies have generated valuable contributions to the current understanding of SIP and self-regulation in early childhood and school-age populations. However, limitations in the current research base are notable. First, as mentioned previously, the majority of the studies described above were conducted using variable-centered designs, which do not allow for the identification of common subgroups of children who may demonstrate distinct and meaningful patterns of SIP and self-regulatory functioning. Second, the single study to date (Denham, Bassett, et al., 2012) that examined SIP and self-regulation factors from a person-centered perspective was acknowledged by the authors to be limited by inadequate sample size to identify a greater range of classes that may exist within the general population. Furthermore, teacher-report was utilized as the lone outcome method for kindergarten measures, and the possibility exists that reporter bias may have impacted results. Additionally, despite theoretical

(Blair, 2002) and empirical evidence that hot and cool self-regulation factors may differentially interact with SIP aspects and later child outcomes (Denham et al., 2014; Willoughby et al., 2011), these were not included as distinct components in the creation of profiles.

Overview of the Present Study

The current study will utilize a person-centered approach to identify profiles of children's social-regulatory processes prior to school entry and examine the predictive value of these profiles across the transition to school. Specifically, this study will employ latent profile analysis (LPA) of data sets from the NICHD Study of Early Child Care and Youth Development (SECCYD) to identify profiles of children at 54 months of age using manifest variables established via the literature of hot self-regulation, cool self-regulation, attribution bias, and social problem solving. Additionally, differential prospective associations of the derived profiles will be examined related to indicators of academic achievement and behavioral adjustment in first grade. The specific research questions that will be addressed are as follows:

1. What types of profiles will be identified at 54 months of age, based on a combination of children's self-regulatory and SIP competence?
2. To what extent do individual and contextual factors (gender, ethnicity, cognitive ability, family income, maternal sensitivity) predict membership in social-regulatory profiles?
3. To what extent do social-regulatory profiles at 54 months predict academic achievement and behavioral adjustment in first grade?

Chapter 2: Literature Review

The value of high-quality preschool programming has been increasingly heralded by politicians, researchers, and educators over the course of the past decade (Armor & Sousa, 2013; Beekman, 2014). Access to preschool, once limited to either private options, state-subsidized, or Head Start programs, is rapidly broadening following President Obama's 2013 introduction of the "Preschool for All" initiative (Chandler, 2014). This movement towards universal preschool access presents increased opportunities for implementation of school-based interventions to improve school readiness skills in young children, and coincides with converging research in domains of educational, developmental, and prevention sciences seeking to identify elements of early education and experience that contribute to improved school and life outcomes (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Forry, Davis, & Welti, 2013; Jones, Bub, & Raver, 2013; Konold & Pianta, 2005).

Although the term "school readiness" is ubiquitous in discussions of early childhood programming, attempts to define and measure young children's preparedness to succeed in school vary widely in the degree to which various child competencies are considered and prioritized (Blair, 2002; Duncan et al., 2007; Raver, Garner, & Smith-Donald, 2007). Within a bioecological framework, differences in children's development prior to school entry may be attributed to child-level factors, contextual factors, and their interaction (Bronfenbrenner, 1979; Chang et al., 2012). For the purposes of the present study, research is reviewed according to a child-centered model of school transition, which acknowledges a broader ecological framework but focuses primarily on the

individual competencies and behavioral functioning that children demonstrate just prior to school entry (Duncan et al., 2007; Rimm-Kaufman & Pianta, 2000). According to this model, children's characteristics, skills, and patterns of behavior provide the foundation for classroom adaptation in kindergarten and first grade through their contribution to the learning environment, receptiveness to instruction, and elicitation of feedback from teachers and peers.

In line with a child-centered model of school transition, prior study has indicated various child characteristics that predict adaptation to school including cognitive and language abilities, pre-academic skills, temperament, and social-emotional functioning (La Paro & Pianta, 2001; NICHD ECCRN, 2003; Schoen & Nagle, 1994). Consistently, children's cognitive abilities and pre-academic skills (letter and number recognition) are the school-entry factors that best predict later school achievement (Duncan et al., 2007; Stevenson & Newman, 1986). Relatedly, associations between sociodemographic risk factors, such as chronic poverty, and deficits in pre-academic skills have fueled widespread efforts to mitigate these risk factors through early childhood programming (Ansari & Winsler, 2011; Beekman, 2014; Bush, 2002). Substantial evidence supports the effectiveness of high-quality early childhood programming in improving children's academic skills across the transition to school, but studies showing that early childhood academic gains are either no longer evident or are attenuated by first grade have resulted in ongoing debate about the constellation of readiness skills that best prepare children for long-term success (U.S. Department of Health and Human Services, 2010). In particular, a growing body of recent research has been focused on domains of social-emotional and self-regulatory functioning as potentially important predictors of successful adaptation to

school, with the suggestion that these factors play a critical role in helping children sustain and build on academic skills given the larger class sizes, longer instructional periods, and expectations for work in larger groups that they typically face in kindergarten as compared with preschool (Denham, Bassett, Sirotkin, Brown, & Morris, 2015; Jones et al., 2013; Rimm-Kaufman et al., 2000; Sabol & Pianta, 2012).

Blair (2002) proposed a model of school readiness that combines findings from neurodevelopmental, social-emotional, and school readiness literatures. In his integrative framework, children's early social-emotional and self-regulatory functioning operate interdependently to promote the higher-order cognitive and behavioral development necessary for continued learning in the school setting. Blair posited that children with higher emotional reactivity or likelihood to either become disinhibited or withdraw in emotion-activating circumstances may demonstrate difficulty focusing attention and applying mental processes necessary for learning. He suggested that learning would be most difficult for children with higher reactivity to social-emotional triggers and lower self-regulatory capabilities. Paralleling Blair's theory, the intersection of cognition and social-emotional functioning as it relates to school readiness has been increasingly explored in research related to respective domains of self-regulation and social information processing, with emerging support for importance of both factors as predictors of success across early childhood and school-age years. Recently, Denham and colleagues (2014) proposed a model of early childhood social-emotional learning necessary for school readiness adapted from prior models by Rose-Krasnor (1997) and Payton et al. (2000). Their bio-ecological model posits that individual social and self-regulatory skills operate interactively with environmental factors including parent, peer,

and teacher relationships to predict children's success with inter- and intra-personal goals, which in turn contribute to early school adjustment and achievement. At the individual level, Denham and colleagues identified four core components of social-regulatory functioning necessary for early school success based on prior research and theorizing: self-regulation, social awareness/emotion knowledge, responsible decision-making, and relationship skills. Although self-regulation and social information processing (SIP) have been extensively studied in separate fields, Denham et al.'s model is the first to consider factors of self-regulation and SIP as interactive predictors of children's adaptation to school, and provides the theoretical foundation for the present study.

In the following sections, the current literature will first be reviewed specific to variable-centered study of self-regulation and social information processing in early childhood. Next, the nascent research base concurrently examining self-regulation and SIP will be detailed. Finally, a review of person-centered study of self-regulation and SIP to date will be offered, along with discussion of gaps in the current research base and need for further study.

Self-Regulation in Early Childhood

The study of self-regulation in children has been the focus of extensive research across disciplines over the course of the past half-century (Post et al., 2006). Plasticity in the area of self-regulation has received particular attention focused on the early childhood period (Bernier, Carlson, & Whipple, 2010; Lunkenheimer, Kemp, & Albrecht, 2013; Raver, Blair, & Willoughby, 2013), with conceptual connection to the observation that brain regions primarily associated with self-regulation skills undergo marked changes in

development from age 3 until around age seven (Huttenlocher, 2002; Posner & Rothbart, 2000). Children's self-regulation skills during this developmental period have been shown to predict a broad array of academic and social outcomes (Allan et al., 2014; Becker, Miao, Duncan, & McClelland, 2014; Blair & Razza, 2007; Raver et al., 2007).

Several decades ago, Walter Mischel and his colleagues (1970) examined self-control in preschool-age children with a simple delay of gratification experiment known as the "marshmallow test" which laid the foundation for contemporary work examining self-regulation (Mischel & Ebbesen, 1970). His subsequent longitudinal studies have demonstrated that the number of seconds children were able to delay gratification in pursuit of a larger reward significantly predicted outcomes in adolescence including SAT scores, social and cognitive competencies, and coping skills (Mischel, Shoda, & Peake, 1988; Shoda, Mischel, & Peake, 1990). Subsequent study of self-regulation across arenas of psychology has built upon Mischel and colleagues' early work in delay of gratification and has extended their findings to consider multiple factors of self-regulation (Neuenschwander, Röthlisberger, Cimeli, & Roebbers, 2012; Zhou, Chen, & Main, 2012). The majority of early childhood self-regulation study has been conducted by developmental scientists through research on processes of effortful control and executive function.

Effortful Control. Self-regulation has been conceptualized in temperament-based research as the ability to suppress a prepotent or dominant response in order to display a less salient or subdominant response (Rothbart & Ahadi, 1994). For example, a young child who wants a toy that another child is holding may suppress the urge to grab the toy (dominant response) and instead request the toy (subdominant response). Temperament

researchers employ the term “effortful control” to describe this self-regulatory process and consider effortful control to involve the synthesis of cognitive and emotion-related developmental processes (Blair & Razza, 2007). This definition is consistent with broader definitions of self-regulation, which describe it as the overarching ability to intentionally regulate or manage thoughts, feelings, and behaviors while in pursuit of attaining a specific goal (Blair & Ursache, 2011). Specification of effortful as opposed to reactive control in temperament research distinguishes behaviors and cognitions that are voluntarily exercised by an individual from those that are reflexive (Eisenberg & Spinrad, 2004). Research on effortful control has been primarily been focused on emotion-related and motivationally relevant processes, with less examination of meta-cognitive processes occurring in affectively-neutral settings (Neuenschwander et al., 2012). Consequently, the temperamentally-based construct of effortful control has been conceptualized as a proxy for emotion-related self-regulation (Eisenberg & Spinrad, 2004). Emotion regulation has also been conceptualized as a distinct construct from affectively-neutral regulation beyond effortful control research, with evidence that predictors and outcomes relate differentially to regulation with varying emotional valence (Cole, Marin, & Dennis, 2004)(Zalewski, Lengua, Wilson, Trancik, & Bazinet, 2011).

Executive Function. Cognitive neuropsychologists describe a definition of self-regulation that is related to but distinct from the construct of effortful control. In the cognitive arena, self-regulation has been widely defined as planning, problem-solving, and goal-directed activity involving cognitive processes of attentional flexibility (or attention shifting), working memory, and inhibitory control (Davidson, Amso, Anderson, & Diamond, 2006; McClelland & Cameron, 2012; Neuenschwander et al., 2012; Miyake

et al., 2000). Within learning contexts, attentional flexibility involves the process of selectively focusing attention on necessary or important aspects of the environment, such as listening to a teacher giving instructions rather than to conversation of peers (Ponitz et al., 2009). Working memory involves holding information in the brain as well as transforming or manipulating it, such as remembering a series of directions and following them in order (D'Esposito & Postle, 2002). Inhibitory control involves the process of suppressing an impulse or resisting temptation in favor of a prosocial alternative, such as raising a hand rather than blurting out a response during instruction (Barkley, 1997). The cognitively-based operations of attentional flexibility, working memory, and inhibitory control are collectively referred to as executive function processes, and have been the focus of cognitive theory and a large body of research related to self-regulation (Blair & Razza, 2007). In contrast to the emotion-activating nature of most of the scenarios traditionally used to measure SR in effortful control study, the majority of cognitive research on self-regulatory executive function processes has been focused on self-regulation in affectively neutral scenarios.

Environmental Contributors. Whereas the majority of self-regulation research in the 20th century was concerned with conceptual and developmental examination of the topic, recent momentum has shifted to the study of prevention-related and promotion-oriented factors associated with differences in the development of self-regulation (Allan, Hume, Allan, Farrington, & Lonigan, 2014; Raver, Garner, & Smith-Donald, 2007). Evidence that self-regulation predicts a variety of short- and long-term social, academic, and health outcomes (Blair & Razza, 2007; Fergusson, Boden, & Horwood, 2013; McClelland et al., 2007; Moffitt & Arseneault, 2011) warrants continued focus on

mechanisms of self-regulation development and intervention (Blair & Diamond, 2008; Schmitt, McClelland, Tominey, & Acock, 2014; Wisner, Jones, & Gwin, 2010).

Although genetic contributors to individual differences in self-regulation skills are documented (Friedman, Miyake, Robinson, & Hewitt, 2011), a growing evidence base supports the additive influence of environmental factors on children's development of self-regulation (Dennis, 2006; Gunnar & Donzella, 2002; Raver et al., 2011).

Parenting. A growing body of research has indicated parenting quality as an influence on young children's self-regulation (Bernier et al., 2010; Kochanska, Aksan, Prisco, & Adams, 2008; Taylor, Eisenberg, Spinrad, & Widaman, 2013). The majority of this research has focused on parenting quality of mothers and mother-child interactions, although examination of fathering influences has seen an increase in recent years (Kochanska et al., 2008). Specific parenting factors that have been linked to children's self-regulation skills include maternal responsiveness and warmth, positive guidance and teaching, and negative control or intrusiveness (Eisenberg et al., 2010; Kochanska, Murray, & Harlan, 2000; Taylor et al., 2013). More recent studies have examined child characteristics as a mediator of parenting's association with self-regulation as well as potential bidirectional effects of child-parent characteristics and interactions (Dennis, 2006; Kim & Kochanska, 2012).

Multiple studies concerning parenting contributors to self-regulation have examined the association between qualitative aspects of parenting and young children's self-regulation (Post et al., 2006). For example, one parenting quality that has been explored across multiple studies is responsiveness, described as a parent's tendency to accept and respond to child signals for attention and emotional support with sensitivity,

warmth, and supportiveness (Darling & Steinberg, 1993). Kochanska and colleagues (2000) examined maternal responsiveness and effortful control aspects of self-regulation in young children and found that maternal responsiveness with children at 22 months uniquely accounted for variance in children's effortful control at 33 months. Bernier and colleagues (2010) extended these findings and demonstrated that maternal sensitivity at 12 months predicted children's self-regulation at 26 months. In slightly older children, there is some support for differential associations of parental warmth (positive affect and affection towards a child) and responsiveness to distress with children's self-regulation; maternal and paternal responsiveness to distress predicted negative affect regulation in 6-8 year-old children, whereas maternal warmth was associated with increased regulation of positive affect (Davidov & Grusec, 2006). Positive maternal expressiveness and warmth has also been shown to predict stronger self-regulation skills in preschool and early elementary-age children (Eisenberg et al., 2001). Beyond the effects of maternal responsiveness, the latter study included examination of additional aspects of parenting that are conceptually linked to influences on children's development of self-regulation: autonomy support and mind-mindedness (Harrist & Waugh, 2002). Results indicated that mothers' autonomy support, or the tendency to scaffold learning experiences for children, at 15 months predicted aspects of children's self-regulation at 26 months, while mind-mindedness, the tendency to describe mental states and thinking when talking to children, predicted changes in children's self-regulation between 18 and 26 months (Bernier et al., 2010). Further studies have demonstrated that increased frequency of maternal teaching involving autonomy support for three-year-olds predicted subsequent self-regulation (Landry, Miller-Loncar, Smith, & Swank, 2002; Lunkenheimer et al.,

2013), and mothers' scaffolding with preschoolers predicted initially higher levels of executive control aspects of self-regulation as well as gains in executive control (Lengua, Kiff, et al., 2014). Additionally, there is some support for the possibility that the effects of autonomy support and self-regulation may be bidirectional, as evidenced by findings that young children's self-regulation predicts the quality of subsequent parental teaching strategies (Eisenberg et al., 2010).

The effects of the parent-child relationship on children's short- and long-term self-regulation may also be observed through attachment theory research. Attachment theory posits that the quality of the relationship formed between an infant and a primary caregiver shapes a developing child's exploration of and expectations about their environment (Ainsworth, Bell, & Stayton, 1974; Bowlby, 1969; Sroufe, 1988). Extant research has demonstrated that warm, sensitive parenting contributes to secure attachment, and that secure attachment relationships, in turn, predict numerous social, behavioral, and cognitive outcomes for children (Booth-Laforce & Oxford, 2008; Cohn, 1990; Fearon, Bakermans-Kranenburg, van Ijzendoorn, Lapsley, & Roisman, 2010; Murray et al., 2011). Studies specific to self-regulation also demonstrate benefits of secure attachment. Drake and colleagues (2014) illustrated the theoretical connection between attachment and self-regulation by suggesting that secure attachment relationships contribute to young children's developing self-regulation through internalization of supportive responses they have received from caregivers and experience regulating responses within the context of such support. Their analysis of data from the NICHD Study of Early Child Care and Youth Development (NICHD Early Child Care Research Network [ECCRN], 2005) indicated that attachment measured at 15

and 36 months predicted children's social self-control and attentional inhibition between Grades 1 and 5 (Drake, Belsky, & Fearon, 2014). Related research has demonstrated connections between secure attachment and increased success on delay of gratification tasks (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002) as well as inhibitory control (Fearon & Belsky, 2004).

In contrast to the positive associations observed between aspects of parenting and attachment and children's self-regulation, negative control, characterized by punitive verbalizations, scolding, and physical control in a parent's behavior towards children, has been shown to predict lower levels of self-regulation. Putnam and colleagues (2002) found that 30-month-old children whose mothers used more controlling and directive statements showed lower self-regulation during a delay-of-gratification task. Similar examples of the negative association between parental negative control and self-regulation have been observed even when controlling for child characteristics such as defiance (Kochanska & Knaack, 2003). Maternal negative expressiveness, involving negative child-directed facial expressions and verbalizations, has also been shown to predict lower self-regulation skills in 4- to 8-year-old children (Eisenberg et al., 2001). There is some evidence that young children's self-regulation may also have an evocative effect on mental health issues such as depression that are associated with increased negative expressiveness; mothers with symptoms of depression whose children demonstrated low self-regulation at age three experienced slower decreases in symptoms of depression over the next seven years compared with mothers of children with high self-regulation (Daniel E Choe, Olson, & Sameroff, 2014).

Research concerning the associations of parenting with self-regulation has been extended to consider other child and parent characteristics and interaction patterns as moderators. Dennis (2006) examined child and mother temperament characteristics as moderators of the relationship between parenting and self-regulation in 3- and 4-year-old children and found that child temperament characteristics moderated the relationship between parenting and self-regulation outcomes. Child temperament has also been examined as a moderator in studies of dyadic quality of parent-child interactions. Specifically, the dyadic construct of mutually responsive orientation (MRO), a relationship characterized by closeness, positivity, and mutually-binding behaviors between parent and child has been shown to predict young children's self-regulation, but only for children high in negative emotionality (Kim & Kochanska, 2012). Moreover, positive dyadic aspects of parent-child relationships appear to correlate with subsequent lower frequency of negative control over time for mothers, although the same finding has not been supported for fathers (Kochanska et al., 2008).

Environmental reliability. Another potential contributor to self-regulation in young children is the notion of environmental reliability. Environmental reliability refers to the child's perception of the predictability and consistency of temporal contingencies based on reinforcement history in similar scenarios (Mischel & Staub, 1965). In a variation on Mischel's (1970) Marshmallow Test experiments, Kidd and colleagues (2013) examined the delay-of-gratification responses of young children (3:6 – 5:10) and found that children who experienced reliable and predictable environmental conditions during a laboratory visit were significantly better able to delay gratification on a subsequent task than were children who experienced unreliable behavior from laboratory

researchers (Kidd, Palmeri, & Aslin, 2013). Although further study is needed to replicate these findings, the possibility that environmental reliability predicts self-regulation above and beyond parental influences has implications for potential impacts and mesosystemic interventions that focus on the consistency between environments to support children's self-regulation in settings outside of the home such as school and child care.

Contextual risk. Contextual risk factors that may influence children during the critical period for self-regulation development are numerous and include poverty, single-parent household, household density, neighborhood risk, parental mental illness, and low parental education (Lengua, Honorado, & Bush, 2007). Several studies have indicated that family income below the poverty threshold is associated with worse performance on executive function tasks for young children (Farah et al., 2006; Hughes & Ensor, 2005; Hughes, Ensor, Wilson, & Graham, 2010). Extant research on associations between poverty and executive function aspects of self-regulation also underscores the further deleterious effect chronic poverty, as opposed to episodic poverty, may have on young children and the differential susceptibility of some children to poverty-related stressors. Chronic poverty between the ages of 12 and 48 months has been shown to correlate with lower performance on executive function tasks at 48 months for children with higher temperamental reactivity, but not for children with lower reactivity (Raver et al., 2013).

Because many environmental risk factors tend to co-occur, much research on contextual associations with child adjustment has been conducted using cumulative risk models that take into account the total number of stable contextual risk factors that are present in a child's life during the developmental period in question (Evans, 2003; Masten et al., 1999; Sameroff, Seifer, & Barocas, 1987; Sampson & Laub, 1994). Study

of the effects of cumulative risk has included inquiry across multiple factors of self-regulation. Cumulative risk in early childhood has been shown to be negatively correlated with children's executive function at ages 2, 4, and 6 years of age (Hughes & Ensor, 2007) and lower delay-of-gratification ability in preschool children (Lengua, Moran, et al., 2014). Recent studies of the effects of cumulative risk have also demonstrated that child traits may mediate associations between cumulative risk and self-regulation. In a study of cumulative risk and emotion-related self-regulation, Chang and colleagues (2012) found that cumulative risk at age 1.5 – 2 years of age predicted lower emotion regulation skills at age three, but only for boys with higher negative emotionality. Consideration of temperament has also been supported in predicting differential response to risk; children with more reactive temperaments have been shown to demonstrate stronger associations between cumulative risk and executive function than children with less reactive temperaments (Raver et al., 2013).

Given the well-documented connection between contextual risks associated with poverty and children's development of self-regulation, the mechanisms underlying this relationship should be understood. Beyond the effects of poverty-related factors on children, the impact of these factors on parents and parent-child interactions is becoming increasingly evident. Contextual risk factors for families have been shown to predict higher stress levels for parents and children, less parenting efficacy, lower rates of supportive, responsive parenting, and higher use of negative control in parenting practices (Mistry, Vandewater, Huston, & McLoyd, 2002; Shaffer, Suveg, Thomassin, & Bradbury, 2011). Additionally, higher cumulative risk has been associated with fewer emotion-related social behaviors in parents of toddlers (Brophy-Herb, Stansbury,

Bocknek, & Horodyski, 2012). Much recent work has underscored the function of family processes as a mediator between contextual risk factors and children's self-regulation. Zalewski and colleagues (2012) studied associations between poverty and single-parent status on the development of effortful control in preschoolers and found that single-parent status was associated with lower effortful control, but only for parents living in poverty (Zalewski et al., 2012). Parenting practices and attachment have also been shown to mediate the relationship between contextual risk factors and children's emotion-related self-regulation (Brophy-Herb et al., 2012; Lengua et al., 2007; Shaffer et al., 2011) and inhibitory control (Fearon & Belsky, 2004). Recent longitudinal study by Blair and colleagues has illustrated the association of poverty with higher stress physiology in infancy and early childhood (Blair, Raver, Granger, Mills-Koonce, & Hibel, 2011). Moreover, results from the same sample indicated parental sensitivity and stress physiology as mediators of the relationship between poverty and disruption in the development of self-regulation (Blair, Granger, et al., 2011). Taken together, these findings illustrate the importance of continued focus on supporting protective factors, such as family well being and parent-child relationship processes, that contribute to child resilience in the face of adversity (Newland, 2014).

Associated Outcomes

Academic achievement. The study of self-regulation as a potential contributor to early academic skill development has implications for children's entire school experience. Children's pre-academic and early academic skills have been shown to be the strongest predictor of their long-term academic achievement (Duncan et al., 2007), and academic skill levels in children usually remain fairly stable after the first-grade year

(Entwisle & Hayduk, 1988). Self-regulation skills have been shown to be distinct from other predictors of academic functioning, such as general cognitive abilities (Zelazo & Muller, 2002), and there is some evidence, albeit modest, that young children's self-regulation skills may be improved through classroom-wide interventions (Diamond, Barnett, Thomas, & Munro, 2007; Schmitt et al., 2014). Exploration of the relationship between self-regulation in young children and early academic skill development may consequently reveal opportunities for changing academic trajectories.

To date, extant research has demonstrated numerous connections between self-regulation skills in early childhood and early academic skills (Becker et al., 2014; McClelland et al., 2007; Neuenschwander et al., 2012). Blair and Razza (2007) examined various aspects of self-regulation including effortful control and aspects of executive function (inhibitory control and attention shifting) in a longitudinal study of children from low-income homes between the ages of 3 to 5 years of age. They found that inhibitory control and teacher-reported effortful control in preschool predicted children's math scores in kindergarten. Additionally, teacher-reported effortful control in preschool and inhibitory control in kindergarten was associated with children's letter knowledge in kindergarten. Recent replication of these findings has confirmed the association between inhibitory control at age 3 and math skills in kindergarten, even after controlling for earlier numeracy skills, socio-economic status, processing speed, and language skills (Clark, Sheffield, Wiebe, & Espy, 2013), and inhibitory control has also been associated with emergent math skills in children from typical-income homes (Espy & McDiarmid, 2004). Links have also been demonstrated between growth in self-regulation and improvement in early academic skills. McClelland and colleagues (2007) examined the

relationship between self-regulation and emergent academic skills in preschool children using a self-regulation measure that tapped inhibitory control, attention, and working memory. They found that self-regulation in fall of the preschool year was related to concurrent emergent skills in literacy and math. Furthermore, children who made greater gains in self-regulation over the course of the prekindergarten school year also showed greater improvement in vocabulary and emergent math and literacy skills from fall to spring. These findings have been replicated with children from predominantly low-income families, with associations demonstrated between self-regulation and emergent literacy, math, and vocabulary skills even after controlling for child age, ELL status, and maternal education (Becker et al., 2014).

Whereas most of the aforementioned studies examined multiple factors of self-regulation drawn from temperament-based and neural science traditions, a recent study of preschool children using an integrative framework of self-regulation encompassing aspects of effortful control and executive function inhibitory control also demonstrated associations between self-regulation and emergent literacy skills, specifically in the areas of phonemic awareness and letter knowledge (Allan & Lonigan, 2011). In a subsequent meta-analytic investigation of self-regulation specific to inhibitory control, Allan and colleagues (2014) found that while inhibitory control was generally found to be associated with academic skills in preschool and kindergarten children, certain types of inhibitory control measures were better predictive than others. Specifically, they found that associations were strongest between academic skills and behavior tasks that were intended to measure “cool”, or low emotion-arousing, inhibitory control than those designed to measure “hot”, or emotion-arousing, inhibitory control. Additionally,

findings of their meta-analysis indicated that direct behavior tasks and teacher-report measures of inhibitory control were better predictors of academic skills than were parent-report measures. Finally, they concluded that results supported inhibitory control as a better predictor of emergent math skills than literacy skills in preschool and kindergarten children (Allan et al., 2014).

Social-emotional functioning. The interdependence of children's social-emotional and academic functioning is becoming increasingly apparent (Ladd, Birch, & Buhs, 1999; Raver et al., 2007). Beyond the links between self-regulation and academic functioning, associations have been observed between self-regulation and social-emotional factors including social competence and adjustment problems in young children (Eisenberg, Smith, Sadovsky, & Spinrad, 2004). These associations have been observed both in proximal development as well as longitudinally, and support the notion that self-regulation underlies observable differences in children's developmental trajectories of adjustment (Posner & Rothbart, 2000).

Short-term studies of self-regulation have demonstrated associations with children's maladaptive behaviors across home and school settings. Research has demonstrated that delay of gratification in three-year-children predicts parent-reported aggression and conduct problems (Gusdorf, Karreman, van Aken, Deković, & van Tuijl, 2011). Greater inhibitory control in children 4 to 8 year-old children have been shown to concurrently predict fewer teacher-reported externalizing and internalizing behaviors (Allan & Lonigan, 2011). Greater effortful control throughout early childhood has also been associated with fewer parent- and teacher-reported disruptive behaviors at ages five and six, with child guilt as a moderating factor (Kochanska, Barry, Jimenez, Hollatz, &

Woodard, 2009). Additionally, inhibitory control and delay of gratification aspects of self-regulation in children during early childhood have been associated with later social problems as well as symptomology of ADHD (Campbell & von Stauffenberg, 2009; Gewirtz, Stanton-Chapman, and Reeve, 2009)

Beyond the evidence that poor self-regulation contributes to adjustment difficulties in children, the extant literature also suggests that stronger self-regulation is linked to greater social competence. Attentional and inhibitory control aspects of self-regulation have been shown to relate to preschoolers' resiliency and agreeableness as rated by peers and teachers (Cumberland-Li, Eisenberg, & Reiser, 2004), and preschool children with greater effortful control are more likely to demonstrate social competence such as empathy and problem-solving during stressful conflicts with peers (Fabes et al., 1999). Self-regulation as measured by effortful control has also been linked to greater empathy in five- to eight-year-old children (Gurthrie, Eisenberg, & Fabes, 1997; Rothbart & Ahadi, 1994). Although further research is needed to specify relationships between components of self-regulation and social-emotional outcomes across development, current evidence suggests that aspects of self-regulation appear to be critical to the development and use of social-emotional skills and competence.

Adaptation to school. A particularly relevant arena for examining potential effects of early childhood self-regulation is the transition to school. During entry to kindergarten, children are faced with a range of expectations related to regulation, including the need to attend to and follow learning instruction, comply with behavioral expectations, and engage in social interactions involving turn-taking, compromising, and problem-solving (Raver et al., 2007). Across a nationally-representative sample,

kindergarten teachers have named difficulty with these regulation-related skills as a primary deficit in children's kindergarten readiness (Rimm-Kaufman, Pianta, & Cox, 2000). Following bioecological models, factors such as family background, cognitive ability, and gender have been shown to predict successful adjustment to kindergarten (Ladd et al., 1999), with evidence of mediation by processes that may be related to self-regulatory behaviors that enable positive relationships with teachers and peers and engagement in classroom activities (Valiente, Swanson, Lemery-Chalfant, & Berger, 2014). Self-regulation upon entry to kindergarten has also been shown to predict end-of-the-year kindergarten teacher's ratings of children's classroom participation specific to behavioral self-control, cognitive self-control, and work habits (Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). Blair and Razza (2007) studied self-regulation in a sample of children attending Head Start across the transition to kindergarten. They found that various aspects of self-regulation were predictive of emergent academic skills in kindergarten independent of intellectual ability, with particularly strong associations found between inhibitory control and math and reading skills (Blair & Razza, 2007). Kindergarten students with higher self-regulation in the fall have been also been shown to make greater gains in math skills over the course of the kindergarten year (Ponitz et al., 2009). In a meta-analysis of links between school-entry variables and later school achievement, Duncan and colleagues (2007) found attention-related skills including self-regulation to be the third most powerful predictor of later school achievement, following early math and reading skills (Duncan et al., 2007). In sum, these findings support the importance of self-regulation skills at school entry as a predictor of children's early academic achievement and successful transition to school.

Long-term outcomes. Recently, longer-term outcomes associated with self-regulation have been demonstrated (Moffitt & Arseneault, 2011; Converse, Piccone, & Tocci, 2014). Moffitt and colleagues (2011) followed a cohort of children from birth for over 30 years and found that self-regulation beginning at age 3 was predictive of pathways to maladaptive behaviors during adolescence (school drop-out, smoking) and eventual job satisfaction and income. Similar work by Fergusson and colleagues (2012) found associations between lower self-regulation beginning at age six and poorer outcomes into adulthood, including higher instances of violent offense and lower educational and income attainment (Fergusson et al., 2013). When considering the long-term implications of impaired self-regulation, it is clear that preventative supports for families and young children are warranted in order to alter these trajectories and their impact on individuals and society as a whole.

Taken together, the links between self-regulation in early childhood and major life outcomes illustrate striking opportunities to alter trajectories for children. The multiple associations between self-regulation and academic, social-emotional, and long-term socioeconomic outcomes underscore the importance of continued focus on contributors to self-regulation that may be impacted through intervention to benefit young children. In addition to the research summarized thus far, much current research is focused on differences in how self-regulation processes may differ according to the emotional valence of a situation. This research is summarized in the following section, with description of outcomes differentially associated with emotion-activated and emotion-neutral self-regulation.

Hot and Cool Factors of Self-Regulation

As summarized earlier, self-regulation research to date has been primarily focused on the construct of effortful control in temperament-based psychology and executive function in cognitive neuropsychology. Given the broad and growing research base according to these two distinct conceptualizations of self-regulation within their respective disciplines, recent calls have been made for a unified definition of self-regulation that bridges the concepts of EC and EF (Zhou et al., 2012; Neuenschwander et al., 2012). Despite areas of conceptual overlap between EC and EF, studies comparing the two using traditional measures have yielded only modest correlations (Blair & Razza, 2007). Moreover, EC and EF have been found to differently predict academic and social outcomes for children, further indicating that these two conceptualizations of self-regulation cannot be used interchangeably. Recent transdisciplinary attempts to find common ground between EC and EF constructs have been focused on the component of inhibitory control, with particular exploration of contributions of emotion within this construct.

Examination of theoretical and measurement approaches to SR study across EC and EF provide some support for alignment of these constructs along the inhibitory control dimension of EF (Allan & Lonigan, 2011). According to this conceptualization, EF is considered to be a broader construct than EC in that EF encompasses additional components of working memory and attention shifting along with inhibitory control, whereas EC may align primarily with inhibitory control alone. Although there is some evidence supporting this argument (Allan et al., 2014; Gusdorf et al., 2011), confirmation of inhibitory control as a common factor bridging EC and EF research has been complicated by disparities in the types of tasks used to measure inhibitory control across

these respective disciplines (Zhou et al., 2012). Specifically, study of the ability to inhibit responses has been examined primarily within emotion-arousing contexts in EC research using tasks requiring delay of gratification or regulation of negative affect (Hot IC), whereas EF measures of inhibitory control have primarily been conducted under circumstances assumed to be more emotion-neutral (Cool IC) involving tasks such as Go/No Go tasks (Neuenschwander et al., 2012; Zhou et al., 2012). The possibility that executive control in young children may best be represented by two separate but interrelated hot and cool constructs has been explored by researchers across EC and EF traditions, and has the potential to provide a heuristically useful approach to study of self-regulation in young children.

Factor analytic support. Support for a two-factor Hot-Cool model of inhibitory control in early childhood has been demonstrated by several recent factor analytic studies. Brock and colleagues (2009) examined hot and cool inhibitory control with a sample of 173 kindergarteners and found that a two-factor hot-cool model fit the data better than a one-factor model (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009). Additionally, they found that hot and cool factors were moderately and positive correlated. A subsequent larger study by Willoughby and colleagues examined hot and cool inhibitory control in a sample of 759 children aged 3 – 5 years old and demonstrated superior fit of a two-factor model for their data (Willoughby et al., 2011). Bassett and colleagues also found support for a two-factor hot-cool model of inhibitory control with 296 preschoolers across two timepoints, with evidence for significant stability of individual differences on hot and cool factors (Bassett & Denham, 2012). In contrast to these findings, other studies of preschool children, albeit with smaller samples, have

found that a one-factor model of inhibitory control provides a better fit with the data than a two-factor model (Allan & Lonigan, 2011; Sulik et al., 2010). Although there is some ongoing debate regarding the latent structure of inhibitory control in children given the contradictory results of the relatively few studies in this area, the preliminary evidence for hot-cool distinctions in self-regulation offers opportunity for improved understanding for individual differences and outcomes associated with these factors. In addition, with the increased focus on providing personalized or tailored services, these two dimensions of self-regulation offer ways in which providers can better understand and more precisely intervene to improve children's self-regulation.

Predictive value. Beyond factor analytic results, examination of the predictive value of hot and cool variables lends support for separable factors in early childhood. Hot IC has been shown to predict behavioral performance whereas Cool IC predicted academic performance in cross-sectional study of preschoolers (Willoughby et al., 2011). Similar predictive relationships have been observed in longitudinal study, with Hot IC in preschool predicting ratings of children's behavior at age 8 and Cool IC predicting ratings of children's academic performance (Kim et al., 2013). Allan and colleagues (2014) conducted a meta-review of 75 studies of inhibitory control and early academic skills and found that cool IC tasks, but not hot IC tasks, were associated with children's academic skills in preschool and kindergarten (Allan et al., 2014). There is also evidence that hot and cool IC may contribute differently to behavior in students with ADHD, a disorder characterized by deficits in inhibitory control (Thorell, 2007). Despite the general indication from these studies that hot self-regulation may predict behavioral outcomes whereas cool self-regulation better predicts academic success, results of one

study in this area failed to confirm predictive value of hot self-regulation. Brock and colleagues (2009) found support for a relationship between Cool IC and academic and behavioral functioning, but no significant relationship between Hot IC and these outcomes (Brock et al., 2009).

Taken together, the research to date on hot and cool factors of self-regulation in young children generally supports the validity and differential predictive value of these two factors, despite some evidence to the contrary (Brock et al., 2009). These differences in results may be attributable to differences in measures for hot and cool self-regulation utilized across studies. According to Blair's (2002) model of school readiness, another explanation for mixed results of predictive studies may reside in individual differences in areas that interrelate with self-regulation, such as social-emotional reactivity and related processing of social information. Indeed, children's internal reactions and processing of social scenarios have been identified as likely interrelated with self-regulatory functioning, and evidence suggests that these processes may act synergistically to impact young children's child social and academic adjustment. Following is a review of social information processing in children.

Social Information Processing

As mentioned previously, young children's self-regulation skills are associated with a host of academic and adjustment outcomes, including social competence (Fabes et al., 1999). For many young children, the preschool setting is the first experience in which they are expected to play and work collaboratively with groups of children their same age, implicating preschools as possible venues for prevention efforts aimed at improving social competence. As social-emotional learning (SEL) programs and requirements

proliferate within preschool and elementary school settings (Scott-Little, Kagan, & Frelow, 2006), consideration of theoretical models and associated research that guide development of such programs is essential. Dodge and colleagues' social information processing (SIP) model offers a useful framework for understanding children's social development (Crick & Dodge, 1994, 2006; Dodge, 1980). The SIP model describes the ways in which children attend to social behavior, interpret the emotions and intentions of others, and enact responses in social situations. According to this model, external social cues activate mental mechanisms for processing social information. Initial stages of processing include 1) attending to and encoding social cues and 2) interpreting cues, while later stages include 3) clarifying goals, 4) generating possible responses, and 5) selecting a response. In the first step, children notice and direct attention to aspects of the scenario such as situational factors, facial expressions, nonverbal cues, and verbalizations. In the second step, children utilize salient cues to make inferences about the intentions of others in the scenario. The third step involves internal processing of the child's own motives and desired outcomes for the scenario. Finally, the fourth and fifth steps include the processes of identifying a range of choices for how to respond to the social situation and ultimate selection of a response. Throughout this process, an individual's mental database of behavior for social interactions is affected by and affects each step of responding and guides perception of inappropriate and appropriate social behavior. Thus, distortions in early stages (selective attention to social cues and interpretation of others' behavior) and/or later stages (knowledge of effective/ineffective or appropriate responses to social scenarios) may result in problematic and maladaptive social decision-making.

For preschool-age children, differences in aspects of SIP have been shown to affect social behavior and school readiness (Denham, Way, Kalb, Warren-Khot, & Bassett, 2013; Raikes, Virmani, Thompson, & Hatton, 2012; Ziv, 2012). In particular, the stages of interpretation of cues, response construction, and response decision have demonstrated associations with children's social competence and early academic readiness skills. At the stage of interpretation of cues, the majority of research has been focused on the construct of hostile attribution bias (HAB), the tendency to attribute ambiguous but unpleasant actions of others as stemming from hostile, rather than benign, intent (Choe, Lane, Grabell, & Olson, 2013; Nelson & Perry, 2014). A smaller body of research has examined social problem-solving, the generation and selection of solutions to conflicts, as manifestation of the later stages of social information processing (see Adrian, 2010 for a review). Contributors to and outcomes associated with HAB and social problem-solving are reviewed in the following section.

Contributors to Social Information Processing

Contextual risk. Various contextual risk factors have been associated with deficits in social information processing. Shaw and colleagues (2003) examined risk factors in early childhood in a sample of 178 economically disadvantaged boys and found that factors of low socio-economic status, single-parent status, and low maternal education predicted more maladaptive response generation to social problem-solving scenarios at age 10.

Chen and Matthews (2001) examined the attribution biases of 201 children (ages 8 -10) and adolescents (ages 15-17) and found that lower SES predicted HAB. Although the research regarding the specific mechanisms by which contextual risk factors influence

SIP is sparse, theoretical rationale indicates the influence of adverse experiences such as increased exposure to violence (McLoyd, 1998) and unpredictable and stressful life events (Attar, Guerra, & Tolan, 1994) as the basis for children's development of mental schema through which they appraise even ambiguous situations as potentially threatening. Relatedly, the influence of parenting on children's SIP has been examined by several researchers and uncovered noteworthy findings.

Parenting. Multiple aspects of parenting behavior and parent-child relationships have been examined as potential contributors to children's SIP. Much of the research in this area has been grounded in the belief that children's early social observations and interactions lead to their formation of internal working models through which they process future social information (Bowlby, 1969). Accordingly, young children who experience harsh, coercive, or rejecting parenting practices might develop representations of the social world as hostile and threatening, which may affect their interpretations, attributions, and responses to peer behavior. At extreme levels, as in cases of child maltreatment, harsh and inconsistent discipline from parents has been associated with increased HAB and increased generation of aggressive responses in ambiguous social provocation scenarios (Dodge, Pettit, Bates, & Valente, 1995). Furthermore, increased frequency of physical abuse has been related to increased probability of HAB (Price & Glad, 2003), and children who have been maltreated are more likely to expect positive outcomes from aggressive behavior (Dodge, Pettit, Bates, & Valente, 1995). Other research has demonstrated that parent-to-child aggression (slapping, spanking) at levels that do not reach the threshold of abuse may also be associated with HAB in children (Weiss, Dodge, Bates, & Pettit, 1992). Beyond study of maltreatment and parent-to-child

aggression, sparse research also indicates associations between authoritarian parenting attitudes and increased HAB (Runions & Keating, 2007), while children's perceptions of warm, supportive parenting from their mothers has been negatively related to HAB (Gomez, Gomez, DeMello, & Tallent, 2001).

Research on attachment also demonstrates associations with social information processing. Theory in this area suggests that secure attachment contributes to adaptive social interpretation and responding, whereas insecure attachment may lead to development of maladaptive social information processing (Rubin & Rose-Krasnor, 1992). A small body of research supports this theory, with evidence that securely attached children are better able to accurately identify others' emotions (Laible & Thompson, 1998; Ontai & Thompson, 2002) and are less likely to demonstrate HAB (Cassidy, Kirsh, Scolton, & Parke, 1996). Additionally, securely attached children are better able to generate adaptive solutions to social conflict scenarios (Raikes & Thompson, 2008). In sum, although specific mechanisms by which parenting impacts social information processing in children are yet to be adequately researched, existing research suggests that factors that contribute to secure attachment (e.g. warmth, responsiveness), and the quality of mother-child attachment predict children's early social attributions and response ideation, with demonstrated negative associations between harsh, physically aggressive, and inconsistent parenting and adaptive social information processing. Indeed, secure attachment relates to healthy child development in a more global sense, as well as the acquisition of specific competencies among children in a more specific sense. Of particular interest for children's early development is evidence that parenting factors that contribute to secure attachment in children have been

demonstrated to influence both social information processing (Ontai & Thompson, 2002; Raikes & Thompson, 2008) and self-regulation in children (Drake et al., 2014; Gilliom et al., 2002) whereas environmental risk factors have demonstrated negative associations with adaptive development of these processes. This overlap between factors that appear to influence SIP and self-regulation, while yet to be fully researched, illustrates the potentially multiplicative benefits that may result from interventions aimed at increasing protective factors for children and families facing sociodemographic risk.

Associated Outcomes

Social-emotional outcomes. The majority of research examining outcomes associated with SIP has focused on aggression and violent behavior in children and adolescents. Conceptually, children who perceive hostility and aggression in the intentions of others may be more likely to react with retaliatory or defensive aggression than children who interpret conflict as resulting from accidental or benign intent. Numerous studies have demonstrated that aggressive children are more likely to make hostile attributions about others' intentions during ambiguous social conflict situations than non-aggressive children. For example, Dodge (1980) orchestrated an experiment with aggressive and non-aggressive third and fifth grade boys during which a structure they had constructed was destroyed by a child with observable hostile intent (meant to destroy the structure), benign intent (accidentally destroyed the structure), or ambiguous intent. Both aggressive and non-aggressive boys reacted aggressively to the explicitly hostile antagonists and demonstrated restraint in responses to antagonists with benign intent. However, aggressive boys reacted to the ambiguous scenario as if the antagonist had been hostile, whereas the non-aggressive boys responded in line with benign

assumptions for ambiguous antagonists. Similar results were found in the same study when the boys were present with hypothetical vignettes. Subsequently, multiple studies have utilized hypothetical vignettes in oral or cartoon format to assess HAB and have demonstrated associations between HAB and aggressive behavior in school-age children across gender (Feldman & Dodge, 1987; Lochman, 1987), ethnicity (Graham & Hudley, 1994; Graham, Hudley, & Williams, 1992), and culture (Comodeca & Goossens, 2004). Similar results have been found in study of preschool children. Runions and Keating (2007) analyzed relations of early childhood SIP using data from the NICHD SECCYD and found that children who demonstrated only benign attributions in preschool demonstrated fewer externalizing tendencies in first grade than did children who reported any hostile attributions (Runions & Keating, 2007). Katsurada and Sugawara (1998) utilized video vignettes to assess the attribution styles of 68 preschool children and found that hostile/aggressive children were more likely to demonstrate HAB. In contrast to these findings, Ziv and Sorongon (2011) found that preschool children's positive evaluation of aggressive responses in social scenarios, but not HAB, was predictive of concurrent teacher-rated aggressive behavior (Ziv & Sorongon, 2011).

Although less studied, associations between attribution bias and behavioral functioning beyond aggression have also been demonstrated. In a study of anxious and non-anxious fifth-grade students, Bell-Dolan (1995) found that anxious youth were more likely to misinterpret non-hostile situations as hostile. Others have found that shy/withdrawn pre-adolescent children were more likely to blame themselves for problems in social scenarios involving unfamiliar peers, whereas they demonstrated attributions similar to other children for scenarios involving friends (Burgess, Rose-

Krasnor, Wojslawowicz, Rubin, & Booth-LaForce, 2006). Additionally, well-liked boys have been found to generate more positive responses to ambiguous social situations than their less popular peers, indicating a potentially protective effect for certain attributional styles (Mayeux & Cillessen, 2003).

Associations between problem-solving aspects of social information processing and social-emotional outcomes have also been demonstrated. Preschool boys rated as more aggressive by teachers have been found to generate more aggressive solutions to hypothetical social conflict scenarios (Gouze, 1987), and aggressive school-age children have been found to generate fewer total solutions to social problems (Lochman & Dodge, 1994). Furthermore, preschool children who generate more socially competent solutions to conflict scenarios have been shown to demonstrate better social-emotional adjustment in kindergarten (S. a. Denham et al., 2013). Differences in problem solving have also been demonstrated for children from clinical samples. Preschool-age children with oppositional defiant disorder have been shown to provide more aggressive solutions or endings to story scenarios (Coy, 2001), whereas depressed children are more likely to suggest non-assertive (e.g. withdrawal) and irrelevant solutions to social problems (Quiggle, Garber, Panak, & Dodge, 1992).

Given the associations between aggressive and depressed behavior and SIP, the quality of children's peer relationships is logically implicated as an outcome related to SIP. Indeed, differences have been observed in the SIP of rejected children compared with their socially accepted peers. Socially rejected school-age children are more likely to demonstrate HAB than their non-rejected peers (Schulz, Izard, & Ackerman, 2000) and are more likely to generate aggressive or avoidant solutions for conflict (Warden &

McKinnon, 2003). Although some have suggested that deficits in SIP precede relational difficulties and peer rejection (Adrian et al., 2010), further longitudinal research is needed to illustrate the directionality of the relation between SIP and social status in children. Much as children's early social interactions with parents have been indicated as contributing to SIP, children's early interactions with peers may shape their subsequent processing of attributions and problem-solving.

Academic outcomes. Although sparse research had explored the relation between SIP and academic outcomes, related research demonstrating that children's social skills are associated with their school readiness and later academic achievement supports the possibility that social information processing plays a role in children's academic success (Bulotsky-Shearer, Fernandez, Dominguez, & Rouse, 2011; Pianta & McCoy, 1997; Wentzel, 1993). To date, two studies have examined associations between SIP and academic functioning. Denham and colleagues (2013) hypothesized that styles of SIP may allow some children to take better advantage of the learning environment through improved interactions with teachers and peers and tendencies to develop more adaptive learning behaviors. They evaluated the SIP of 298 preschoolers from Head Start and private childcare settings and found that preschoolers who selected socially competent response choices in conflict scenarios were rated by teachers as having stronger academic skills in kindergarten (Denham et al., 2013). In a related study, Ziv (2012) examined the links between social information processing and school readiness in 198 preschool children and found that children who demonstrated more adaptive SIP (benign attribution style and competent social problem solution generation) at the beginning of the year demonstrated more growth in expressive language skills over the course of one year of

preschool (Ziv, 2012). Although further study of the relationship between social information processing and early academic success is needed, this nascent research base illustrates potential for further study that may lead to improvements in prevention of early academic difficulties through social-emotional pathways.

Self-Regulation and Social Information Processing

Given the separate but related bodies of extant research demonstrating associations between self-regulation and SIP and children's social-emotional and academic achievement, the degree to which these processes interrelate to impact child outcomes is of interest. Conceptual overlap between SIP steps and self-regulatory functioning can be illustrated at each stage of the social information processing model proposed by Crick & Dodge (1994). At initial stages involving encoding and interpreting of cues, self-regulation in areas of sustained attention and attention shifting may be required in order for individuals to attend to multiple aspects of social cues and shift attention between cues. In later stages involving internal clarification of goals, response construction, and response selection, the roles of working memory and inhibitory control are implicated processes necessary for the comparison of current cues and response options to prior experiences, as well as the modulation of impulses to enact responses that are incompatible with goals.

Despite the aforementioned conceptual relevance, extant literature examining factors of both self-regulation and SIP is sparse and limited to several recent studies. These early studies generally provide support for interactive impact of self-regulation and SIP on child outcomes. In a study of 83 middle grade boys, Ellis (2009) and colleagues found that planning ability and inhibitory control mediated the relationship between HAB

and reactive aggression. At low levels of HAB, planning and inhibitory control were unrelated to aggression, whereas as HAB increased, lower planning and inhibitory control were increasingly linked to more aggressive outcomes. The authors suggested that children with poor self-regulation may be reacting more impulsively to their perceptions, with responses shaped by their attributions, whereas children higher in self-regulation may better able to inhibit initial hostile cue encoding and attend to alternative cues and response options (Ellis et al., 2009). Support for this possibility is presented by recent research utilizing eye-tracking methods that indicates that children with HAB take longer to encode non-hostile cues, recall hostile cues better, and use potentially hostile cues as the basis for concluding hostile intent (Horsley, De Castro, & Van Der Schoot, 2010). These findings illustrate the potential role of self-regulatory processes such as sustained attention, attention shifting, inhibitory control, and working memory required for children with HAB to incorporate non-hostile cue information into their intent attributions and response planning. Children with HAB must sustain attention towards non-hostile cues, inhibit automatic tendencies towards hostile conclusions, and remember and incorporate non-hostile cues into their attribution schemas.

To date, only two variable-centered studies have included concurrent measures of SIP and self-regulation in preschool-age children. One recent longitudinal study of 101 preschoolers examined relations of self-regulation and social information processing to child outcomes across the transition to kindergarten (Denham, Bassett, Zinsler, & Wyatt, 2014). Results indicated direct and indirect contributions of self-regulation and SIP to kindergarten teachers' ratings of children's classroom adjustment and academic readiness. In a related study, Denham and colleagues (2014) examined SIP and aspects of

hot and cool self-regulation in 316 preschool children over a three-month period and found associations between aspects of hot and cool executive control with children's emotion responses and social response plans (Denham et al., 2014). Both cool and hot self-regulation were positively related to socially competent response choices and negatively related to aggressive response choices. Additionally, hot (but not cool) self-regulation was negatively correlated with angry response choices when children were asked about their emotional reaction to peer provocation scenarios. Given that previous research has indicated predictive value of children's emotion response choices in such scenarios for aggressive versus socially competent responding (Roberts, Strayer, & Denham, 2003; Denham et al., 2013), the potentially distinct relationship of cool versus hot self-regulation with such aspects of children's social information processing presents opportunities for further study.

Person-Centered Study

The literature reviewed above has been conducted according to a variable-centered approach. A variable-centered approach considers skills as individual entities without examination of the organization of multiple traits or skills within an individual (Hart, Atkins, Fegley, Robins & Tracy, 2003). In contrast, psychologists have recently found value in utilization of person-centered study to examine how discrete skills may combine with one another to create distinct profiles of groups of children with varying developmental and psychosocial outcomes. "Person-centered" refers to analytical approaches that use the individual as the focal unit of analysis (Hart et al., 2013). Denham and colleagues (2012) argued that person-centered analyses are advantageous because they allow researchers to examine constellations of skills commonly found in

types of children, a perspective more closely aligned with the tendency of parents and teachers to view children as entities, rather than as discrete skills (Denham et al., 2012). Furthermore, person-centered analyses allow consideration of interactive links between discrete skills in patterns that may promote or preclude individuals' attainment of social and educational goals (Laible, Carlo, Murphy, Augustine, & Roesch, 2014). Person-centered analyses also lend data that can be utilized to inform the development of diagnostic assessments that identify children according to the profile or group to which they belong in order to inform the selection of targeted services. The following section includes a review of person-centered study of self-regulation and SIP in children.

Self-regulation. Sasser and Bierman (2012) conducted a person-centered study of self-regulation in preschool children attending Head Start. Using latent profile analysis, they determined that sub-groups of children demonstrated variation in profiles of self-regulation on indices of direct executive function assessment, teacher-rated general impulsivity, and observer-rated attention during academic tasks. They found that four classes fit the data best: “well-regulated” (characterized by high scores on all three indices), “impulsive” (characterized by higher impulsivity than well-regulated group), “dysfunctional” (characterized by poorer attention and higher impulsivity), and “low EF” (characterized by low EF scores). Differences between these classes were found for kindergarten and first-grade outcomes. The Low EF and Dysfunctional groups performed significantly lower than the Well-Regulated group on measures of early math skills in first grade, and the Impulsive and Dysfunctional groups showed lower levels of social competence than the Well-Regulated group in kindergarten and first grade, with the Low EF group demonstrating lower social competence in first grade only. The Impulsive and

Dysfunctional groups also demonstrated higher levels of aggression than the Well-Regulated group in both kindergarten and first grade. Although preliminary, these results suggest that differences in aspects and manifestations of self-regulation deficits have distinct predictive value and may present opportunities for according differentiation of preventive efforts for sub-groups of children.

Person-centered study of self-regulation has also been applied to “hot” self-regulation in emotion-eliciting scenarios. Zalewski and colleagues (2011) examined self-regulation in third-fifth grade students in conditions designed to produce frustration or anxiety (Zalewski et al., 2011). Self-regulation was measured on indices of physiological reactivity, observed behavior, and child self-report. Results of latent profile analysis revealed 5 classes for frustration tasks and 4 classes for anxiety tasks ranging from high regulation on all three indicators to low regulation across indicators. For both tasks, classes were also identified that were notable for higher regulation on some but not all indices. Frustration-regulation profiles were found to differentially mediate relations between temperament and adjustment outcomes, providing preliminary support for the value of examining patterns of regulation within individuals.

Social information processing. Social information processing has also been the subject of person-centered study, albeit limited. One study to date has examined SIP in early childhood from a person-centered approach. Denham and colleagues (2012) used latent class analysis to identify subgroups of 4 ½ year-old children according to their responses about how they would feel (happy, sad, angry, or OK) and their social problem solving response (socially competent, aggressive, crying, or passive) for social conflict scenarios (Denham, Kalb, et al., 2012). Results revealed that five latent classes fit the

data best: happy/passive, sad/socially competent, sad/passive, angry/passive, and angry/aggressive. Subgroup membership predicted preschool and kindergarten teacher ratings of children's social competence and classroom adjustment, with children in the sad/socially competent class demonstrating higher scores in both areas than children in other subgroups. Children in the sad/socially competent subgroup also received higher ratings of academic readiness in kindergarten than children in the three passive subgroups. Children in the angry/aggressive group did not differ significantly from other groups on academic readiness. Subgroup membership also differed by gender and economic risk. Boys were more likely to have membership in the angry/aggressive subgroup, and girls in the sad/socially competent class. In terms of socio-demographic risk, children in any of the three passive subgroups were more likely to demonstrate economic risk than children in the sad/socially competent subgroup. Consistent with previous findings that boys are more likely to select aggressive solutions than girls; gender differences were also observed; boys were more likely to be members of the angry/aggressive subgroup and girls were more likely to belong to the sad/socially competent subgroup. Overall, these results support links between children's patterns of SIP in preschool and subsequent social and academic functioning in kindergarten.

The importance and stability of SIP across development has also been examined through person-centered study. Lansford and colleagues (2006) conducted a 12-year longitudinal study designed to examine outcome differences in children with the following four profiles: 1) no social information processing problems, 2) problems in early steps (encoding or making attributions), 3) problems in later steps (goal selection, response generation, or response evaluation, 4) problems in both early and later steps.

Results indicated significant main effects of both early and later step problems on concurrent externalizing problems in kindergarten, whereas later step problems only demonstrated main effects on concurrent behavior in grade three. In terms of stability, no relation was found between elementary school SIP profiles and middle or high school profiles, although Grade 8 profiles predicted Grade 11 profile membership. The authors suggested that lack of comparability in measurement approaches used between elementary and middle/high school assessment points may account for this lack of stability, although the possible cognitive restructuring of beliefs about aggression over development was also cited. In terms of predictive value, only kindergarten early step problems predicted externalizing behavior in Grade 11, whereas grade 8 profile patterns predicted Grade 11 externalizing outcomes. Overall, these results provide some support for concurrent and longitudinal relationships between patterns of early childhood SIP and externalizing behavior, with evidence of fluctuation and distinctions in these associations over the course of development.

Other researchers have utilized person-centered analyses to examine stability of SIP in children. Goldweber and colleagues (2011) examined patterns of hostile attribution bias, aggressive response generation, and justification of aggression in 429 children between the ages of 7 and 13 over the course of one year (Goldweber et al., 2011). They found support for two classes: a “low SIP problems” class characterized by lower scores on all SIP measures and a “high SIP problems” class characterized by higher HAB and aggressive response generation. Examination of stability across one year using latent transition analysis revealed four classes: stable high, stable low, decreasing, and increasing. Children in the stable high class demonstrated more aggressive behavior than

children in other classes. The authors also found implications for the role of self-regulation in SIP outcomes: children in the decreasing class had higher scores on self-report measure of self-regulation than children in the stable high class, suggesting a possible protective effect of self-regulatory skills for children at risk for aggressive behavior.

Given the theoretical support and preliminary research findings for the meaningful interrelation of SIP and self-regulation skills within individuals, further person-centered study examining the combination of self-regulation and SIP skills is indicated. To date, one study has incorporated self-regulation and SIP indices using a person-centered approach. In a study of 275 four-year-old preschool children from Head Start and private preschool settings, Denham and colleagues (2012) measured self-regulation and SIP functioning through a combination of direct and observational assessments (Denham et al., 2012). The authors utilized *k*-means cluster analysis to identify three profiles of children: “social-emotional learning (SEL) risk”, “SEL competent-social/expressive”, and SEL competent-restrained”. The SEL risk group demonstrated lower self-regulation and less adaptive social problem solving than the other groups. The SEL competent-social/expressive and SEL competent-restrained groups did not differ on self-regulation, but the competent-social/expressive group showed significantly more adaptive social problem solving than the competent-restrained group. Concurrent analyses revealed that the SEL risk group showed lower teacher-rated scores for adaptive learning behaviors and lower scores on teacher-rated social-emotional competence in the area of sensitivity/cooperation. In kindergarten, the SEL risk group again demonstrated lower scores than either of the SEL competent groups on teacher-

rated adaptive learning behaviors, as well as lower scores on teacher-rated academic skills, student-teacher relationships, and a composite measure of social-emotional competence. Additionally, all three groups differed in kindergarten in the areas of sensitivity/cooperation: the SEL risk group showed the lowest scores, the SEL-competent/expressive group the next lowest, and the SEL-competent/restrained group the highest scores. Although their study provided preliminary evidence that distinct patterns of self-regulation and SIP functioning can be observed within individuals, the authors argued that analytic options were somewhat limited due to the study sample size. Further study using more powerful analytic approaches may allow for further differentiation of classes beyond the three identified in this study.

Limitations of the Current Research Base

Although the aforementioned studies have provided foundational insights regarding social and self-regulatory processes in children, notable limitations are evident in the current research base. Despite evidence that social information processing and self-regulation in early childhood may have predictive validity for school-age outcomes, few studies have examined these processes simultaneously. Additionally, previous study of social information processing and self-regulation has been predominantly conducted using variable-centered designs. Examination of patterns of early social-cognitive and regulatory functioning using person-centered approaches may complement findings from variable-centered studies by revealing meaningful patterns of functioning within individuals. Additionally, the sole study to date that addressed patterns of social information processing and self-regulation in preschool children utilized only teacher reports as outcome measures, which may be subject to bias, and was constrained by

inadequate sample size for more sophisticated analytic methods, such as latent class analysis (Denham, Bassett, et al., 2012). Finally, despite theoretical (Blair 2002) and empirical evidence (Brock et al., 2009; Willoughby et al., 2011) that hot and cool factors of self-regulation may differently influence children's social and academic functioning, no study has examined these factors alongside social information processing variables in children to examine specific profiles of children and the link to relevant outcomes for young children.

Purpose of this Dissertation

The current study aims to contribute to the emerging body of literature on the importance of self-regulation and SIP factors across the transition to school by identifying social-regulatory profiles prior to school entry and specifying the predictive value of these profiles for outcomes of academic achievement, behavior, and social competence during first grade. Specifically, latent profile analysis will be conducted using a large longitudinal dataset to create profiles of children at 54 months based on performance on direct assessments of attribution bias, social problem solving, and hot and cool self-regulation and examine associations between identified profiles and first-grade academic, social, and behavioral outcomes. Evidence that social, behavioral, and academic functioning are interrelated during the early years of school (Ladd et al., 1999), indicates that consideration of each of these outcome areas may best provide a comprehensive picture of children's overall adjustment to school. Given the relative stability of children's academic skills after the first grade year (Entwisle & Hayduk, 1988), the value of identifying mechanisms that impact adjustment and learning up to that point are apparent. Improved clarity regarding common profiles of social-regulatory

functioning prior to school entry may offer opportunities to improve design and differentiation of social-emotional programming for young children's self-regulation development and potentially improve trajectories for children through early intervention and support. The following research questions will be addressed in the present person-centered study:

Research Questions and Hypotheses

1. What types of profiles will be identified at 54 months of age, based on a combination of children's self-regulatory and SIP competence?

Based on prior research, it is hypothesized that distinct patterns of attribution bias, social problem solving, hot self-regulation and cool self-regulation will indicate social-regulatory profiles that could not be identified by examining linear relations. Following Denham et al. (2012) it is expected that patterns characterized by higher scores for attributions, high social problem solving, and high hot and cool self-regulation will be identified and will be indicative of an adaptive or competent social-regulatory functioning profile. Patterns characterized by lower attribution scores, low social problem solving, and low hot and cool self-regulation will be indicate a maladaptive or social-regulatory deficit profile. Additionally, based on research suggesting that children may demonstrate differential development of hostile attribution bias and social problem solving (Lansford et al., 2006) and hot and cool self-regulation (Denham et al., 2015), it is predicted that profiles characterized by discrepancies in performance across SIP and self-regulation variables will be identified, with high functioning on some indicators and low on others. As the analysis for this research question will allow for identification of

profiles on an empirical basis, a range of profiles with discrepant SIP and self-regulation indicators is expected but will not be predetermined (Lengua, Kiff, et al., 2014)

2. To what extent do individual and contextual factors (gender, family income, race/ethnicity, cognitive ability, maternal sensitivity) predict membership in social-regulatory profiles?

Prior research suggests that gender, family income, race/ethnicity, cognitive ability, and maternal sensitivity predict SIP and self-regulatory functioning in preschool, with boys, children with lower family income, racial and ethnic minorities, children with lower cognitive ability, and children who experience less sensitive parenting more likely to demonstrate more hostile attributions and poorer social problem solving (Cassidy, Kirsh, Scolton, & Parke, 1996; Choe et al., 2014; Raikes & Thompson, 2008; Runions & Keating, 2007; Ziv & Sorongon, 2011), and lower self-regulation (Drake et al., 2014; Matthews, Ponitz, & Morrison, 2009; Razza & Raymond, 2013; Wanless et al., 2011). As such, it is hypothesized that boys, children from families with lower income-to-needs ratios, non-white children, children with lower cognitive ability, and children with lower observed maternal sensitivity are more likely to demonstrate a Maladaptive Social-Regulatory profile and less likely to demonstrate an Adaptive Social-Regulatory Profile.

3. To what extent do the latent profiles at 54 months predict academic achievement and behavioral adjustment in first grade?

Given the prior associations demonstrated between preschool social information processing and self-regulation and later behavioral functioning (Allan & Lonigan, 2011; Denham et al., 2013; Eisenberg & Spinrad, 2004; Runions & Keating, 2007), it is expected that children characterized by the maladaptive social-regulatory functioning

profile will show significantly lower scores for social competence and higher scores for externalizing behavior than would children characterized by the adaptive social-regulatory profile. Although only preliminary evidence exists to suggest that social information processing in preschool predicts later academic success (Denham, Kalb, et al., 2012), substantial research indicates the relation between preschool self-regulation and early academic achievement (Blair & Razza, 2007; Clark et al., 2013; Duncan et al., 2007). Accordingly, it is anticipated that children characterized by the adaptive social-regulatory profile will perform significantly better on first-grade measures of reading and math skills than children described by maladaptive profiles. As for mixed profiles that may be identified, research indicating that self-regulation mediates the relationship between social information processing deficits and behavioral outcomes (Ellis et al., 2009) suggests that profiles distinguished by deficits in either SIP component with higher self-regulation may be related to behavioral outcomes similar to those for adaptive social-regulatory profiles. Additionally, deficits in hot self-regulation for mixed profiles are expected to predict poorer behavioral adjustment across patterns of high or low SIP functioning (Denham et al., 2014).

Chapter 3: Methodology

Prior studies have demonstrated interrelation and validity of self-regulation and SIP factors in early childhood using variable centered approaches. However, no person-centered study to date has examined aspects of hot and cool regulation alongside SIP components. The current study will utilize a person-centered approach to identify profiles of children's social-regulatory processes prior to school entry and examine the predictive value of these profiles across the transition to school. Specifically, this study will employ latent profile analysis (LPA) of data sets from the NICHD SECCYD to identify profiles of children at 54 months of age using manifest variables of hot self-regulation, cool self-regulation, attribution bias, and social problem solving established in self-regulation and social information processing literature. Additionally, predictive validity of identified profiles will be examined related to indicators of academic achievement and behavioral adjustment in first grade.

Participants

The NICHD SECCYD is a longitudinal prospective study of 1364 children and their families. Families were recruited from hospitals in 1991 during a 24-hour sampling period. Families enrolled in the study were living in or around the following cities at the time of recruitment: Little Rock, Arkansas; Orange County, California; Lawrence and Topeka, Kansas; Boston, Massachusetts; Philadelphia, Pennsylvania; Pittsburgh, Pennsylvania; Charlottesville, Virginia; Morganton and Hickory, North Carolina; Seattle, Washington; and Madison, Wisconsin. Families were initially enrolled in the study when children were one month of age (NICHD Early Child Care Research Network, 2005). Eligibility criteria were met by 5,416 of the 8,986 women who gave birth in recruitment

locations during the 24-hour sampling period. Exclusion criteria included multiple births, maternal age younger than 18, substance abuse acknowledged by the mother, lack of English proficiency, known infant disability or hospital stay longer than seven days, or family residence more than one-hour from laboratory site or in extremely unsafe neighborhood. The 1,364 families who ultimately became participants completed an in-home interview prior to enrollment when their infants were one month old. The enrolled families represented an economically and ethnically diverse sample and included 10% low-education mothers, 14% single mothers, and 24% percent ethnic minority children. Further details about recruitment and selection procedures may be found in prior publications (see NICHD Early Child Care Research Network, 2005) and on the study website ([http:// www.nichd.nih.gov/research/supported/Pages/seccyd.aspx](http://www.nichd.nih.gov/research/supported/Pages/seccyd.aspx)).

NICHD SECCYD Procedures

SECCYD participants were followed longitudinally from the time of enrollment through child age of 15 years. Measures of interest for the present study were collected during laboratory visits at 54 months (SIP, self-regulation measures, and maternal sensitivity measures), laboratory visits in the spring of first grade (Woodcock-Johnson, Revised Tests of Achievement), and ratings completed by participants' teachers in the spring of their first-grade year (Teacher Report Form, Social Skills Rating System). Following is a detailed description of the measures used to assess maternal sensitivity, self-regulation, SIP, and academic and behavioral outcomes. Further details on study procedures and measures utilized at each time point may be found on the study website: <https://www.nichd.nih.gov/research/supported/Pages/seccyd.aspx>.

Instrumentation and Measures

The current study will include measures of social information processing and hot and cool self-regulation prior to school entry and measures of social competence, externalizing behavior, and academic achievement collected in first grade. The following measures were used as indicators of social information processing, self-regulation, social competence, externalizing behavior, and academic achievement:

54-Month Measures.

Social information processing. Measures of SIP included in the present study include measures of children's social problem solving and attribution bias at 54 months. As summarized previously, each of these steps have been previously indicated as predictive of children's social and academic adjustment across the transition to school. Measures were selected to represent both early stage and late stage SIP based on evidence that these steps may have distinct predictive value for outcomes of interest.

Social problem solving. The Social Problem Solving Test, Revised was originally developed by Rubin (1983) and has been widely used with preschool children (Rubin & Clark, 1983; Raikes et al., 2012). Children were presented with drawings and stories for five social scenarios in which a character wishes to solve problems involving object acquisition (gaining access to a toy or material in another child's possession) or social initiation (becoming friends with an unfamiliar child). Children were prompted to provide at least two possible solutions for each scenario, and were then asked to select the response that they would choose to enact. A composite variable of "Socially Competent Solutions" was calculated for each child by standardizing and summing the total number of prosocial responses generated, variety of responses, total number of solutions generated, with higher scores representing better social problem solving skills ($\alpha = .83$).

Attribution bias. Attribution bias was assessed with a questionnaire developed by Dodge and colleagues (Dodge, Pettit, McClaskey & Brown, 1986) involving hypothetical social scenarios. Four ambiguous social scenarios were read aloud to children. Scenarios were gender-tailored and included the following hypothetical circumstances: 1) being hit in the back by a ball while playing catch, 2) having a favorite toy taken by another child, 3) having juice spilled on the child, and 4) tripping over another child's leg during play. For each scenario, children were asked whether the peer's actions were intentional (e.g. "did he/she want to?") or unintentional (e.g. "by accident?"). A point was given for each attribution of negative intent. For the present study, scores were subsequently reversed to aid in interpretability in comparison with other study variables, so that higher scores indicated lower tendency to infer hostile intent. ($\alpha = .64$). Procedures utilized followed previous methods of attribution bias assessment in preschoolers (Feshbach, 1989; Webster-Stratton & Lindsay, 1999) and are supported by previous work demonstrating validity of attribution bias assessment in non-clinical samples (Rubin, 2011).

Self-regulation. Measures of self-regulation were selected for inclusion in the current study based on their theoretical alignment with hot and cool constructs. Measures were also selected that have demonstrated alignment with hot and cool constructs in prior factor analytic research. All measures selected have been widely employed in self-regulation research with preschool-age children and have demonstrated some degree of predictive validity for outcomes of interest in this study.

Hot self-regulation. The delay of gratification (snack delay) task is utilized in the present study as a direct measure of children's hot self-regulation. The version of this task employed in the SECCYD was modeled after the waiting task pioneered by Mischel

(1974; 1981). Procedures for the delay of gratification task were as follows: Children were asked whether they preferred to have a smaller amount of a preferred food (M & M's, animal crackers, or pretzels) or a larger amount. Once it was established that children preferred a larger amount, they were given instructions for playing a "waiting game". Children were trained in the use of a bell to summon the assistant, and were told that they can ring the bell to call the assistant if they decide that they would rather stop waiting for the larger reward and eat the smaller reward instead. Children were then instructed to wait at a table with plates in front of them containing both the larger and smaller amounts of food while the assistant left the room to "do other work." Children were asked to wait a total of 7 minutes in order to receive the larger reward. Total wait time for each child before eating the snack or ringing the bell was measured in seconds, with better inhibitory control indicated by longer wait times. Because the self-imposed waiting required in the delay of gratification task occurred in the face of a tangible, desirable, and immediately visible reward, this task was considered to conceptually align with hot self-regulation demands. Prior work has supported the validity of snack delay tasks as indicators of hot self-regulation in preschoolers (Bassett & Denham, 2012; Willoughby et al., 2011).

Cool self-regulation. The Continuous Performance Task (CPT) is utilized as a direct measure of cool self-regulation in the present study. The CPT procedures in the SECCYD followed those developed by Mirsky and colleagues (e.g., Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991; Rosvold, Mirsky, Sarason, Bransome, & Beck, 1956) and have been shown to have good validity and reliability with preschool children (Belsky, Pasco Fearon, & Bell, 2007; Merz et al., 2014). Children were presented with

dot-matrix versions of pictures (butterfly, fish, flower) on a computer screen and were instructed to press a button each time a target stimulus (chair) appeared on the screen. Stimuli were presented in 22 blocks each consisting of ten stimuli, and target stimuli were randomly presented in each block. Errors of commission (the number of responses to non-target stimuli) were reverse-scored and included as a measure of self-regulation in this study, with resulting higher proportions indicating higher self-regulation. The abstract, decontextualized nature of the CPT and the absence of linked rewards or consequences support its classification as an emotion-neutral task for purposes of this study (McClelland & Cameron, 2012).

First Grade Measures.

Academic achievement. Academic achievement measures of interest for the present study included individual direct-assessment measures of achievement. The Woodcock-Johnson, Revised Tests of Achievement (WJ-R Ach) is a wide-range battery consisting of individually-administered tests across multiple areas of academic achievement. The WJ-R Ach battery was standardized on a large ($n=6,359$), nationally-representative sample and demonstrates strong psychometric properties (McGrew, Werder, & Woodcock, 1991). Selected subtests of the WJ-R Ach were administered to SECCYD participants by trained research assistants during the second half of their first-grade year. For the present study, the Letter-Word Identification ($\alpha = .92$) and the Applied Problems ($\alpha = .83$) subtests were included as measures of academic achievement in first grade. The Letter-Word Identification subtest is correlated with measures of reading decoding, reading speed, and comprehension and the Applied Problems subtest is correlated with measures of number facility and automaticity,

problem solving, and reasoning (Bierman et al., 2002), and both subtests have shown strong reliability with first-grade students (McGrew, Werder, Woodcock, 1991).

Behavioral adjustment. Behavioral adjustment indicators in the current study include factors of problem behavior and social competence. These factors were operationalized for the present study with SECCYD variables of teacher-reported externalizing problems and social skillfulness, with lower externalizing problems and higher social skillfulness representing better behavioral adjustment in school. The measure of externalizing problems for the present study was drawn from teacher ratings on the Teacher Report Form (TRF). The TRF is a widely-used behavioral rating scale demonstrating strong psychometric properties (Achenbach, 1991). Teachers rate students' behavior on a broad range of behavioral and emotional problems using a three-point scale: (0 = not true; 1 = sometimes or somewhat true; 2 = very true or often true). Results are presented in T-scores ($M = 50$, $SD = 10$) for eight Syndrome scales three and Total scales (Internalizing, Externalizing, and Total Problems). In the SECCYD, the TRF was completed by children's classroom teachers during the second half of the first-grade year and the average T-Score ($M=50.67$) from SECCYD teacher ratings was similar to the average scale scores for the normative sample (Boys: $M=50.3$, Girls: $M=50.7$). The TRF Externalizing Total scale utilized as a measure of externalizing behavior for this study was comprised of the subscales of Delinquent Behavior and Aggressive Behavior, with higher scores indicating a greater tendency to display behaviors in these domains. Examples of items from the Delinquent Behavior scale include: lies and cheats, steals, hangs around others who get into trouble, and no guilt after misbehaving. Example items

from the Aggressive Behavior scale include: argues, defiant, demands a lot of attention, destroys his/her own things, disrupts, fights, and threatens.

The measure of social skillfulness utilized in the present study was the Peer Competence raw score created for the SECCYD using items from the Social Skills Rating System (SSRS; Gresham & Elliott, 1990). The SSRS Teacher Form instructs teachers to rate how often a social behavior occurs on a 3-point scale (0 = never, 1 = sometimes, 3 = very often). Ten items from the SSRS Teacher Form were selected and summed to form an a priori indicator of children's competence in interactions with peers ($\alpha = .85$) with higher scores indicating a higher positive response from the child to his or her peers. Examples of items from the Peer Competence scale include: responds appropriately to peer pressure, makes friends easily, accepts peers' ideas for group activities, and cooperates with peers without prompting.

Covariates.

Maternal Sensitivity. The measure of maternal sensitivity for the present study was computed from observations of maternal behaviors during semi-structured play interactions with study children at 15, 24, 36, and 54 months. At each time period, mothers were asked to play with their children with three sets of toys. Interactions were videotaped and coded for maternal behaviors on a four-point scale at 15 and 24 months and a seven-point scale at 36 and 54 months. At 15 and 24 months the index of maternal sensitivity was computed from the sum of ratings for sensitivity to nondistress, intrusiveness (reversed) and positive regard. At 36 and 54 months maternal sensitivity was computed from the combined ratings of supportive presence, hostility (reverse-scored) and respect for autonomy. Intra-class correlations for coded behaviors exceeded

.80 at every age, and internal reliability was adequate for the maternal sensitivity index ($\alpha > .70$ at each age) (NICHD Early Child Care Research Network 2003, 2005).

Maternal sensitivity across early development will be computed for the present study by standardizing sensitivity scores at each age and averaging to form a maternal sensitivity composite.

Cognitive ability. The Woodcock-Johnson, Revised (WJ-R) Picture Vocabulary Standard Score (Woodcock & Johnson, 1990) was used as a proxy for early cognitive ability in the present study. This subtest was administered to children as part of a larger battery of tests during the 54-month lab visit. This subtest requires children to identify or name pictures of familiar and unfamiliar objects. Vocabulary knowledge is commonly used as a proxy for cognitive ability in young children (Blair & Razza, 2007; Miller, Dunsmore, & Smith, 2014; Nesbitt, Baker-Ward, & Willoughby, 2013) and is strongly predictive of general cognitive skills (Marchman & Fernald, 2008). The items used to generate the Picture Vocabulary Standard Score in the present study demonstrated moderate internal reliability ($\alpha = .76$) and this measure has acceptable psychometric properties with preschool-age children (McGrew, Werder, Woodcock, 1991).

Family income. Family income-to-needs ratio is a commonly-used measure of a family's socioeconomic well-being (Matthews, Marulis, & Williford, 2014). Mothers in the SECCYD provided information regarding total family income when children were 54 months of age, and income-to-needs ratio was calculated by dividing the total family income by the 1991 poverty threshold for respective family size.

Race and Ethnicity. Racial and ethnic information was collected from parents after study enrollment. Ethnicity and race categories included American Indian, Eskimo,

or Aleutian, Asian or Pacific Islander, Black or African-American, White, Other, and Hispanic. A dichotomous ethnicity variable was constructed (-1 = White, non-Hispanic, 1 = all others) and used to control for ethnicity and race in the current study.

Gender. Gender category was available for all study participants.

Data Analytic Plan

A combination of descriptive and inferential statistics will be used to answer research questions for the present study. Preliminary data analyses will include descriptive and bivariate analyses for all variables of interest. Following is a description of further planned analytic approaches for each research question:

1. What types of profiles will be identified at 54 months of age, based on a combination of children's self-regulatory and SIP competence?

Latent profile analysis (LPA; Muthen, 2001) will be employed to examine whether distinct social-regulatory profiles can be identified. LPA is a form of mixture modeling that allows for identification of the smallest number of latent sub-groups across indicators that account for the total distribution of individuals. In essence, when a researcher utilizes LPA, it involves modeling a "mixture" of sub-groups within a population. Through LPA, individuals are assigned to one mutually-exclusive profile according to their performance on variables of interest. LPA is considered to serve as an improved approach over k -means cluster analysis because it allows for statistical rather than subjective determination of the number of groups that best fits the data (Pastor, Barron, Miller, & Davis, 2007). Moreover, LPA provides results regarding the probability for an individual's membership in each identified profile group, thereby providing useful

information regarding how well the model classifies individuals (Hill, Degnan, Calkins & Keane, 2006). Model fit for number of classes will be assessed using the Akaike information criterion (AIC), Bayesian information criterion (BIC), and the Bootstrap Likelihood Ratio Test (BLRT; McLachlan & Peel, 2000; Schwarz, 1978). Moreover, analyses generate data indicating the percentage of individuals who belong to each group and enable the construction of a group membership variable that can then serve as the dependent variable of analyses that focus on variables that predict membership in the profiles/groups.

2. To what extent do individual and contextual factors (gender, ethnicity, cognitive ability, family income, maternal sensitivity) predict membership in social-regulatory profiles?

An important step in determining theoretical validity of LPA profile groups is the prediction of class membership from auxiliary variables, or covariates (Muthen, 2004). Based on prior research, gender (Matthews, Ponitz, & Morrison, 2009; Runions & Keating, 2007), ethnicity (Raver et al., 2011), cognitive ability, family income (Wanless et al., 2011; Ziv & Sorongon, 2011), and maternal sensitivity (Bernier et al., 2010; Raikes & Thompson, 2008) will be included as potential LPA covariates in the present study. Multinomial logistic regression will be conducted to determine whether covariates predict class membership. Covariates with significant relations to latent profiles will be retained for follow-up analyses.

3. To what extent do social-regulatory profiles at 54 months predict academic achievement and behavioral adjustment in first grade?

In order to determine relations between 54-month social-regulatory profiles and first-grade outcomes of interest, a series of one-way MANCOVA's will be conducted comparing identified profiles on dependent variables for separate academic (WJ-R Letter-Word Identification, Applied Problems), and behavioral domains (TRF Externalizing Total, SSRS Peer Competence). Considering that it is anticipated that more than two profiles will emerge from the LPA analysis, the MANCOVAs will represent omnibus tests and significant effects will be followed up with post hoc analyses to determine specifically which profiles are significantly different from one another. In particular, post hoc t-tests that include family-wise Bonferroni adjustments will be conducted.

Chapter 4: Results

Following preliminary and descriptive analyses, results are presented in accordance with the data analytic plan. To answer the first research question, social-regulatory classes identified through latent profile analysis are presented, described, and interpreted. To address the second research question regarding covariates associated with class membership, results of multinomial logistic regression are presented, and indicated covariates selected for inclusion in subsequent analyses are specified. To answer the third research question regarding outcomes associated with social-regulatory class membership, results of MANCOVA and indicated post-hoc analyses are presented and interpreted.

Preliminary Analyses

Handling of missing data. The number of cases with missing data varied across measures and time points (see Table 1 for a summary). Multiple imputation of missing values was performed using predictive mean matching with multivariate imputation by chained equations (MICE) in R (MICE; Van Buuren & Groothuis-Oudshoorn, 2011). Multiple imputation is recommended in lieu of excluding cases with missing data, which can bias parameter estimates and undermine statistical power (Allison, 2003). Multiple imputation is comparable in performance to the full-information maximum likelihood (FIML) method and is recommended over mean substitution and list-wise deletion (Allison, 2003; Schafer & Graham, 2002). Initially, cases that had at least one observation for LPA variables of interest were retained for imputation procedures ($n = 1060$). Following standard MICE procedures, missing values were then imputed variable by variable, with the imputation model specified separately for each variable with

missing data, using the other variables as predictors (Azur, Stuart, Frangakis, & Leaf, 2011). Imputations were repeated iteratively until convergence for a total of five imputations. The dataset obtained from the fifth imputation was utilized in all analyses.

Descriptive statistics. Descriptive statistics for study participants and variables of interest are presented in Table 1 and intercorrelations among study variables are presented in Table 2. Examination of intercorrelations revealed that Attribution Bias was not significantly related to Social Problem Solving; all other LPA variables were modestly correlated in the expected directions. Covariates (Maternal Sensitivity, Picture Vocabulary, Income-to-Needs Ratio) were modestly correlated with all LPA variables in expected directions. Comparison of covariates revealed that, consistent with prior research, Picture Vocabulary was moderately correlated with maternal sensitivity (Downer & Pianta, 2006); all other covariates were modestly intercorrelated in expected directions. First grade behavioral outcome variables were not correlated with any of the LPA variables with the exception of SSRS Peer Competence, which was modestly negatively correlated with Social Problem Solving. Modest negative correlations were also observed between Peer Competence and Picture Vocabulary, and a modest positive correlation was noted between TRF Externalizing and Income-to-Needs Ratio. A moderate negative correlation was observed between TRF Externalizing and SSRS Peer Competence. Finally, first grade academic outcome variables were modestly correlated with all LPA variables in expected directions, and modestly to moderately correlated with covariates, also in expected directions. Neither first grade academic outcome variable was correlated with either of the first grade behavioral outcome variables. Consistent with previous findings (Preschool Evaluation Research Consortium, 2009), first-grade

Letter-Word Identification scores were moderately correlated with first-grade Applied Problems scores.

Identification of Latent Profiles

Latent profile analysis was conducted to address Research Question 1 and uncover the number of latent groups. The number of classes was determined iteratively by adding an increasing number of classes until the addition of a class did not improve the model. Model selection was based on LPA output, interpretability and conceptual clarity, and information criteria-based fit statistics including the Bayesian Information Criteria (BIC; Schwartz, 1978), Akaike Information Criteria (AIC; Akaike, 1987). Additionally, entropy was examined to determine the accuracy with which models classify individuals into their most likely class and improvement between neighboring class models was compared using the Bootstrap Likelihood Ratio Test (BLRT; McLachlan & Peel, 2000).

Results from the LPA supported a four latent social-regulatory profiles solution. Models with up to six classes were considered. AIC and BIC values were examined as a first step in model selection. Lower values on these fit statistics, or the point at which these indices begin to level off, indicate better model fit (Muthen, 2004). Visual inspection of the data according to AIC and BIC values suggested indicated that models with three, four, or five classes were likely to provide the best fit (Figure 1). Next, entropy was examined for potential models. Entropy values range from zero to one, with higher values indicating better classification accuracy (Berlin, Parra, & Williams, 2014). Examination of entropy values for three, four, and five class solutions were similar,

indicating good classification accuracy for each of these models. AIC, BIC, and entropy values are presented in Table 3.

After consideration of fit statistics, bootstrapping procedures are recommended as an additional step in determining model selection (Berlin et al., 2014). The BLRT test was utilized for comparison of class models to determine whether a statistically significant improvement in fit was observed for the inclusion of additional class models. When the three-class model was compared to the four-class model, the BLRT value was statistically significant, indicating improvement in fit for the four-class model (BLRT = 29; $p < .01$). Comparison of the four-class model with the five-class model did not indicate significant improvement in fit with the addition of the additional class (BLRT = -.02, $p = .90$), providing evidence for the four-class model as demonstrating the best fit for the data.

Conceptual clarity was also considered for the three- four- and five-class solutions. The four-class solution provided additional meaningful differentiation between classes over the three-class solution, with identification of an additional class (*socially adaptive/moderate regulation*) that differed in pattern of LPA variables. When the four-class solution was compared with the five-class solution, no additional meaningful information appeared to be offered by the five-class solution, with similar patterns observed as in the four-class solution. Thus, given consideration of AIC/BIC values, entropy, BLRT significance, and conceptual clarity, the four-class solution was selected as the preferred model for present study.

The results of the LPA are presented in Figure 2, which displays the deviation of the class mean from the overall sample mean for social-regulatory profiles. The profile

means for the SIP and self-regulation variables are reported in Table 4. Profile 1 ($n = 138$) comprised 13 percent of the total sample and was characterized by more adaptive scores for attributions, higher cool self-regulation and moderately weaker hot self-regulation than the overall sample. Social problem solving was slightly lower than the overall sample for this group. This profile might be considered a *socially adaptive/moderate regulation* group. Profile 2 ($n = 266$) comprised 25 percent of the sample and was characterized by less adaptive scores for attribution bias and lower social problem-solving than the overall sample. This group also had the lowest cool and hot self-regulation of any of the four classes. Due to poorer performance across SIP and self-regulation measures, this profile might be considered a *social-regulatory deficit* group. Profile 3 ($n = 558$) comprised 53 percent of the sample and was notable for stronger scores on attribution bias and social problem solving as well as higher cool and hot self-regulation than the overall sample. This profile might be considered a *social-regulatory competent* group. Finally, profile 4 ($n = 98$) comprised 9 percent of the total sample. This group was notable for the least adaptive scores for attribution bias of any of the four groups, as well as lower social problem-solving and cool and hot self-regulation than the overall sample. This profile is characterized as a *hostile attribution/low-regulation* group.

Predictors of Profile Membership

A multinomial logistic regression was performed using SAS LOGISTIC to determine whether covariates were associated with membership in the four latent classes. Study site, gender, ethnicity, cognitive ability, family income-to-needs ratio, and maternal sensitivity were entered as independent variables and class membership was entered as the dependent variable. Profile 1, the socially adaptive/moderate regulation

class was used as the reference group in regression analyses. Maternal sensitivity and cognitive ability showed significant associations with class membership. Compared to profile 1 (socially adaptive/moderate regulation) membership in profile 3 (social-regulatory competent) was significantly predicted by higher scores on maternal sensitivity ($OR = 1.60, p = .004, 95\% CI [1.16, 2.21]$) whereas membership in profile 2 (social-regulatory deficit) was predicted by lower maternal sensitivity scores at a level approaching significance ($OR = 0.72, p = 0.053, 95\% CI [0.52, 1.01]$). Cognitive ability predicted membership only in the social-regulatory competent group. Compared to the socially adaptive/moderate regulation group, membership in the social-regulatory competent group was significantly predicted by higher cognitive ability scores ($OR = 1.03, p = .001, 95\% CI [1.01, 1.04]$). None of the other variables was significantly associated with class membership.

Associations Between Profiles and First-Grade Outcomes

To examine associations between the latent social-regulatory profiles and first-grade outcomes, multivariate analyses of covariance (MANCOVAs) were performed for the two sets of child-level academic and behavioral variables. Variables identified in the multinomial logistic regression, maternal sensitivity and cognitive ability, were entered as covariates for each MANCOVA. Significant omnibus MANCOVA F 's were followed with univariate tests and pairwise t -test comparisons to test the means of the profiles within each of the outcome variables. To control for Type 1 error rates, the Bonferroni correction procedure was used for pairwise comparisons. Results of MANCOVA's for academic achievement and behavioral adjustment and follow-up univariate tests are presented in Table 5.

Academic Achievement. Results of MANCOVA for the academic achievement model indicated that classes differed on the best linear combination of the academic achievement construct (Wilks' $\Lambda = 0.95$, $F(6,2106) = 9.08$, $p < .001$, partial $\eta^2 = .05$). This effect size is small to medium in magnitude (Cohen, 1977). Univariate results indicated statistically significant differences across profiles for first grade reading (WJ Letter-Word Identification, $F(3,1054) = 4.48$, $p < .05$, $R^2 = 0.15$) and math outcomes (WJ Applied Problems, $F(3,1054) = 17.95$, $p < .001$, $R^2 = 0.29$). Follow-up pairwise *t*-test comparisons using a Bonferroni adjustment showed that for reading outcomes, the social-regulatory competent group ($M = 114.89$, $SD = 15.37$) was higher than the social-regulatory deficit group ($M = 108.65$, $SD = 16.34$; $t(1054) = 3.64$, $p < .05$, $d = .30$). No other significant differences were found between classes for early reading.

Pairwise comparisons for first-grade math outcomes indicated multiple significant differences between classes. The social-regulatory competent group ($M = 115.99$, $SD = 15.32$) demonstrated higher math scores than the social-regulatory deficit group ($M = 105.18$, $SD = 16.89$; $t(1054) = 6.95$, $p < .001$, $d = .57$) as well as the hostile attribution/low regulation group ($M = 107.66$, $SD = 15.28$; $t(1054) = 3.54$, $p < .05$, $d = .39$). Additionally, the socially adaptive/moderate regulation group ($M = 112.34$, $SD = 16.83$) also had significantly higher math scores than the social-regulatory deficit group ($t(1054) = 4.65$, $p < .001$, $d = .49$) and approached significance for higher scores than the hostile attribution/low regulation group ($t(1054) = 2.44$, $p = .09$, $d = .32$).

Behavioral Adjustment. Results of MANCOVA for the behavioral adjustment model indicated that classes differed on the best linear combination of the behavioral adjustment construct (Wilks' $\Lambda = 0.98$, $F(6, 2106) = 2.48$, $p < .05$, partial $\eta^2 = .01$). This

effect size is small in magnitude (Cohen, 1977). Univariate results did not indicate significant differences across profiles for either measure of behavioral adjustment, however, differences across profiles at levels approaching significance were detected for first grade externalizing behavior (TRF Externalizing Total, $F(3, 1054) = 2.30, p = .07, R^2 = 0.01$) and social skillfulness (SSRS Peer Competence, $F(3, 1054) = 2.31, p = .07, R^2 = 0.01$). Follow-up pairwise *t*-test comparisons using a Bonferroni adjustment showed that for externalizing behavior, the hostile attribution/low regulation group ($M = 48.73, SD = 7.69$) was lower than the social-regulatory deficit group ($M = 51.41, SD = 8.59; t(1054) = 2.56, p = .06, d = .29$) at a level approaching significance. No other differences were found between classes for externalizing behavior or social skillfulness.

Chapter 5: Discussion

Early social information processing and self-regulation have been shown to predict a range of short- and long-term outcomes for children. However, most prior research in these areas has been conducted through variable-centered study, which precludes consideration of meaningful within-person patterns of functioning. This study utilized a person-centered approach to identify patterns of social-regulatory functioning for children at 54 months of age, specify individual and contextual factors that predict profile membership, and explore associations between profile membership and first-grade academic and behavioral outcomes. A combination of SIP and self-regulation variables with well-documented construct and predictive validity was used to identify subgroups of children with distinct patterns of social-regulatory functioning. Person-centered quantitative analyses were used in order to explore particular profiles of children based on patterns among SIP and self-regulation measures, rather than any single construct, and determine whether the profiles were associated with success across the transition to elementary school.

Identification of Social-Regulatory Profiles

Results of latent profile analysis provided support for a four social-regulatory profile solution. The profiles that emerged depicted a range of children's social-regulatory responses. As predicted, a group emerged with more adaptive SIP and self-regulation skills, as well as a group with generally weaker skills across these areas. These groups represented the majority of children, accounting for profile membership of 78 percent of the total sample. Consistent with hypotheses, LPA also identified additional groups that differed on patterns of SIP and self-regulation variables, with a group

demonstrating higher hostile attributions and moderately low self-regulation and a group demonstrating more adaptive SIP processes and moderate performance across self-regulation tasks.

The identification of a sub-group (social-regulatory competent) with stronger performance across indicators of SIP and self-regulation is consistent with results from person-centered studies of SIP (Lansford et al., 2006; Goldweber et al., 2011) and self-regulation (Sasser & Bierman, 2012). This group represented 53 percent of the total sample, very similar to the percentage found for children with higher overall functioning across SIP and self-regulation measures in the single prior person-centered SIP/self-regulation study to date (Denham, Bassett, et al., 2012). Also consistent with prior study was the identification of a group (social-regulatory deficit) with lower self-regulation and SIP functioning across measures (Denham, Bassett, et al., 2012; Lansford et al., 2006; Sasser & Bierman, 2012). In contrast with results of Denham and colleagues (2012), two additional groups (socially adaptive/moderate regulation, hostile attribution/low regulation) with varying social-regulatory patterns were identified in the present study. The inconsistency of these results with Denham and colleagues' study could be due to the use of different SIP measures across the two studies; the prior study included a measure of child-reported emotion rather than attribution of intent for early-step SIP measurement, and utilized conflict scenarios with clear hostile intent rather than the ambiguous intent scenarios employed in the present study. Furthermore, the present study included self-regulation tasks for separate hot and cool factors, a distinction that was not made in the Denham et al. study. Additionally, the present study included a significantly larger sample size ($n = 1060$) than the Denham et al. (2012) study ($n = 275$), which may have

allowed for sufficient power to differentiate additional sub-groups. Beyond the statistical and conceptual support described previously for the selection of the four-class model in the present study, the emergence of classes with unevenly developed SIP and self-regulation is supported by prior variable-centered research indicating that aspects of SIP and self-regulation may represent separate, albeit interrelated constructs (Brock et al., 2009; Keil & Price, 2009; Raikes et al., 2012; Willoughby et al., 2011) such that within-person variability across these constructs is plausible and likely.

Predictors of Profile Membership

Examination of individual and contextual contributions to social-regulatory profile membership revealed partial support for predictive value of maternal sensitivity and early child cognitive ability. Children whose mothers were observed to demonstrate more maternal sensitivity between the ages of 15 and 54 months were more likely to be members of the social-regulatory competent class, whereas children who experienced lower maternal sensitivity were more likely to be members of the social-regulatory deficit class. This finding was expected given prior research indicating that higher maternal sensitivity predicts better SIP (Raikes & Thompson, 2008) and self-regulation skills (Bernier et al., 2010; Razza & Raymond, 2013) in children. Although the mechanisms by which maternal sensitivity may influence children's social-regulatory functioning are yet to be fully understood, extant research suggests that when children experience sensitive caregiving early in life, they come to expect that their distress responses to challenging situations will be responded to with warmth and support, which in turn contributes to children's expectancies that they will be able to cope with and persevere through difficult situations (Gunnar & Donzella, 2002). Sensitive parenting has also been described as a

process through which self-regulation and prosocial behavior is modeled and eventually internalized by children (Buck, 2014; Kochanska et al., 2000). It has also been suggested that children with stronger SIP and self-regulation skills may elicit more sensitive parenting, which, in turn, may contribute to ongoing developmental advantages in these areas (Eisenberg et al., 2010). Taken together, results of the present study add support to prior research indicating that sensitive parenting in early childhood contributes to more adaptive social-regulatory functioning for children.

Membership in the social-regulatory-competent group was also predicted by higher cognitive ability scores. Cognitive ability in early childhood has been shown to predict areas of self-regulation and SIP that were included in the latent profile analysis, with higher cognitive ability typically predicting less hostile attribution bias (Choe et al., 2013) and stronger social problem-solving (Adrian et al., 2010) as well as stronger self-regulation (Razza & Raymond, 2013; Tillman, Bohlin, Sorensen, & Lundervold, 2009). Children with stronger early cognitive abilities may be better able to employ working memory and verbal strategies for perspective-taking, solution generation, and attention regulation during SIP and self-regulation tasks. Given that SIP and self-regulation have been shown to predict academic and behavioral outcomes for children even after accounting for cognitive ability, results of this study indicate that cognitive ability should be considered as a control variable in future social-regulatory research.

Contrary to hypotheses in the current study, gender, ethnicity, and family income-to-needs ratio did not uniquely predict membership in any of the social-regulatory profiles. Although these factors have been shown to be associated with SIP and self-regulation in prior research (Denham, Bassett, et al., 2012), other studies have failed to

find such associations for the inhibitory control aspects of self-regulation included in the current study (Lengua et al., 2007; Neuenschwander et al., 2012) or for SIP factors (Raikes & Thompson, 2008). Furthermore, shared variance among covariates in the present study may have made unique contributions of demographic factors to social-regulatory profile membership difficult to identify. These findings may also result from the presence of additional, as yet unidentified individual or contextual variables that mediate or moderate the associations between gender, ethnicity, and income-to-needs ratio and social-regulatory functioning.

Associations Between Social-Regulatory Profiles and First-Grade Outcomes

The hypotheses anticipating that social-regulatory profiles would predict first-grade outcomes had mixed support. As expected, significant differences were found between the two groups on the opposite ends of the spectrum, with the social-regulatory competent (i.e., a group with generally more adaptive functioning in SIP and self-regulation) group outperforming the social-regulatory deficit group (i.e., a group with less adaptive SIP and self-regulation) in both reading and math. These results are consistent with prior research indicating that children with better-developed social-regulatory functioning perform better on early academic tasks than children with profiles indicative of deficits in social-regulatory processes (Denham et al., 2012). Given that children in these groups generally demonstrated either high or low functioning across SIP and self-regulation variables, it is quite possible that differences in academic outcomes may be better accounted for by particular profile variables (e.g. self-regulation variables) and less by others (e.g. SIP). Given that prior research has repeatedly demonstrated associations between self-regulation and early academic outcomes (Becker et al., 2014; Blair &

Razza, 2007; McClelland et al., 2007; Neuenschwander et al., 2012), children with stronger self-regulation skills might be expected to perform better on academic outcomes, regardless of SIP functioning. Although research linking SIP factors to academic outcomes is limited, preliminary investigations in this area indicates that preschool children with more adaptive SIP demonstrate stronger early academic skills (Denham et al., 2013) and more growth in early expressive language skills, a strong predictor of academic success (Ziv, 2012). As such, children with stronger skills in both self-regulation and SIP may experience increased magnitude of benefit possibly resulting from a combination of SIP and self-regulation factors.

Of particular interest was the finding that social-regulatory class membership predicted first grade math outcomes beyond the two “competent” and “risk” groups identified in prior research (Denham et al., 2012). The socially adaptive/moderate regulation group demonstrated higher math scores than the social-regulatory deficit group and did not differ significantly from the social-regulatory competent group on this outcome, despite lower scores than the competent group on both measures of self-regulation. Additionally, the hostile attribution/low regulation group, notable for higher scores on attribution bias than the deficit group and moderately low regulation, demonstrated lower math scores than the social-regulatory competent group. These findings illustrate the concept of equifinality, or multiple developmental pathways to similar outcomes (Kochanska, 1997). For the socially adaptive/moderate regulation group, stronger cool self-regulation and lower hostile attributions may have sufficiently allowed children to interact successfully with learning opportunities so that they achieved at levels comparable to children with stronger performance across all social-regulatory

areas. In contrast, children in the hostile attribution/low regulation group, despite demonstrating similar hot self-regulation to the socially adaptive/moderate regulation group, demonstrated the least adaptive SIP of any group and earned lower scores in early math skills than the competent group. These findings raise the possibility that more adaptive SIP skills may contribute to other factors, such as student-teacher relationships, that have been shown to partially mediate the relationship between self-regulation and academic outcomes (Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008) or that particular executive function processes beyond inhibitory control, such as attentional flexibility, contribute to both SIP and math reasoning (Clark, Pritchard, & Woodward, 2010). Although the mechanisms by which social-regulatory profiles relate to math outcomes should be further explored, these results suggest that SIP and self-regulation, although related, may develop unevenly, with more adaptive skills in some areas possibly allowing children to compensate for less developed areas of functioning during learning opportunities.

Implications for Practice

Although social-regulatory profiles were found to be related to first grade behavioral adjustment outcomes collectively, no differences between profiles were found for either of the behavioral measures in the present study. This result was contrary to hypotheses. Although the conclusion that social-regulatory profiles do not actually relate to first-grade behavioral adjustment should be considered, it is possible that the measures of behavioral adjustment employed in the present study did not capture actual behavioral differences that may exist between profiles. Although the measures of externalizing behavior and social competence selected for the present study were similar to those have

been shown to be associated with SIP and self-regulation in prior studies (Allan & Lonigan, 2011; Denham et al., 2013; Fabes et al., 1999; Runions & Keating, 2007), the majority of associations found between SIP and behavioral adjustment have been specific to aggressive behavior, rather than the broader externalizing behavior construct included in the present study. Furthermore, although associations have been previously found between self-regulation and behavioral outcomes, these associations are typically weaker than those found between self-regulation and academic outcomes (Allan & Lonigan, 2011; Willoughby et al., 2011). These factors, in addition to the use of a fairly conservative analytic approach to adjust for Type I error due to multiple comparisons in the present study (Holm, 1979) may explain the lack of significant findings for behavioral outcomes, particularly given that results were trending towards significance in hypothesized directions for both externalizing behavior and social competence.

Overall, results from the present study distinguished meaningful subgroups of children based on patterns of SIP and self-regulation. Results also identified the percentage of children in each social-regulatory class, thus providing information about which profiles may represent more common social-regulatory profiles in early childhood, as well as individual and contextual factors associated with profile membership. Differences between social-regulatory classes were also identified for academic outcomes across the transition to elementary school. In line with Denham and colleagues' (2012) model of social-emotional learning, which suggests that SIP and self-regulation skills jointly and interactively provide a foundation for the maintenance of positive and regulated engagement required for learning, these results, albeit preliminary, may have implications for design and implementation of early childhood interventions. Given that

current national recommendations for early social-emotional learning programs cite competencies related to SIP and self-regulation as primary areas of focus (CASEL, 2013), better understanding of common patterns of social-regulatory functioning in early childhood may allow for tailoring of interventions to improve likelihood of effectiveness for most children. Additionally, potential benefit could result from personalizing intervention for groups of children who may demonstrate uneven development of social-regulatory functioning, such as hostile attribution/low regulation group identified in the present study. For example, intervention programs targeting SIP skills often include units on early step skills such as emotion recognition and “searching for clues” about intentions of others (Terzian, Li, Fraser, Day, & Rose, 2014). Children with social-regulatory profiles notable for hostile attribution biases might benefit from increased frequency of instruction or practice opportunities with these early step units, whereas children with more notable deficits in self-regulation, such as the social-regulatory deficit group, may benefit from increased practice with self-calming and distraction skills for regulating strong emotions (Drogan & Kern, 2013). Findings from the present study indicating that social-regulatory class predicted academic but not behavioral first-grade outcomes also highlight the possibility that social-regulatory functioning may contribute to differences in academic achievement across the transition to school even for children who do not differ on teacher-reported areas of externalizing behavior and social competence. Finally, the finding that maternal sensitivity predicted membership in the social-regulatory competent group provides support for the implementation of family-based intervention to improve contextual influences on children’s early development to increase school readiness. Indeed, preliminary study of preschool programs that

concurrently target child SIP and parenting practices have been shown to contribute to improved academic, social, and behavioral outcomes for children, and improved child-parent relationships (Conner & Fraser, 2011). Programs with a parenting component may increase the magnitude of gain for children with social-regulatory deficits beyond the benefits of child-directed interventions alone (Webster-Stratton, Reid, & Hammond, 2004).

Limitations and Future Directions

A number of limitations should be considered for the present study. First, although the study sample was regionally, ethnically, and socioeconomically diverse, it was not nationally representative, which limits potential for generalizability. Second, results from this study are descriptive and correlational, not experimental, which allow only for examination of associations and limits conclusions about causality. Third, although extensive covariates were included in the study design, it is possible that additional, unobserved variables may contribute to class membership and/or differential first-grade outcomes. Fourth, social-regulatory classes were determined at a single time point prior to school entry without accounting for possible changes in group membership that may have occurred between preschool and first grade. Fifth, SIP and self-regulation were measured through use of laboratory tasks, which, although widely utilized in the literature, may not replicate real-world SIP and self-regulation behavior. Sixth, only one measure was utilized for each construct included in LPA analyses; multi-measure approaches would likely increase validity and reliability of construct measurement. Furthermore, the latent classes uncovered in this study were generated from only two categories of variables. Consideration of additional categories, such as child reactivity,

might lead to the identification of more distinct groups of children associated with different early school outcomes. Additionally, effect sizes observed for significant first-grade outcomes were modest to moderate, indicating that caution should be used in drawing practice or policy conclusions based on these results (McCartney & Rosenthal, 2000). Finally, exploratory methods were utilized for identification of social-regulatory classes and require replication and confirmation in future research.

Multiple opportunities exist for future research to build off the findings from the present study. Confirmation of social-regulatory profiles with a nationally-representative sample would improve empirical support and generalizability of findings. Additional study examining stability of social-regulatory class membership across the transition to school as well as outcomes associated with latent trajectories is also indicated. While the present study utilized a widely-used delay-of-gratification task as a measure of hot self-regulation in young children, this task was limited to children's regulation within the context of a positively-motivating act. In contrast, tasks that require children to suppress uncomfortable emotions, such as frustration, or to tolerate an aversive state, such as teasing, might be more ecologically relevant to children's early school experience and should be considered for inclusion in future research (Kim et al., 2013). Another opportunity for the extension of research lies within the study of differential reactivity in young children. Preliminary research has indicated that children vary in the degree of reactivity that self-regulation tasks evoke (Wilson, Lengua, Tininenko, Taylor, & Trancik, 2009); further studies that consider reactivity alongside SIP and self-regulation would contribute to understanding of within-person social-regulatory patterns. Finally, opportunities to improve understanding of the mechanisms by which social-regulatory

functioning may impact adjustment to school are apparent and needed to improve practical knowledge and expand intervention potential for educators and psychologists working in early childhood.

Conclusion

In sum, the current study utilized a person-centered approach to uncover subgroups of 54-month-old children who demonstrated meaningful patterns of social information processing and self-regulation functioning. Results provided support for a four-class solution, and class membership was associated with individual (cognitive ability) and contextual (maternal sensitivity) factors. Differences between classes were found for first grade academic outcomes, providing preliminary support for predictive validity of social-regulatory functioning across the transition to elementary school. Further research is needed to confirm these findings and identify related opportunities to improve trajectories for children through early social-regulatory and contextual supports.

Table 1. Sample Description

Characteristic	Child's age at data collection	N	%	Mean	SD
<i>Demographic characteristics</i>					
Gender:					
Male		529	49.91		
Female		531	50.09		
Race/Ethnicity:					
American Indian, Eskimo, Aleutian		4	0.38		
Asian or Pacific Islander		15	1.42		
Black or African-American		123	11.60		
White		872	82.26		
Other		46	4.34		
Hispanic		61	5.75		
		999	94.25		
Family income-to-needs ratio	54 months	1073		3.59	3.17
<i>Child Variables</i>					
LPA variables					
Social Problem Solving	54 months	1050		-0.01	2.42
Attribution Bias	54 months	1013		-1.73	1.33
Delay of Gratification	54 months	961		4.42	3.03
Continuous Performance Task	54 months	1002		0.92	0.13
Outcome variables					
Letter-Word Identification	1st Grade	1025		111.64	15.86
Applied Problems	1st Grade	1023		110.66	17.18
TRF Externalizing	1st Grade	1008		50.81	8.81
SSRS Peer Competence	1st Grade	1001		15.2	3.63
Covariate measures					
Picture Vocabulary	54 months	1060		100.26	15.02
Maternal Sensitivity	15-54 months	973		0.03	0.73

TRF = Teacher Report Form; SSRS = Social Skills Rating System

Table 2.

Intercorrelations Among Social-Regulatory, Covariate, and Outcome Variables

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Attribution Bias	--										
2. Social Problem Solving	.03	--									
3. Continuous Performance Task	.13 ***	.16 ***	--								
4. Delay of Gratification	.16 ***	.13 ***	.29 ***	--							
5. Maternal Sensitivity	.09 **	.21 ***	.26 ***	.35 ***	--						
6. Picture Vocabulary	.08 *	.25 ***	.19 ***	.30 ***	.40 ***	--					
7. Income-to-Needs Ratio	.08 **	.08 **	.14 ****	.21 ***	.33 ***	.32 ***	--				
8. TRF Externalizing	.04	.01	-.02	-.03	-.03	.05	.08 *	--			
9. SSRS Peer Competence	-.04	-.06 *	-.01	-.05	-.01	-.08 *	-.06	-.57 ***	--		
10. Letter-Word Identification	.07 *	.18 ***	.21 ***	.23 ***	.30 ***	.33 ***	.18 ***	.01	-.05	--	
11. Applied Problems	.17 ***	.21 ***	.24 ***	.35 ***	.39 ***	.45 ***	.27 ***	-.01	-.04	.58 ***	--

Note. N=1060. TRF = Teacher Report Form; SSRS = Social Skills Rating System

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

Table 3.
*Summary of BIC and AIC Measures for Latent Profile
 Analysis of Social-Regulatory Variables*

No. Classes	AIC	BIC	Entropy
1.00	11878.24	11947.77	--
2.00	10320.04	10429.29	0.99
3.00	9393.21	9542.19	0.99
4.00	9205.54	9394.25	0.97
5.00	9098.20	9326.64	0.96
6*	10608.60	10876.77	0.78

Note. AIC = Akaike information criteria;

BIC = Bayesian information criteria

*No model identified for number of classes greater than six.

Table 4

Latent Profile Means and Standard Deviations for SIP and Self-Regulation Variables

	Socially Adaptive/ Mixed Regulation	Social-Regulatory Deficit	Social-Regulatory Competent	Hostile Attribution/ Low Regulation
Attribution Bias	-.92 (.80)	-2.05 (1.22)	-1.54 (1.35)	-3.11 (.64)
Social Problem Solving	-.24 (2.43)	-.44 (2.46)	.36 (2.25)	-.68 (2.81)
Continuous Performance Task	.94 (.07)	.85 (.17)	.95 (.09)	.88 (.17)
Delay of Gratification	3.10 (1.83)	.20 (.19)	6.20 (.23)	3.01 (1.89)

Table 5.

Results of Multivariate Analyses of Covariance (MANCOVA's) Controlling for Maternal Sensitivity and Early Cognitive Ability with Univariate Follow-Ups

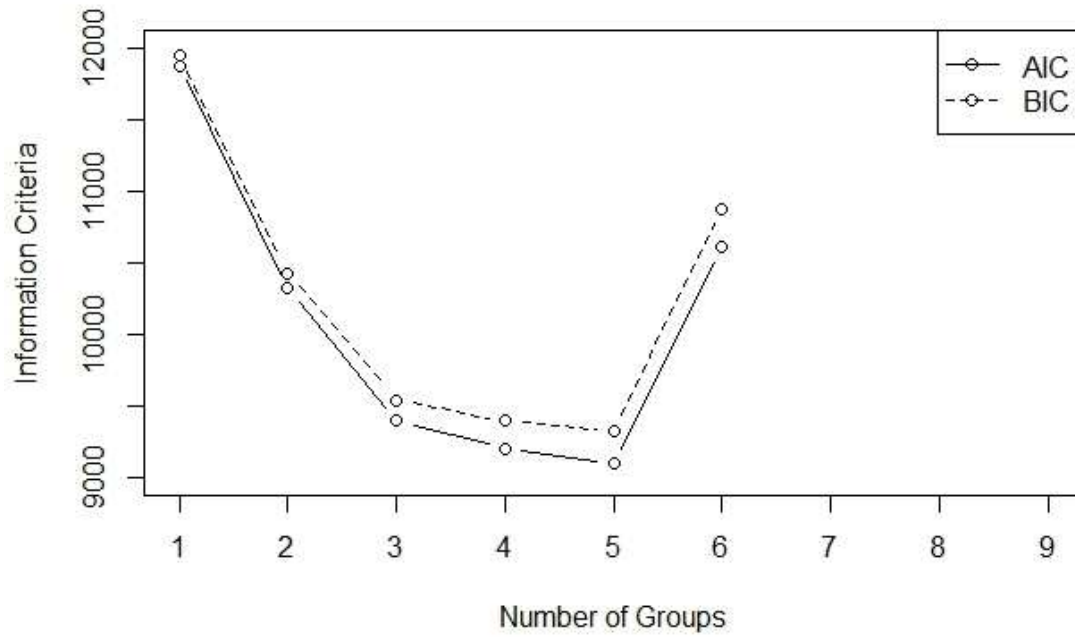
Measures	Socially Adaptive/ Moderate Regulation n = 138		Social-Regulatory Deficit n = 266		Social-Regulatory Competent n = 558		Hostile Attribution/ Low Regulation n = 98		F	ES
	M	(SD)	M	(SD)	M	(SD)	M	(SD)		
<i>Academic Achievement</i>									9.08 (6,2106) ***	.05
WJ-R Letter-Word Identification	111.28	(13.86)	108.65 _a	(16.34)	114.89 _a	(15.37)	110.18	(14.96)	4.48 (3,1054) *	.15
WJ-R Applied Problems	112.34 _b	(16.83)	105.18 _{b,c}	(16.89)	115.99 _{c,d}	(15.32)	107.66 _d	(15.28)	17.95 (3,1054) ***	.29
<i>Behavioral Adjustment</i>									2.48 (6,2106) *	.01
TRF Externalizing	51.04	(9.27)	51.41	(8.59)	50.87	(8.95)	48.73	(7.69)	2.30 (3,1054)	.01
SSRS Peer Competence	14.86	(3.62)	15.53	(3.53)	15.01	(3.69)	15.88	(3.47)	2.31 (3,1054)	.01

Note. N=1060. WJ-R = Woodcock-Johnson, Revised; TRF = Teacher Report Form; SSRS = Social Skills Rating System;

Effect size for multivariate tests is partial eta-squared; effect size for univariate tests is r-squared.

Means with same subscripts differ significantly at $p < .05$ in post hoc pairwise comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$; all ps for univariate follow-up tests are adjusted for multiple comparisons using Bonferroni correction.



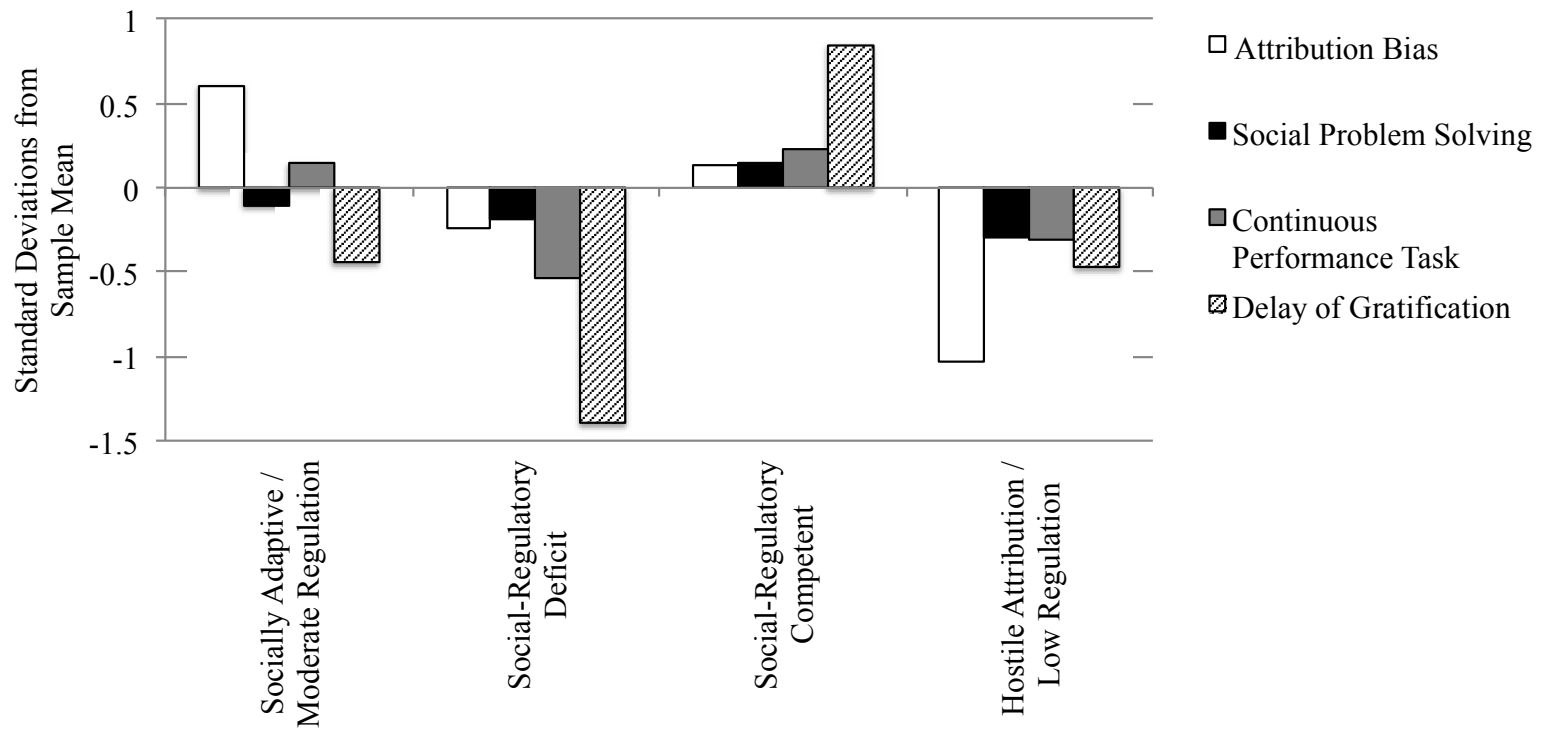


Figure 2. Standard deviations from the overall sample mean of each class for attribution bias, social problem solving, continuous performance task, and delay of gratification.

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