

BEHAVIORAL SELF-REGULATION AND RELATIONS TO ACADEMIC
ACHIEVEMENT ACROSS A FOUR YEAR TIME PERIOD

A Dissertation

by

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ABSTRACT

Research demonstrates that behavioral self-regulation (BSR) serves as a concurrent, explanatory factor of academic achievement in various elementary grades, and that kindergarten BSR predicts growth in academic achievement across elementary grades. Despite these findings, important aspects of the association between BSR and academic achievement remain under-studied. Few studies have simultaneously investigated developmental changes in BSR and academic achievement. Thus, using an academically at-risk sample and an empirically validated, multi-source measure of BSR, this dissertation investigates whether initial level of BSR in first grade predicts initial level and growth in academic achievement across grades 1 to 4, and whether growth in BSR across grades 1 to 4 predicts growth in academic achievement across that same time span. Longitudinal growth curve modeling (LGCM) was used to obtain growth trajectories for BSR, reading, and math across grades 1 to 4. Structural equation modeling (SEM) was used to investigate the effect of BSR in grade 1 on reading and math in grade 1, and on growth in reading and math from grades 1 to 4. SEM was also used to investigate the impact of growth in BSR on growth in reading and math from grades 1 to 4.

Participants included 745 students. BSR was measured by peer ratings obtained via sociometric interviews and by teacher ratings on well-validated questionnaires. Reading and math were assessed with an individually administered standardized measure. LGCM results demonstrated linear growth in BSR and quadratic growth in

reading and math. Although average levels of BSR in first grade were zero and on average, BSR presented a flat linear slope, individual differences existed in first grade BSR and in BSR across grades 1 to 4. Additionally, statistical significance was found for the average intercept and quadratic slope of reading and math, and individual differences were present in first grade reading and math. SEM results revealed that first grade BSR significantly predicted first grade reading and math achievement, above relevant demographic covariates; however, first grade BSR and linear growth in BSR did not significantly predict quadratic growth in reading or math. Limitations and implications for research and intervention are discussed.

To my family

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CHAPTER I

INTRODUCTION

Self-regulation has surfaced as a vital domain of interest for researchers investigating human development across the life span. Beginning at birth and continuing onward throughout life, individuals' capacities for self-regulation allow them to control cognition, behavior, and emotion (Calkins, 2007; Hrabok & Kerns, 2010). Self-regulation has received substantial research attention within the academic realm. Researchers began to study self-regulation in academics due to emerging research findings that individuals' academic skills and aptitudes failed to comprehensively explain their achievement levels (Zimmerman, 2001). Such findings suggested that other individual differences (e.g., motivation and self-regulation) affect academic success.

Essentially, in addition to research (e.g., Miller, Kelly, Zhou, & Campbell, 2005; Whitehurst & Lonigan, 2002) establishing the academic skills necessary to educational success (e.g., knowledge of basic mathematics, vocabulary, and emergent literacy), ample literature has also highlighted the critical role that aspects of self-regulation play in young children's successful transition into the formal schooling system (i.e., their school readiness; e.g., Blair, 2002; Morrison, Ponitz, & McClelland, 2010; Vitiello, Greenfield, Munis, & George, 2011) and in children's continued academic progress (e.g., Duckworth & Seligman, 2005; Howse, Lange, Farran, & Boyles, 2003). Research also documents that the majority of kindergarten teachers consider children's self-

regulation to hold more value in contributing to their school readiness than children's academic knowledge (Lewit & Baker, 1995; Lin, Lawrence, & Gorrell, 2003).

As a broad construct, self-regulation has been conceptualized and defined in a variety of ways (e.g., learning-related skills, executive function, effortful control, behavioral regulation, and emotional regulation), and is generally perceived as entailing three primary domains (i.e., cognition [or executive function], behavior, and emotion). Due to the numerous conceptualizations of self-regulation, diverse methods have been used to measure this broad construct in various research studies. For example, some researchers measure self-regulation as indicated by an individual's executive functions, including working memory, inhibitory control, and attention (Blair, 2002; Blair & Razza, 2007; St. Clair-Thompson & Gathercole, 2006), while others have measured more specific components of executive functions (e.g., effortful control; Murray & Kochanska, 2002). Additionally, researchers have investigated self-regulation as indicated by the ability to apply executive function to overt behaviors (e.g., Greenwood, 1991; Jahromi, Bryce, & Swanson, 2013), and yet others have measured self-regulation as indicated by positive social interactions with peers and teachers and social-emotional competency (e.g., Denham, 2006; Mashburn & Pianta, 2006).

This dissertation focuses on the self-regulation domain of behavioral self-regulation (BSR). A working definition of BSR and definitions regarding the general construct of self-regulation will be provided below. Beforehand, it is essential to demonstrate that BSR makes important contributions to children's academic success. Specifically, research demonstrates that BSR uniquely serves as a concurrent,

explanatory factor of children's academic achievement in kindergarten and other elementary school grades (e.g., Howse, Calkins, Anastopoulos, Keane, & Shelton, 2003; Ready, LoGerfo, Burkam, & Lee, 2005). Furthermore, BSR, *measured in kindergarten*, predicts growth in children's academic achievement across the elementary school grades (e.g., Matthews, Kizzie, Rowley, & Cortina, 2010).

Overall, the studies cited above demonstrate that BSR, measured at one point in time, predicts children's concurrent and future achievement. However, there are particular and important aspects of the association between BSR and academic achievement that remain under-studied. In particular, research is needed with more diverse samples and with a focus on the development of BSR across time (Schunk, 2005). In essence, few studies have investigated developmental changes in BSR (e.g., Raffaelli, Crockett, & Shen, 2005) and even fewer studies have investigated such changes in BSR while also investigating changes in academic achievement (e.g., Breslau et al., 2010).

To the best of the author's knowledge, no study has investigated the effect of *growth* in BSR on *growth* in academic achievement using an academically at-risk sample and an empirically validated, multi-source measure of BSR. Finding that growth in BSR in the early elementary grades predicts growth in academic achievement, would suggest the potential benefit of interventions targeting the development or enhancement of BSR on the academic performance of students at risk of educational failure. Therefore, the primary purpose of this dissertation is to investigate the hypothesis that initial level of BSR in first grade predicts initial level and growth in academic

achievement across grades 1 to 4, and that growth in BSR across grades 1 to 4 predicts growth in academic achievement across that same time span. I investigate this hypothesis in a large, academically at-risk sample using an empirically validated, multi-source measure of BSR (Cerda, Im, & Hughes, 2014).

With the introduction and purpose of this dissertation provided, the focus will now be to provide a review of the literature in chapter 2; this review will set the foundation for the study described in chapters three and four. Chapter five will offer conclusions and future directions for research.

CHAPTER II

LITERATURE REVIEW

Definitions and Conceptualizations of Self-Regulation in General and BSR in Particular

General Definitions of Self-Regulation

Numerous definitions of self-regulation and its components have surfaced across the years (e.g., Blair & Diamond, 2008; Calkins & Fox, 2002; Dahl & Conway, 2009; Eisenberg & Spinrad, 2004; Kochanska, Murray, & Coy, 1997; McClelland, Cameron, Wanless, & Murray, 2007; Morrison et al., 2010; Pintrich, 2000; Schunk & Zimmerman, 1997). Across these various definitions, the consensus is that self-regulation is a multi-faceted construct of acquired, deliberate skills implicated in the regulation (i.e., the directing, controlling, and planning) of cognition (also referred to as executive function), behavior, and emotion (McClelland, Ponitz, Messersmith, & Tominey, 2010; Morrison et al., 2010). A more specific and often cited definition of self-regulation is that this construct pertains to the predominantly “volitional cognitive and behavioral processes through which an individual maintains levels of emotional, motivational, and cognitive arousal that are conducive to positive adjustment and adaptation, as reflected in positive social relationships, productivity, achievement, and a positive sense of self” (Blair & Diamond, 2008, p. 900). Importantly, rather than viewing the various aspects of self-regulation as completely separate functions, it is more fitting to conceptualize all aspects of self-regulation as forming a dynamic and interactive system (Zelazo & Müller, 2002).

Scholars such as Dahl and Conway (2009) and McClelland, Ponitz, Messersmith, and Tominey (2010) unpack the definition of self-regulation in rather enlightening and concise manners. For example, Dahl and Conway segment the actual term, “self-regulation,” by focusing on the fact that using the term “self,” implies individual internal abilities; yet, these scholars also acknowledge the compelling and popular assertion that individuals’ environments naturally impact and interact with virtually every facet of their self-regulation processes. Thus, instead of perceiving self-regulation as a solely intrinsic individual ability, scholars such as Dahl and Conway interpret self-regulation as an assemblage of processes and connections that occur between an individual and his or her environment. In turn, self-regulation allows individuals to develop adaptive methods for managing and adjusting different components of their internal condition and outward behavior that are consistent with their goals and principles (Dahl & Conway, 2009).

McClelland et al. (2010) unpack the definition of self-regulation by focusing on the aforementioned “deliberate” nature of self-regulation skills and the “adaptive” outcomes such skills are aimed at accomplishing. More specifically, drawing from Carver (2004) and Grolnick and Farkas (2002), McClelland et al. explain that the deliberate, intentional nature of self-regulation signifies changing one’s manner of thinking, behaving, or feeling as a means of obtaining a goal that could not be achieved by continuing onward with the present manner. Thus, when the altering of one’s actions and reactions (i.e., cognitions, explicit behaviors, and emotional responses) yields a more constructive outcome than remaining on the present course, that individual is striving for and obtaining a more adaptive outcome via his or her self-regulatory

capacities (MacCoon, Wallace, & Newman, 2004; McClelland et al., 2010). McClelland et al. further note that what is perceived as adaptive in one instance might not be adaptive or appropriate under other circumstances. Thus, “adaptive” relies upon individual viewpoints and the context at hand.

Behavioral Self-Regulation Defined

BSR may be succinctly defined as “the execution and manifestation of cognitive processes in overt behavior” (Morrison et al., 2010, p. 204). Thus, BSR is represented by one’s capacity to apply executive function (i.e., the cognitive component of self-regulation) to behavioral actions (McClelland et al., 2007). Specific examples of BSR include the ability to complete tasks, organize one’s belongings and materials, plan forthcoming tasks, remember and utilize information, manage physical actions, focus on and comprehend others’ statements, persevere towards reaching set goals, and maintain control of one’s attention (McClelland et al., 2007; Morrison et al., 2010). All of these examples serve as markers of adaptive behavioral regulation. As one component of self-regulation, BSR is closely aligned with the cognitive (i.e., executive function) and emotional components of self-regulation, and these alignments are discussed in brief below.

BSR and Executive Function

Due to the undeniable overlap between executive function and BSR in actuality and in the manner in which the two constructs are discussed and measured in relevant literature and research, it is important to elucidate the relationship between these two constructs. For the purpose of this dissertation, executive function, or the cognitive

component of self-regulation, is defined as a cognitive “construct that unites working memory, attention, and inhibitory control for the purposes of planning and executing goal-directed activity” (Blair, 2002, p. 113). Aspects of executive function are often measured via child performance measures in laboratory or individual settings (e.g., Blair & Razza, 2007; Kochanska et al., 1997; Murray & Kochanska, 2002; St. Clair-Thompson & Gathercole, 2006). Some researchers employ the term BSR when referring to the expression of several cognitive procedures in explicit behavior (e.g., McClelland et al., 2007; Morrison, et al., 2010). As the external manifestation of executive function, BSR is usually measured via behavioral ratings from parents (e.g., Jahromi et al., 2013), teachers (e.g., Matthews et al., 2010; McClelland, Acock, & Morrison, 2006), and peers (e.g., Wu, West, & Hughes, 2008).

BSR is also often studied within naturalistic contexts (e.g., classrooms) via direct observational measures (e.g., Greenwood, 1991). Naturalistic settings such as classrooms place a premium on different components of self-regulation. Children must employ aspects of executive function (i.e., working memory, attention, and inhibitory control) to engage in various classroom activities including, taking turns with peers and sustaining attention on one task while also remembering to clean up that task prior to transitioning to the next (Morrison et al., 2010). In classroom settings, children are also often required to attend to, comprehend, and engage in teacher directives amidst the actions of classmates (some of which may be distracting). Additionally, as children work independently or within groups in classrooms, they often must focus on the task at

hand, interact with peers or practice independence, and adhere to general classroom rules.

These are but a few examples of the diverse possible classroom scenarios, but such situations can impact how children manifest their executive functions outwardly in their behaviors. For instance, whereas a child may perform well on a performance measure of executive function (e.g., the Dimensional Change Card Sort [DCCS] task; Müller, Dick, Gela, Overton, & Zelazo, 2006) when completed in a laboratory setting free of distractions, this same child may struggle to complete a similar task and then clean it up in a classroom that is filled with multiple and competing demands on one's attention (Morrison et al., 2010). Overall, context is an important consideration when studying components of self-regulation.

BSR and Emotional Regulation

As mentioned previously, not only is BSR closely linked to the cognitive component of self-regulation (i.e., executive function); BSR also connects with another facet of self-regulation that is often termed emotional regulation. For this dissertation, emotional regulation “consists of the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals”(Thompson, 1994, p. 27-28). Concisely, emotional regulation is typically represented by the motivational and affective facets of self-regulation (McClelland et al., 2010). Emotional regulation is often measured in laboratory settings where researchers might examine individuals' facial or vocal expressions to index the latency, rise time, duration, and recovery time of

the observed emotional responses (e.g., Jahromi & Stifter, 2008; Thompson, 1994). In laboratory settings, researchers might also investigate the range, lability, and intensity of emotional reactions across long- and short-time segments (Thompson, 1994). Emotional regulation may also be measured via teacher ratings (e.g., Izard, Trentacosta, King, Morgan, & Diaz, 2007; Williford, Whittaker, Vitiello, & Downer, 2013) and parent ratings (e.g., Graziano, Reavis, Keane, & Calkins, 2007; Howse, Calkins, et al., 2003).

Scholars have attempted to recognize the empirical and conceptual associations between emotional regulation and BSR. For example, research suggests that BSR skills may mediate the effect of emotional regulation on academic performance. Trentacosta and Izard (2007) found that teacher ratings of children's emotional regulation in kindergarten indirectly predicted their first grade academic competence via teacher ratings of attention to academic tasks measured in first grade. Similarly, Howse, Calkins, Anastopoulos, Keane, and Shelton (2003) found that BSR mediated the relationship between children's emotional regulation measured in preschool and their academic achievement measured in kindergarten. Additionally, as explained by Morrison, Ponitz, and McClelland (2010), children who are prone to presenting strong emotional responses, but who are also capable of controlling their attention and behavior, fare better than children who also exhibit intense emotional reactions, but struggle to regulate their behaviors. Overall, compared to emotional regulation, BSR may serve as the conceivable producer of effective adjustment and academic progress (Morrison et al., 2010).

The definitions and conceptualizations provided above demonstrate the connections and distinctness of various domains of self-regulation. The focus will now turn to briefly describing the development of self-regulation.

The Development of Self-Regulation: A Brief Review

Both genetics and environment play important, interactive roles in the development of children's self-regulation. Thus, elements of children's neurology, biology, psychology, and experiences contribute in interactive ways to children's self-regulation (Morrison et al., 2010).

Child Factors Influencing the Development of Self-Regulation

Neurological and biological factors have been implicated in the development of self-regulation. Specific to the neurological factors, research has demonstrated that executive skills surface early in children's lives and gradually grow through early adolescence (at minimum). As described by Morrison et al. (2010), research also acknowledges three prime phases of cortical development (i.e., 18 months to 5 years, 5 to 10 years, and 10 to 14 years). Across the early childhood years, substantial myelination and pruning occurs as the brain components that assist children in managing and planning their behaviors undergo substantial augmentation (Morrison et al., 2010). Furthermore, particular sites within the cortex are stimulated concurrently with certain behavioral doings (Blair, 2002), and such concurrent procedures support the operation of children's self-regulation. Essentially, ideal regulation is achieved when synchronization is present in the stimulation of various brain domains (Lewis & Todd, 2007).

In relation to the biological roots of children's self-regulation, the construct of temperament is noteworthy. Temperament is represented by the fundamental individual variations that are at least minimally associated with genetic allelic differences and that foretell the development of a child's eventual personality (Berger, 2011). Temperament may be defined as the inborn individual distinctions in behavioral propensities and mannerisms that emerge early in life and stay fairly constant with time and across various circumstances (Goldsmith et al., 1987). Children can vary substantially in their temperamental characteristics (Rothbart & Rueda, 2005); examples of temperamental dimensions include the propensity to exhibit positive emotionality and to draw near novel incitements.

Family Factors Influencing the Development of Self-Regulation

Parent-child attachment and parenting styles have also been implicated in the development of self-regulation. Specifically, a child's ability to regulate stress, behavior, and attention is substantially reliant upon his or her primary caregiver who, as the child's initial informant about life, helps the child learn to self-regulate (Morrison et al., 2010). Via their interactions with children, parents/caregivers either teach children of an environment that is a secure and reliable place in which signs for assistance, stress, or happiness are attended to or that their environment is a frightening and erratic place where one's behaviors are overlooked (Morrison et al., 2010). Parents/caregivers who respond to a child with proper degrees of assistance and comfort when the child is stressed or with positivity when the child is joyful, have a greater likelihood of generating a secure parent-child attachment (De Wolff & Van IJzendoorn, 1997); a

secure parent-child attachment permits children to properly express emotions and to possess adaptive behavioral regulation (Calkins, 2004; McClelland et al., 2007).

The quality of parenting further contributes to the evolvment of self-regulation. Overall, parents' behaviors such as helpful directions, presentation of positive emotions, and constructive discipline strategies, promote superior self-regulation in their children. The most successful parenting style entails a positive, sentimental, warm, and guiding relationship that is non-intrusive, but fosters independent regulation (Berger, 2011). Thus, pairing such a parenting style with sufficient demands and evasion of power-assertive authority is most optimal for promoting self-regulation (Berger, 2011).

Classroom and Teacher Factors

The individual child and family factors discussed above interact with children's early school experiences and with various teacher factors to impact a child's expression of self-regulation at school. For example, research has found that kindergarteners' executive function (i.e., cognitive problem-solving) predicts teacher-rated aspects of behavioral regulation (e.g., self-directed learning style and work habits), observed classroom engagement, and math achievement (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009). Additionally, focusing on the impact of parents to children's classroom behavioral regulation, Nathanson, Rimm-Kaufman, and Brock (2009) found that kindergarteners possessing poor parent-rated behavioral regulation with parents who self-reported lax parental control styles had the most struggles in teacher-rated school adjustment; for children with higher levels of behavioral regulation, lax parental control style did not relate to their school adjustment.

Demonstrating the importance of teaching factors to the manifestation of behavioral regulation in school contexts, Rimm-Kaufman et al. (2002) found that children categorized as socially bold (e.g., exhibiting minimal distress when a stranger approached) at 15 months manifested higher degrees of behavioral regulation in classrooms containing responsive teachers; however, such children were off-task more frequently and less self-governing in classrooms with less responsive teachers. Similarly, by investigating classroom quality (i.e., the emotional and instructional support teachers provided to their kindergarteners) in contexts that necessitated different degrees of BSR, Rimm-Kaufman, La Paro, Downer, and Pianta (2005) found that high-quality emotional and instructional support (e.g., providing feedback and conversing about academic tasks) minimized students' off-task behaviors; this finding endured even in contexts that necessitated elevated degrees of BSR.

In sum, the information discussed in this section demonstrates that child, family, classroom, and teacher factors impact the developmental trajectory of children's self-regulation. Next, a review of the relationship between BSR and academic achievement will be provided.

Behavioral Self-Regulation and Academic Achievement

As stated previously, the development of various self-regulation skills in the early childhood years is critical to children's school readiness (e.g., Bierman, Nix, Greenberg, Blair & Domitrovich, 2008; Blair, 2002) and to their sustained academic success (e.g., Duckworth & Seligman, 2005; Howse, Lange, et al., 2003). Furthermore, the specific domain of BSR is critical to children's academic success. Basically, BSR

skills foster the evolution of principles for behavior and conduct that are impelled from within; children need such skills to independently operate in the school context and amongst their peers (Calkins & Williford, 2009). Research supports that above the cognitive and emotional components of self-regulation, BSR is important to school readiness. For example, Miller, Gouley, Seifer, Dickstein, and Shields (2004) found that preschoolers who exhibited elevated degrees of dysregulated classroom behavior (e.g., running versus walking, inability to sit quietly, and throwing temper tantrums) were rated by teachers as possessing subordinate school readiness skills (e.g., early knowledge of math and reading, comprehension of routines, and friend-making skills).

Also pertinent to the relation between school readiness and BSR, Fitzpatrick and Pagani (2013) evaluated the advantage of viewing classroom engagement skills, or reflections of BSR (e.g., teacher-ratings of students' abilities to follow rules/instructions, work independently, finish work on time, and work carefully and neatly), as a component of school readiness. These authors specifically investigated prospective relations between kindergarten classroom engagement skills and later academic adjustment. Ultimately, their results revealed that superior kindergarten classroom engagement forecasted better academic achievement (i.e., math test scores and teacher-rated academic success) and less teacher-child conflict, inattentiveness, peer victimization, aggression, and antisocial behavior in grade 4. These prospective associations remained after taking into account concurrent academic skills and family variables.

Additionally, and as cited previously, several studies support the assertion that BSR distinctively serves as a concurrent, explanatory factor of children's academic achievement in kindergarten and other elementary school grades (e.g., Howse, Calkins, et al., 2003; Ready et al., 2005), and that BSR, *measured in kindergarten*, predicts growth in children's academic achievement across the elementary school grades (e.g., Matthews et al., 2010). In particular, McClelland, Acock, and Morrison (2006) found that after controlling for child IQ, ethnicity, age, and maternal education, teachers' ratings of 538 children's learning-related skills (i.e., an overarching construct including aspects of BSR) at kindergarten significantly predicted the original levels (i.e., intercept) of math and reading between kindergarten and second grade and between third and sixth grade. McClelland et al. also found that children's learning-related skills in kindergarten significantly predicted growth (i.e., slope) in math and reading scores between kindergarten and second grade.

By graphing direct and indirect pathways between early family risk factors, parent-rated BSR at 54 months, teacher-rated BSR at kindergarten, and first-grade academic achievement, Sektnan, McClelland, Acock, and Morrison (2010) demonstrated the importance of BSR (in the face of risk factors) to academic achievement. These authors employed data derived from a large, national sample, and parent- and teacher-rated BSR measures including aspects of attentional focusing (e.g., task completion, attentiveness to instructions, and distractibility) and inhibitory control (e.g., ability to use time properly, stop an activity when asked to do so, and transition without disruptions). Overall, Sektnan et al. (2010) found that Hispanic and Black ethnic minority status, low

family income, low maternal education, and longer durations of maternal depression, were negatively associated with first grade academic achievement directly and indirectly via children's 54-month and kindergarten levels of BSR. Additionally, the connection between BSR at 54 months and first-grade achievement was via children's BSR in kindergarten. Importantly, Sektnan et al. also found that children with superior BSR fared better academically as compared to children possessing lower BSR, despite the existence of a risk factor.

Matthews, Kizzie, Rowley, and Cortina (2010) demonstrated the important role that aspects of BSR play in racial and gender differences in achievement. Using teacher reports of kindergarteners' learning-related skills, or BSR (i.e., task persistence, attentiveness, learning independence, eagerness to learn, and organization), and a large, nationally representative sample, Matthews et al. (2010) first confirmed prior reports of the academic underperformance of African American boys compared to their female and White peers. Furthermore, in assessing the extent to which these gender and race effects were explained by measured behavior/social factors (i.e., socioeconomic status, interpersonal skills, externalizing problem behaviors, home literacy environment, and BSR), Matthews et al. found that BSR explained the most variance between demographic variables (i.e., gender and race) and academic achievement. Additionally, BSR had the strongest effect on literacy achievement in kindergarten, and only BSR was significantly related to literacy growth through the fifth grade for all racial/ethnic and gender groups included in the study.

The studies cited above make it clear that BSR skills measured in the preschool and/or kindergarten years are important child assets in the academic realm. However, as discussed in the initial chapter of this dissertation, there are key aspects of the relation between BSR and academic achievement that remain unclear. Namely, there is a need for research that focuses on the *development* of BSR and its relations to the development of academic achievement across time (Matthews et al., 2010; Schunk, 2005). This research need is due to the limited amount of studies that have investigated developmental changes in BSR (e.g., Raffaelli et al., 2005) and the even fewer number of studies that have investigated such changes in BSR while also investigating changes in academic achievement (e.g., Breslau et al., 2010; Ladd & Dinella, 2009).

Raffaelli, Crockett, and Shen (2005) sought to study the development of self-regulation (i.e., mother-reported items reflecting regulation of attention, behavior, and affect) from early childhood to adolescence by investigating the structure, stability, and change in the self-regulation of 646 children. Self-regulation was measured at three time points (i.e., 4 to 5 years, 8 to 9 years, and 12 to 13 years). Raffaelli et al. (2005) first found that structurally, self-regulation within their study appeared to be an integrated construct (of mother-rated attention, behavior, and affect regulation) that operated similarly across genders. Additionally, the authors found that girls demonstrated more self-regulation than boys across all ages, and that significant stability in self-regulation existed for their sample, starting in the preschool years (i.e., they found early emergence of stable individual differences in self-regulation). Most importantly to the focus of this dissertation, Raffaelli et al. found evidence of age-related growth in self-regulation,

particularly from the early childhood to middle childhood time span. Nonetheless, although this latter finding supports the notion that self-regulation changes with age, and that future investigations into this matter are warranted, Raffaelli et al. did not investigate whether the age-related changes influenced academic achievement.

Breslau et al. (2010) improved upon the study conducted by Raffaelli et al. (2005) by investigating the relation between change in teacher-rated attention problems, measured at ages 6 and 11, and change in reading and math achievement, measured at ages 11 and 17, for a sample of 590 children. Breslau et al. found that after controlling for children's IQ and family factors, change in achievement scores from ages 11 to 17 was forecasted by change in attention problems from ages 6 to 11. Specifically, they found that an increase in attention problems during the first 5 years of school forecasted a decrease in achievement scores from ages 11 to 17. In contrast, a decrease in attention problems contributed to advancements in achievement scores during the later ages. Despite these promising findings that change in attention problems predicted change in academic achievement, Breslau et al. solely utilized a single reporter (i.e., teachers) to measure their specific self-regulation aspect of focus (i.e., attention). Although teachers provide quality ratings of children's behavior, their ratings may be swayed by their beliefs about children's academic abilities and those beliefs may be predicated on factors like race or socioeconomic status (SES; Downey & Pribesh, 2004). Furthermore, because factors such as race and SES may also be uniquely predictive of academic achievement, study findings may be enhanced by using a multi-source measure of BSR, as is done in this dissertation.

Using a sample of 383 children recruited as they began kindergarten and followed prospectively through completion of the eighth grade, Ladd and Dinella (2009) conducted a study using multiple sources (i.e., parents and teachers) and measuring two aspects of school engagement, which reflect aspects of self-regulation (i.e., school liking-avoidance, conceptualized as a psychological or emotional type of school engagement, and cooperative-resistant classroom participation, conceptualized as a behavioral construct reflecting children's classroom involvement). Importantly, although parents and teachers reported on children's school-liking and avoidance, only teachers reported on children's cooperative-resistant classroom participation, and it is this latter aspect of school engagement that is similar to BSR (as defined in this dissertation). Ultimately, Ladd and Dinella found that despite moderate stability in both types of children's school engagement (measured from first to third grade), across these first three elementary school years, only change in cooperative-resistant classroom participation made an independent and significant predictive contribution to changes in academic achievement (measured from first to eighth grade), in the context of children's gender, cognitive maturity, ethnicity, and school-liking/avoidance, as well as family's SES. With only two waves of measurement of cooperative-resistant classroom participation, Ladd and Dinella were unable to address the differential contributions of initial level and growth of cooperative-resistant classroom participation to growth in children's academic achievement. The current study addresses this gap.

Study Purpose

The literature and studies cited above provide a solid foundation for examining the effect of *growth* in BSR on *growth* in academic achievement. Although some studies have investigated changes in BSR and relations to changes in academic achievement, to the best of the author's knowledge no study has done so by using an academically at-risk sample (i.e., participants scored below the median score for their school district on a state approved, district-administered measure of literacy) and an empirically validated, multi-source measure of BSR that has demonstrated convergent and discriminant validity (via structural equation modeling) with other aspects of self-regulation (Cerda et al., 2014).

It is particularly important to investigate the role of BSR in academic achievement using a sample that is academically at-risk (based on subpar literacy skills) because children who start school with underdeveloped literacy skills often face severe academic struggles throughout their school years, which can lead to life-long challenges (Snow, Burns, & Griffin, 1998; Sonnenschein, Stapleton, & Benson, 2010; Whitehurst & Lonigan, 2002). However, as detailed previously, BSR skills are imperative to children's academic success, both in terms of promoting school readiness (Fitzpatrick & Pagani, 2013; Miller, Gouley, Seifer, Dickstein, & Shields, 2004) and academic achievement in kindergarten and other elementary school grades (e.g., Howse, Calkins, et al., 2003; Ready et al., 2005). Thus, it is possible that fostering growth in children's BSR skills is an effective way to enhance academic skills, indicating that it is important to provide effective, related early interventions for children most at-risk for school

failure. Selecting children for early BSR intervention programs and implementing such programs with success requires knowledge regarding critical points in time for promoting growth in BSR (e.g., when to implement interventions as a means of producing the most powerful effects and the ideal duration of interventions).

Furthermore, it is important to use a multi-source measure of BSR because such a measure reduces measurement variance that is specific to a single source, thereby decreasing the possibility of bias due to a single measurement source. Additionally, using a measure of BSR that has demonstrated distinctiveness from other aspects of self-regulation (i.e., effortful control and social competence; Cerda et al., 2014), leads to a more clear understanding of what aspect of self-regulation is being measured and to less ambiguity in interpreting results.

Based on the preceding discussion, the primary purpose of this dissertation is to investigate the effect of trajectories of BSR from grade 1 to grade 4 on trajectories of reading and math achievement from grade 1 to grade 4, using a large, academically at-risk sample of students, and an empirically validated, multi-source measure of BSR (Cerda et al., 2014). First, using longitudinal growth curve modeling, growth trajectories for BSR across grades 1 to 4 and growth trajectories for reading and math achievement across grades 1 to 4 are obtained. Next, using structural equation modeling (SEM), I investigate the effect that children's level of BSR in grade 1 (i.e., intercept) has on children's level of reading and math achievement in grade 1 (i.e., intercept) and on growth in their reading and math achievement from grades 1 to 4 (i.e., slope), above relevant demographic covariates (i.e., gender, IQ, and economic adversity status).

Additionally, using SEM, I examine the impact that children's growth in BSR from grades 1 to 4 (i.e., slope) has on their growth in reading and math achievement from grades 1 to 4 (i.e., slope), above the aforementioned demographic covariates. The specific hypotheses for this study are as follows: 1) BSR intercept will predict reading and math achievement intercept and slope; and 2) BSR slope will also predict reading and math achievement slope.

CHAPTER III

METHODS

Participants

Participants included in this dissertation were drawn from a larger ($N = 784$) longitudinal study investigating the impact of grade retention on academic achievement. During their first-grade school years, participants for the larger longitudinal study were recruited across two chronological cohorts in the fall of 2001 and 2002. At the time of recruitment, participants were enrolled in one of three school districts located in Southeast Texas (two small cities and one urban city). The ethnic composition of first grade classrooms in these three school districts was 42% White, 25% African American, 27% Hispanic, and 5% Other; 53% were male and 44% qualified for free or reduced lunch. Children were eligible to participate in the larger longitudinal study if they spoke either English or Spanish; were not receiving special education services other than speech and language; had not been previously retained in first grade; and scored below the median score for their school district on a state approved, district-administered measure of literacy. Based on this latter criterion, the sample is considered to be academically at-risk. Relative to age, gender, ethnic status, family language, language status (i.e., limited English proficiency), and literacy test scores, no evidence of selective consent for participation in the longitudinal study was found. However, children with parental consent to participate in the longitudinal study were more likely to receive free

or reduced lunch (62%) compared to children without parental consent for participation (38%).

Of the 784 participants in the overall longitudinal study, 745 (51.9% male) children are included in this dissertation. The ethnic distribution of the sample was: 33.8% White, 22.7% African American, 38.3% Hispanic, and 5.2% Other. This dissertation includes data collected during participants' first, second, third, and fourth years in the larger longitudinal study discussed above (when most students were in grades 1, 2, 3, and 4). Participants were included in the analysis sample if they had data on a measure of teacher-rated BSR (i.e., classroom engagement and attention and behavioral control) at a minimum of one assessment wave (i.e., Year 1, 2, 3, or 4), a measure of peer-rated BSR (i.e., behavioral control and behavioral compliance) at a minimum of one assessment wave, and a measure of reading and math achievement at a minimum of one assessment wave. Analyses on demographic variables (i.e., children's gender, race/ethnicity, average district literacy score, and familial economic adversity status in first grade) and academic achievement in first grade, found no systematic differences between the 745 students who met the inclusion criteria for this dissertation and the 39 students who did not.

At the start of their first grade school year, participants had a mean age of 6.57 (SD = .39) years and a mean age standard score of 93.11 (SD = 14.66) on the abbreviated Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998). As measured during their first grade school year, participants' mean age standard scores on the Woodcock–Johnson III Tests of Achievement (WJ-III ACH) Broad Reading and

Broad Mathematics tests (Woodcock, McGrew, & Mather, 2001) were 96.45 (SD = 18.21) and 100.76 (SD = 14.28), respectively. Furthermore, 58.9% of the participants in the current study were eligible for free or reduced lunch and 14.5% were enrolled in bilingual classrooms.

Assessment Overview

Demographic information (e.g., children's gender, race/ethnicity, average district literacy score, and familial economic adversity status in first grade) was obtained from school district records. From October through May of participants' first grade school years, trained research staff visited schools to individually administer tests of intelligence to student participants, and during those same months across first, second, third, and fourth grade school years, the research staff individually administered tests of academic achievement to student participants. Children identified by the schools as LEP or speaking some Spanish were administered the Woodcock–Muñoz Language Survey (WMLS; Woodcock & Muñoz-Sandoval, 1993) to determine if they were more proficient in Spanish than English. Children more proficient in Spanish were administered all tests in Spanish.

Children's BSR was measured with ratings from two sources (i.e., peers and teachers). Peer ratings of BSR were obtained during the spring semester of each year via individual sociometric interviews that entailed asking children to nominate classmates who best fit several behavioral descriptors, including a descriptor of behavioral control and a descriptor of behavioral compliance. Written parental consent was obtained for each child who participated in the sociometric interviews; yet, all children in a classroom

were eligible to be rated or nominated. Furthermore, psychometrically sound sociometric data for behavioral characteristics can be gathered via the unlimited nomination method when a minimum of 40% of children in a classroom participate (Marks, Babcock, Cillessen, & Crick, 2012). Therefore, peer nomination scores were calculated only for student participants placed in classrooms where greater than 40% of their classmates participated in the sociometric interviews. The mean rate of classmate participation in the sociometric interviews was .65 (range from .40 to .95) and the median number of children in a classroom supplying nominations was 12.

Also during the spring semester of participants' first, second, third, and fourth grade school years, teachers were mailed a questionnaire for each student participant in their classroom. The teacher questionnaires tapped into several domains including aspects of BSR (e.g., students' classroom engagement). Teachers were compensated for completing the questionnaire.

Importantly, the research staff members, who visited schools to conduct the aforementioned tasks with the student participants, received training in how to administer the measures of IQ, academic achievement, and the sociometric interviews. Prior to conducting such tasks with actual study participants, the research assistants were required to demonstrate proficiency in administration procedures.

Measures

Demographic Variables

As mentioned previously, information regarding student participants' gender, race/ethnicity, average district literacy score, and familial economic adversity status in

first grade was obtained from school district records. Eligibility for free or reduced lunch during student participants' first grade school year was used as an indicator of their economic adversity status.

Academic Achievement

The Woodcock-Johnson Tests of Achievement, Third Edition (WJ-III ACH; Woodcock et al., 2001) is an assessment instrument that includes an assemblage of individually administered and norm-referenced tests that measure academic achievement for individuals ages 2 to adulthood. For the purposes of this dissertation, student participants' WJ-III ACH Broad Reading W scores and their WJ-III ACH Broad Math W scores were used. The WJ-III ACH Broad Reading W score is based on the Letter-Word Identification, Reading Fluency, and Passage Comprehension subtests, and the WJ-III ACH Broad Math W score is based on the Calculations, Math Fluency, and Applied Problems subtests. Extensive research documents both the reliability and construct validity of the WJ-III ACH (Woodcock et al., 2001). Student participants who were determined to be more proficient in Spanish than English per the WMLS (Woodcock & Muñoz-Sandoval, 1993) were administered the comparable Spanish tests from the Bateria Woodcock-Muñoz Pruebas de aprovechamiento – Revisada (Bateria-R APROV; Woodcock & Muñoz-Sandoval, 1996), which yield W scores for Broad Reading and Broad Math that are comparable to those of the Woodcock-Johnson Test of Achievement – Revised (WJ-R ACH; Woodcock & Mather, 1989, 1990), the precursor to the WJ-III ACH.

Cognitive Ability (IQ)

The Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998) is a standardized nonverbal measurement of the general intelligence of youth ages 5 years through 17 years. The UNIT measures memory and reasoning abilities via the use of culturally and linguistically common body and hand gestures. During their first-grade school year, student participants were administered the Abbreviated Battery of the UNIT, which is comprised of the Symbolic Memory and Cube Design subtests. The Abbreviated Battery of the UNIT produces a full scale IQ that is well correlated with full scale IQ scores derived from the full battery of the UNIT ($r = .91$). The Abbreviated Battery of the UNIT also has sound internal consistency, test-retest reliability, and construct validity (Bracken & McCallum, 1998; Hooper, 2002).

Behavioral Self-Regulation (BSR)

BSR was computed as the mean of the standardized score of four indicators that are discussed in detail under the sub-headings below. Two of these indicators were assessed from teacher ratings and two were assessed from peer ratings. Specifically, teachers rated: 1) participants' levels of classroom engagement; and 2) participants' levels of attention control and behavioral control. Peer nominations assessed participants' levels of: 1) behavioral control; and 2) behavioral compliance. The internal consistency for the four indicators of BSR at each of the four assessment periods ranged from .81 to .86.

Teacher-Rated Classroom Engagement

Teachers completed a 10-item scale drawing 8 items from the Conscientious scale of the Big Five Inventory (BFI; John & Srivastava, 1999) and 2 items from the Social Competence Scale (Conduct Problems Prevention Research Group, 1999). These 10 items assessed task persistence, organization, and task completion, using a 5-point Likert Scale. Examples include: “Makes plans and follows through with them” and “Able to effectively set goals and work toward them.” Across the 10 items, a standardized average composite score was created to index student participants’ classroom engagement from teachers’ perspectives. The internal consistency of the 10 items for this dissertation sample ranged from .91 to .95 across the four assessment periods.

Teacher-Rated Attention Control and Behavioral Control

Teachers completed the Strength and Difficulties Questionnaire (SDQ; Goodman, 1997), which is a 25-item screening measure for psychopathology that yields five scales (i.e., Conduct Problems, Hyperactivity, Emotional Symptoms, Peer Problems, and Prosocial). Each of these five scales is comprised of 5 items rated on a 0-2 scale on which teachers indicated whether each item was “not true,” “somewhat true,” or “certainly true” for each rated child. The results of a confirmatory factor analysis support the five-factor structure of the SDQ (Hill & Hughes, 2007). Teacher-rated attention control and behavioral control are represented by a standardized average composite score created from the 5-item Hyperactivity Scale for the teacher version of the SDQ. Basically, teacher-rated attention control and behavioral control was measured

via a deficit in BSR; therefore, items were reverse scored as needed so that a higher composite score indicates a higher level of attention control and behavioral control. Examples include: “Restless, overactive, cannot stay still for long” (reverse scored), “Sees tasks through to the end, good attention span,” and “Thinks things out before acting.” The internal consistency of the 5 items for this dissertation sample ranges from .86 to .88 across the four assessment periods.

Peer-Nominated Behavioral Control and Behavioral Compliance

An adapted version of the Class Play (Masten, Morrison, & Pellegrini, 1985) was employed for the peer nominations. Peer nominations were obtained for several behavioral descriptors. Two of these behavioral descriptors (i.e., “Some kids do strange things and make a lot of noise; they bother people who are trying to work,” and “Some kids get into trouble a lot”) were used to measure peer-nominated behavioral control and peer-nominated behavioral compliance, respectively, from a deficit standpoint. Thus, nomination scores obtained for each of these two behavioral descriptors were multiplied by -1 so that a higher score indicates a higher level of behavioral control and behavioral compliance. Peer nomination scores for each item (i.e., behavioral control and behavioral compliance) were obtained by totaling all nominations each student participant received and then standardizing the nomination score within classrooms.

CHAPTER IV

RESULTS

Overview of Data Analyses

Analyses were conducted in two phases using *Mplus* (version 7.0, Muthén & Muthén, 1998-2012). First, longitudinal growth curve analysis was used to obtain individual students' trajectories (i.e., intercept and slope) of BSR and of reading and math achievement. Second, SEM was used to examine the impact of 1) the intercept of children's BSR trajectories on the intercept and slope of their reading and math trajectories and 2) the slope of children's BSR trajectories on the slope of their reading and math trajectories, controlling for student's demographic variables (i.e., children's gender, economic adversity status, and IQ). Notably, because the participants included in the larger ($N = 784$) longitudinal study (from which this dissertation sample was drawn from) were selected based on relatively low literacy scores, it was important to analyze reading and math achievement separately.

All analyses used full information maximum likelihood (FIML) with robust standard errors and a mean-adjusted chi-square statistic test (*Mplus*, version 7.0, Muthén & Muthén, 1998-2012), which supplies appropriate adjustment for data that are missing at random (Enders, 2010). To account for the dependencies among the observations (i.e., the student participants) within clusters (i.e., classrooms), all analyses were conducted using the "TYPE=COMPLEX" routine in *Mplus* (version 7.0, Muthén &

Muthén, 1998-2012), which accounted for the nested structure of the data by adjusting the standard errors of the estimated coefficients.

Descriptive Statistics

The correlations, means, standard deviations, and percentage of missing data for all four indicators of BSR at each of the four time periods are presented in Table B-1. Table B-2 displays the correlations, means, standard deviations, and percentage of missing data for the following study variables: the aforementioned covariates (measured in first grade); reading achievement across the four grade levels; math achievement across the four grade levels; and the aforementioned BSR composite score across the four grade levels. All variables were screened for normality and outliers. All variables were within the normal range according to the cutoff values of 2 for skewness and 7 for kurtosis (West, Finch, & Curran, 1995).

As Table B-1 demonstrates, the one-year average stability of each indicator of BSR across the four assessment periods provide evidence of stability and are close in range (i.e., .59 for teacher-rated classroom engagement; .56 for teacher-rated attention control and behavioral control; .51 for peer-nominated behavioral control; and .64 for peer-nominated behavioral compliance). Furthermore, the four indicators comprising BSR are significantly correlated with one another in the expected direction at each of the four assessment periods. As depicted in Table B-2, gender does not correlate significantly with student participants' math achievement at any of the four assessment periods or with student participants' reading achievement at grades 1, 2, and 4; however, girls have higher third grade reading achievement. Girls were also rated as having

higher levels of BSR across all four assessment periods. Economic adversity status is negatively related to participants' IQ at first grade, math achievement across grades 1 to 4, and reading achievement across grades 2 to 4. Students' IQ levels are positively correlated with reading achievement, math achievement, and BSR across all four assessment periods. Finally, as portrayed in Table B-2, BSR is positively and significantly correlated with participants' reading and math achievement at each of the four assessment periods. These descriptive results are generally consistent with previous research findings.

Longitudinal Growth Curve Analyses

Using longitudinal growth curve modeling, the intercept (i.e., children's average level of BSR, reading achievement, or math achievement in grade 1) and slope (i.e., children's average level of growth in BSR, reading achievement, or math achievement across grades 1 to 4) parameters for children's BSR, reading achievement, and math achievement were obtained. Due to this study involving a maximum of four annual assessments periods (i.e., grades 1- 4), for BSR, reading achievement, and math achievement, both linear and quadratic shapes of growth or decline were considered. Specifically, unconditional linear growth models and unconditional quadratic growth models were first tested for BSR, reading achievement, and math achievement. Thereafter, to determine which unconditional growth model (i.e., linear or quadratic) best modeled the shape of growth in BSR, reading achievement, and math achievement, the unconditional linear growth model and unconditional quadratic growth model for each of these measures were compared using the Satorra-Bentler Chi-square difference

($\Delta \chi^2$) test (Satorra & Bentler, 2001). To evaluate model fit, the following fit indices were used: Chi-square, RMSEA, and CFI. SRMR was not used because this fit index does not account for misfit between the mean structure of the observed data and the mean structure of the model-implied data (Kenny, 2014; Preacher, Wichman, MacCallum, & Briggs, 2008) and is thereby not appropriate for evaluation of fit with longitudinal growth curve models (Kenny, 2014). Additionally, the following cutoff criteria were used to determine whether a relatively good fit existed between the unconditional linear growth model or unconditional quadratic growth model and the observed data: a) larger than .95 for CFI; and b) less than .06 for RMSEA (Hu & Bentler, 1999).

For BSR, the Satorra-Bentler $\Delta \chi^2$ test was non-significant ($\chi^2(4) = 2.445, p = 0.655$), indicating that the unconditional quadratic growth model was not superior to the unconditional linear growth model for BSR. Thus, we analyzed the unconditional linear growth model for BSR, which demonstrated good fit (Hu & Bentler, 1999), $\chi^2(5) = 2.465, p = .782$; CFI = 1.000; RMSEA = .000. As shown in Table B-3, which summarizes the unstandardized model results of the unconditional linear growth model for BSR, although the average level of BSR in first grade was zero (intercept = -0.039 with $SE = .030, p = .188$) and on average, BSR presents a flat linear slope (linear slope = .010 with $SE = .010, p = .283$), both the intercept and linear slope parameters for BSR possess significant variance (Variance in intercept = .563 with $SE = .037, p = .000$; Variance in linear slope = .021 with $SE = .006, p = .001$), indicating that individual differences exist in the intercept and linear slope parameters of BSR. Based on these

latter results, a conditional linear growth model for BSR was used to determine the impact of the aforementioned demographic covariates (i.e., children's gender, IQ, and economic adversity status) on the intercept and linear slope parameters of BSR.

Table B-4 summarizes the unstandardized model results of the conditional linear growth model for BSR, which also demonstrated good fit (Hu & Bentler, 1999), $\chi^2(11) = 6.055$, $p = .870$; CFI = 1.000; RMSEA = .000. As depicted in Table B-4, boys had lower levels of BSR in first grade (Gender on intercept = $-.552$ with $SE = .061$, $p = .000$) and children with higher IQ in first grade possessed higher levels of BSR at that time as well (IQ on intercept = 1.221 with $SE = .174$, $p = .000$). Surprisingly, economic adversity status did not significantly impact levels of BSR in first grade (Econ on intercept = $-.009$ with $SE = .058$, $p = .872$). As also shown in Table B-4, none of the demographic covariates significantly impacted the linear slope of BSR. Finally, children who possessed higher levels of BSR in grade 1 demonstrated slower linear growth in BSR across time (Covariance between intercept and slope = -0.049 with $SE = 0.012$, $p = .000$).

Based on the results of the Satorra-Bentler $\Delta \chi^2$ tests for reading and math achievement, significant results were derived for both forms of achievement (reading: $\chi^2(4) = 145.827$, $p = 0.000$; math: $\chi^2(4) = 43.248$, $p = 0.000$), suggesting that the unconditional quadratic growth models were the superior growth models for both reading and math achievement. However, before discussing these results in more detail, it is important to note that the initial unconditional quadratic growth models for reading and math achievement presented non-convergence issues, which required the variance of

the quadratic slope of reading and math to be fixed at zero in the unconditional quadratic growth model for reading and for math. Once this step was taken in each model, convergence was achieved for both the reading and math unconditional quadratic growth models.

For reading achievement, this resulted in an unconditional quadratic growth model (with the variance of the quadratic slope of reading fixed at zero) that demonstrated the following adequate fit indices: $\chi^2(4) = 25.733$, $p = .000$; CFI = .973; RMSEA = .085. Table B-5 displays the unstandardized model results for this final unconditional quadratic growth model for reading achievement. The average intercept, average linear slope, and average quadratic slope of reading achievement were statistically significant (intercept = 4.355 with $SE = .017$, $p = .000$; linear slope = 0.284 with $SE = 0.009$, $p = 0.000$; quadratic slope = -.036 with $SE = .002$, $p = .000$).

Regarding the growth patterns for reading achievement reported here and in Table B-5, a positive linear slope coefficient and a negative quadratic slope coefficient were obtained. A linear slope coefficient shows the rate of growth when the grade is equal to zero, and a quadratic slope coefficient indicates both the direction and steepness of the curvature. Thus, the negative value of the quadratic slope coefficient for reading achievement indicates that the curvature of reading growth is downwards. The intercept parameter for reading achievement possessed significant variance (Variance in intercept = .049 with $SE = .005$, $p = .000$), and as reported previously, the variance of the quadratic slope of reading was fixed at zero (Variance in quadratic slope = 0.000 with $SE = 0.000$, $p = 999.000$). Therefore, a conditional quadratic growth model for reading achievement

(with the variance of the quadratic slope of reading fixed at zero) was tested to determine the impact of the demographic covariates (i.e., children's gender, IQ, and economic adversity status) on the intercept and quadratic slope parameters of reading achievement.

The unstandardized model results of the conditional quadratic growth model for reading achievement are portrayed in Table B-6. This model demonstrated the following adequate fit indices: $\chi^2(7) = 32.389$, $p = .000$; CFI = .983; RMSEA = .070. As shown in Table B-6, higher IQ in first grade was associated with higher reading achievement in first grade (IQ on intercept = .432 with $SE = .071$, $p = .000$). Furthermore, economically disadvantaged children and children with higher IQ levels demonstrated more rapid growth in reading achievement across time (Econ on quadratic slope = .012, with $SE = .004$, $p = .001$; IQ on quadratic slope = .031, with $SE = .013$, $p = .014$).

In consideration of math achievement, the final unconditional quadratic growth model (with the variance of the quadratic slope of math fixed at zero) demonstrated good fit (Hu & Bentler, 1999): $\chi^2(4) = 3.964$, $p = .411$; CFI = 1.000; RMSEA = .000. Table B-7 presents the unstandardized model results for the final unconditional quadratic growth model for math achievement. As seen in Table B-7, and consistent with the findings derived from the unconditional quadratic growth model for reading achievement, the average intercept, average linear slope, and average quadratic slope of math achievement were statistically significant (intercept = 4.629 with $SE = .009$, $p = .000$; linear slope = 0.135 with $SE = 0.005$, $p = 0.000$; quadratic slope = -.008 with $SE = .001$, $p = .000$). As with reading achievement, the negative value of the quadratic slope coefficient for math achievement indicates that the curvature of math growth decelerates

over time. The intercept parameter for math achievement possessed significant variance (Variance in intercept = .012 with $SE = .001$, $p = .000$), and as reported previously, the variance of the quadratic slope of math was fixed at zero (Variance in quadratic slope = 0.000 with $SE = 0.000$, $p = 999.000$). Based on these results, a conditional quadratic growth model (with the variance of the quadratic slope of math fixed at zero) for math achievement was also tested to examine the influence of the demographic covariates (i.e., children's gender, IQ, and economic adversity status) on the intercept and quadratic slope parameters of math achievement.

The model fit indices for the conditional quadratic growth model for math achievement also demonstrated good fit (Hu & Bentler, 1999): $\chi^2(7) = 13.909$, $p = .053$; CFI = .996; RMSEA = .036. The unstandardized model results for this conditional quadratic growth model for math achievement are presented in Table B-8. As with reading achievement, children with higher IQ in first grade also possessed higher math achievement in first grade (IQ on intercept = .262 with $SE = .034$, $p = .000$). However, in grade 1, economically disadvantaged children possessed lower levels of math achievement (Econ on intercept = -.076, with $SE = .012$, $p = .000$). Across time, children with higher IQ levels demonstrated more rapid quadratic growth in math achievement (IQ on quadratic slope = .025, with $SE = .007$, $p = .001$).

Structural Equation Modeling

Following the longitudinal growth curve analyses, SEM was employed to investigate the impact that children's initial level of BSR in grade 1 (i.e., intercept) has on children's initial level of reading and math achievement in grade 1 (i.e., intercept) and

on quadratic growth in their reading and math achievement from grades 1 to 4 (i.e., quadratic slope), above relevant demographic covariates (i.e., gender, IQ, and economic adversity status). Additionally, SEM was used to examine the impact that children's linear growth in BSR from grades 1 to 4 (i.e., linear slope) has on their quadratic growth in reading and math achievement from grades 1 to 4 (i.e., quadratic slope), above the relevant demographic covariates. As with the longitudinal growth curve analyses, the following fit indices were used to evaluate model fit for the SEM analyses: Chi-square, RMSEA, and CFI. (SRMR was not used to evaluate model fit due to the rationale stated previously in the Longitudinal Growth Curve Analyses section above). The following cutoff criteria were used to determine whether a relatively good fit existed between the hypothesized SEM models and the observed data: a) larger than .95 for CFI; and b) less than .06 for RMSEA (Hu & Bentler, 1999).

Specific to reading achievement, the results derived from the conditional quadratic growth model for reading achievement were used to trim the SEM for reading achievement. The SEM for reading achievement demonstrated good fit (Hu & Bentler, 1999): $\chi^2(39) = 67.364$, $p = .003$; CFI = .990; RMSEA = .031. Figure A-1 illustrates this SEM for reading achievement (based on the standardized model results), and B-9 displays the unstandardized and standardized model results. Based on the standardized model results displayed in Table B-9, children's initial levels of BSR in grade 1 ($\beta = 0.232$, $SE = 0.035$, $p < .01$) significantly predicted their reading achievement in grade 1 above relevant demographic covariates. However, children's initial levels of BSR in

grade 1 and their linear growth in BSR across grades 1 to 4 did not significantly predict their quadratic growth in reading achievement across grades 1 to 4.

As with reading achievement, the results derived from the conditional quadratic growth model for math achievement were used to trim the SEM for math achievement. The SEM for math achievement demonstrated good fit: $\chi^2(40) = 64.206$, $p = .009$; CFI = .992; RMSEA = .029. The final SEM (based on the standardized model results) for math achievement is illustrated in Figure A-2, and Table B-10 displays the unstandardized and standardized model results. As demonstrated by the standardized model results presented in Table B-10, children's initial levels of BSR in grade 1 ($\beta = 0.166$, $SE = 0.038$, $p < .01$) significantly predicted their initial math achievement in grade 1 above relevant demographic covariates; these results are consistent with the results derived for reading achievement. Also consistent with the results found for reading achievement, children's initial levels of BSR in grade 1 and their linear growth in BSR across grades 1 to 4 did not significantly predict their quadratic growth in math achievement across grades 1 to 4.

CHAPTER V

CONCLUSIONS

Using longitudinal growth curve modeling and SEM, this dissertation used a large, academically at-risk sample and an empirically validated, multi-source measure of BSR (Cerdeira et al., 2014) to determine whether initial levels of BSR in first grade predicted initial levels and growth in reading and math achievement across grades 1 to 4. This dissertation also tested whether growth in BSR across grades 1 to 4 predicted growth in reading and math achievement across that same time period.

First, using longitudinal growth curve analysis and Satorra-Bentler adjusted chi square difference tests (Satorra & Bentler, 2001), it was determined that for this sample, BSR demonstrated linear growth across grades 1 to 4, whereas reading and math achievement exhibited quadratic growth across those same grades. These findings are consistent with prior research that has also demonstrated a significant linear effect for self-regulation (e.g., Raffaelli et al., 2005) and curvilinear, or quadratic, trajectories for reading and math achievement in the elementary school grades (e.g., Li-Grining, Votruba-Drzal, Maldonado-Carreño, & Haas, 2010; Sonnenschein et al., 2010).

Specific to BSR, although average levels of standardized BSR in first grade were zero and on average, BSR presented a flat linear slope, individual differences existed in BSR levels at first grade and across grades 1 to 4. The finding that individual differences existed in BSR in this dissertation aligns with the study conducted by Raffaelli et al. (2005), which also revealed individual differences in self-regulation

amongst their sample of 646 children. Additionally, the longitudinal growth curve analysis for BSR demonstrated that children with higher levels of BSR in first grade demonstrated slower linear growth in BSR across grades 1 to 4. This latter finding may be attributable to regression to the mean or to the notion that children with lower initial levels of BSR possessed more capacity for linear growth in BSR across time.

Furthermore, while gender and IQ impacted initial levels of BSR in first grade (with boys possessing lower levels of BSR and children with higher IQ possessing higher levels of BSR) children's economic adversity status did not. The finding that economic adversity status did not impact initial levels of BSR was surprising and may be due to the selective nature of the sample (i.e., 61.1% of the participants were deemed to have low income based on their eligibility for free or reduced lunch). Also relevant to BSR, none of the examined demographic variables impacted the linear growth of BSR across grades 1 to 4. This suggests that the variance in the linear growth of BSR is explained by factors other than the examined demographic variables (e.g., quality of education received or teachers' instructional practices).

For reading and math achievement, results of the longitudinal growth curve analyses revealed statistical significance for the average intercept and quadratic slope of reading and math achievement, and the presence of individual differences in first grade reading and math achievement levels. Whereas economic disadvantage in first grade related to lower first grade math achievement, children with higher IQ in first grade had higher first grade reading and math achievement. Furthermore, higher IQ in first grade related to more rapid quadratic growth in reading and math achievement across grades 1

to 4, and economic disadvantage in first grade related to faster quadratic growth in reading achievement as well. While higher IQ has been previously and consistently associated with academic achievement in elementary school grades (e.g., Gagné & St Père, 2001; McGrew, Flanagan, Keith, & Vanderwood, 1997; Wise, Ring, & Olson, 1999), the result that economically disadvantaged children in first grade demonstrated faster quadratic growth in reading achievement across time is a more surprising revelation. For this study, this particular finding may be due to lack of sensitivity of the measure of economic disadvantage (e.g., scored 0 or 1 based on eligibility for free or reduced lunch) and the fact that over half of the participants in this dissertation were economically disadvantaged (based on their eligibility for free or reduced lunch).

Relative to the results derived from SEM, children's first grade BSR levels were found to significantly predict their first grade reading and math achievement levels above relevant demographic covariates. These findings generally align with some of the findings of several previously cited studies (e.g., Howse, Calkins, et al., 2003; Matthews et al., 2010; McClelland et al., 2006; Ready et al., 2005). In contrast, children's first grade BSR levels and linear growth in their BSR did not significantly predict quadratic growth in their reading or math achievement across grades 1 to 4. There are a number of possible reasons for this latter finding. For example, it is possible that the use of a more global measure of academic achievement in context (e.g., grade point average versus achievement scores from the WJ-III reading and math scores) would relate more to the employed measure of BSR skills. More specifically, the WJ-III subtests were administered to participants in individual settings that lacked the surroundings typically

present in school classrooms (e.g., distractions from classmates and teachers), whereas the measure of BSR was derived from peer and teacher ratings of such skills as observed in the classroom setting. Perhaps the WJ-III achievement measure used in this dissertation does not parallel what students do in class in the manner that a more global, contextualized measure of academic achievement, such as grade point average, would.

It is also possible that children's first grade BSR levels and linear growth in their BSR did not significantly impact quadratic growth in their reading and math achievement across time because it is initial levels and growth in academic achievement that predicts growth in BSR. Stipek, Newton, and Chudgar (2010) found preliminary evidence for this alternative directionality of the association between academic achievement and BSR. Specifically, Stipek et al. (2010) conducted a longitudinal study with 379 low-income children who began the study in kindergarten or first grade, to specifically investigate the directionality of the association between aspects of BSR and literacy achievement through fifth grade. Thus, while controlling for prior literacy achievement, Stipek et al. assessed the extent to which BSR predicted literacy achievement in a later grade, and while controlling for prior BSR, the authors assessed the extent to which literacy achievement predicted later BSR. Ultimately, while Stipek et al. did find that BSR in kindergarten or first grade strongly predicted third grade literacy skills with previous literacy skills held constant (with the same being discovered for children moving from third to fifth grade), they also found modest evidence supporting that higher literacy achievement in the prior grade predicted an increase in BSR skills at fifth grade (but not third grade) with previous BSR skills controlled for.

Thus, perhaps future researchers could further investigate this alternative directionality between academic achievement and BSR skills.

Limitations and Future Directions

Though this dissertation is strengthened by its use of a large, ethnically diverse sample, a multi-informant measure of BSR, and a longitudinal design spanning four grade levels, there are also several limitations to consider when interpreting the results. For example, because this dissertation includes an academically at risk sample, the findings of this dissertation may not generalize to lower risk or higher achieving children. Moreover, although a multi-informant measure of BSR is utilized, this measure may be improved by using multiple methods of measurement (e.g., including data obtained via direct classroom observations of children's BSR skills). Furthermore, the use of children's eligibility for free or reduced lunch as an indicator of economic adversity status is also limiting; a more comprehensive measure of socioeconomic status would be more suitable. Additionally, this dissertation is an observational study versus an experimental design study, meaning that causal inferences regarding impacts of BSR on reading and math achievement cannot be made. Lastly, and as discussed previously, because it is possible that initial achievement levels have an impact on initial levels and growth in BSR across elementary school grades, and that growth in achievement levels across elementary school grades has an impact on growth in BSR levels across elementary school grades, future researchers are encouraged to examine such alternative models.

Implications for Policy and Practice

The findings that first grade BSR levels predicted first grade reading and math achievement (above relevant demographic covariates) whereas first grade BSR levels and linear growth in BSR across grades 1 to 4 did not predict quadratic growth in reading or math achievement across grades 1 to 4 provides important implications for policy and practice. Specifically, these findings lend support to assessing children's BSR skills during preschool and early elementary school years (i.e., kindergarten and first grade) as an indicator of children's school readiness. Such assessment procedures would support the use of prevention and intervention programs targeting the development of children's BSR skills during preschool and early elementary school years (i.e., kindergarten and first grade) as a means of fostering reading and math achievement during those same years. Additionally, assessing children's BSR skills during preschool and early elementary school years would offer data regarding which children to place in such prevention and intervention programs.

Existing research offers evidence for preventions and interventions aimed at improving aspects of children's BSR skills or aspects of children's executive function skills, which underlie the BSR skills investigated in this dissertation (McClelland et al., 2007; Morrison et al., 2010). For example, Diamond, Barnett, Thomas, and Munro (2007) found that Tools of the Mind, a program that instructs teachers to perform activities intended to aid children in developing self-regulation techniques (e.g., stating aloud what is expected of them) has significantly enhanced preschoolers' executive functions (inhibitory control and attention).

Similar to Tools of the Mind, the Chicago School Readiness Project (CSRP) trains teachers to implement specific strategies intended to enhance classroom management and create more effective support for children's self-regulation in the classroom (e.g., providing more specific, understandable routines and rules, redirecting inappropriate behaviors, and rewarding appropriate behaviors; Raver et al., 2011). The CSRP also provides teachers with ongoing consultation services from a mental health consultant. Raver et al. (2011) found that the CSRP promotes growth in low income children's self-regulation skills (i.e., global dimensions of attention control and impulse control and aspects of executive function and effortful control) and their academic achievement skills.

Tominey and McClelland (2011) also developed an intervention targeting the improvement of children's self-regulation skills (i.e., circle time games that require children to remain attentive, utilize inhibitory control skills, and remember directions and novel rules). This intervention demonstrated some promise in enhancing aspects of self-regulation skills in preschool children who started the school year with subpar levels of self-regulation, and in fostering gains in preschoolers' letter-word identification skills (Tominey & McClelland, 2011).

In addition to the use of specific prevention/intervention programs targeting the development of children's self-regulation skills, daily instructional and classroom practices may also facilitate the development of children's BSR skills within preschool and early elementary grade classrooms. For example, teachers may create and maintain classrooms inclusive of materials that children can independently and easily access;

clearly explicate tasks for students; directly and explicitly teach students strategies for using materials and their classmates to aid their completion of tasks and to enhance their problem-solving skills; and help students become responsible for school work by providing regular work reviews and immediate feedback (Stipek, Newton, & Chudgar, 2010). Additionally, as some researchers (e.g., Elias & Berk, 2002) have found that complex socio-dramatic play (i.e., purposeful play) fosters preschoolers self-regulation skills, teachers can also provide class time for such activities during the school day.

REFERENCES

- Berger, A. (2011). Individual differences in self-regulation. In A. Berger (Ed.), *Self-regulation: Brain, cognition, and development* (pp. 61-90). Washington, DC: American Psychological Association.
- Bierman, K. L., Nix, R. L., Greenberg, M. T., Blair, C., & Domitrovich, C. (2008). Executive functions and school readiness intervention: Impact, moderation, and mediation in the Head Start REDI program. *Development and Psychopathology, 20*, 821-843. doi: 10.1017/S0954579408000394
- Blair, C. (2002). School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *American Psychologist, 57*, 111-127. doi: 10.1037//0003-066X.57.2.111
- Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: The promotion of self-regulation as a means of preventing school failure. *Development and Psychopathology, 20*, 899-911. doi: 10.1017/S0954579408000436
- Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*(2), 647-663.
- Bracken, B. A., & McCallum, R. S. (1998). *Universal Nonverbal Intelligence*. Itasca, IL: Riverside Publishing.

- Breslau, N., Breslau, J., Peterson, E., Miller, E., Lucia, V. C., Bohnert, K., & Nigg, J. (2010). Change in teachers' ratings of attention problems and subsequent changes in academic achievement: A prospective analysis. *Psychological Medicine, 40*, 159-166. doi: 10.1017/S0033291709005960
- Brock, L. L., Rimm-Kaufman, S. E., Nathanson, L., & Grimm, K. J. (2009). The contributions of 'hot' and 'cool' executive function to children's academic achievement, learning-related behaviors, and engagement in kindergarten. *Early Childhood Research Quarterly, 24*, 337-349. doi: 10.1016/j.ecresq.2009.06.001
- Calkins, S. D. (2004). Early attachment processes and the development of emotional self-regulation. In S. D. Calkins (Ed.), *Handbook of self-regulation: Research, theory, and applications* (pp. 324-339). New York, NY: Guilford Press.
- Calkins, S. D. (2007). The emergence of self-regulation: Biological and behavioral control mechanisms supporting toddler competencies. In S. D. Calkins (Ed.), *Socioemotional development in the toddler years: Transitions and transformations* (pp. 261-284). New York, NY: Guilford Press.
- Calkins, S. D., & Fox, N. A. (2002). Self-regulatory processes in early personality development: A multilevel approach to the study of childhood social withdrawal and aggression. *Development and Psychopathology, 14*, 477-498. doi: 10.1017.S095457940200305X
- Calkins, S. D., & Williford, A. P. (2009). Taming the terrible twos: Self-regulation and

- school readiness. In S. D. Calkins & A. P. Williford (Eds.), *Handbook of child development and early education: Research to practice* (pp. 172-198). New York, NY: Guilford Press.
- Carver, C. S. (2004). Self-regulation of action and affect. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 13-39). New York, NY: Guilford Press.
- Cerda, C. A., Im, M. H., & Hughes, J. N. (2014). Learning-related skills and academic achievement in academically at-risk first graders. *Journal of Applied Developmental Psychology, 35*, 433-443. doi: 10.1016/j.appdev.2014.08.001
- Conduct Problems Prevention Research Group. (1999). Initial impact of the fast track prevention trial for conduct problems: I. The high-risk sample. *Journal of Consulting and Clinical Psychology, 67*(5), 631-647.
- Dahl, R. E., & Conway, A. M. (2009). Self-regulation and the development of behavioral and emotional problems: Toward an integrative conceptual and translational research agenda. In R. E. Dahl & A. M. Conway (Eds.), *Biopsychosocial regulatory processes in the development of childhood behavioral problems* (pp. 290-318). New York, NY: Cambridge University Press.
- Denham, S. (2006). Social-emotional competence as support for school readiness: What is it and how do we assess it? *Early Education and Development, 17*, 57-89. doi: 10.1207/s15566935eed1701_4

- De Wolff, M. S., & Van IJzendoorn, M. H. (1997). Sensitivity and attachment: A meta-analysis on parental antecedents of infant attachment. *Child Development, 68*(4), 571-591.
- Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science, 318*, 1387-1388. doi: 10.1126/science.1151148
- Downey, D. B., & Pribesh, S. (2004). When race matters: Teachers' evaluations of students' classroom behavior. *Sociology of Education, 77*, 267-282. doi: 10.1177/003804070407700401
- Duckworth, A. L., & Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science, 16*(12), 939-944.
- Eisenberg, N., & Spinrad, T. L. (2004). Emotion-related regulation: Sharpening the definition. *Child Development, 75*, 334-339. doi: 10.1111/j.1467-8624.2004.0067
- Elias, C. L., & Berk, L. E. (2002). Self-regulation in young children: Is there a role for sociodramatic play? *Early Childhood Research Quarterly, 17*, 216-238. doi: 10.1016/S0885-2006(02)00146-1
- Enders, C. K. (2010). *Applied missing data analysis*. New York: Guilford Press.
- Fitzpatrick, C., & Pagani, L. S. (2013). Task-oriented kindergarten behavior pays off in later childhood. *Journal of Developmental and Behavioral Pediatrics, 34*, 94-101. doi: 10.1097/DBP.0b013e31827a3779
- Gagné, F., & St Père, F. (2001). When IQ is controlled, does motivation still predict

- achievement? *Intelligence*, 30, 71-100. doi: 10.1016/S0160-2896(01)00068-X
- Goldsmith, H. H., Buss, A. H., Plomin, R., Rothbart, M. K., Thomas, A., Chess, S.,...McCall, R. B. (1987). Roundtable: What is temperament? Four approaches. *Child Development*, 58(2), 505-529.
- Goodman, R. (1997). The Strengths and Difficulties Questionnaire: A research note. *Journal of Child Psychology and Psychiatry*, 38(5), 581-586.
- Graziano, P. A., Reavis, R. D., Keane, S. P., & Calkins, S. D. (2007). The role of emotion regulation in children's early academic success. *Journal of School Psychology*, 45, 3-19. doi: 10.1016/j.jsp.2006.09.002
- Greenwood, C. R. (1991). Longitudinal analysis of time, engagement, and achievement in at-risk versus non-risk students. *Exceptional Children*, 57(6), 521-536.
- Grolnick, W. S., & Farkas, M. (2002). Parenting and the development of children's self-regulation. In M. H. Bornstein (Ed.), *Handbook of parenting: Vol. 5, practical issues in parenting* (2nd ed., pp. 89-110). Mahwah, NJ: Erlbaum.
- Hill, C. R., & Hughes, J. N. (2007). An examination of the convergent and discriminant validity of the Strengths and Difficulties Questionnaire. *School Psychology Quarterly*, 22, 380-406. doi: 10.1037/1045-3830.22.3.380
- Hooper, V. S. (2002). *Concurrent and predictive validity of the Universal Nonverbal Intelligence Test and the Leiter International Performance Scale—revised* (Doctoral dissertation). Retrieved from ProQuest dissertations and theses global. (3075546).
- Howse, R. B., Calkins, S. D., Anastopoulos, A. D., Keane, S. P., & Shelton, T. L.

- (2003). Regulatory contributors to children's kindergarten achievement. *Early Education and Development, 14*, 101-120. doi: 10.1207/s15566935eed1401_7
- Howse, R. B., Lange, G., Farran, D. C., & Boyles, C. D. (2003). Motivation and self-regulation as predictors of achievement in economically disadvantaged young children. *The Journal of Experimental Education, 71*(2), 1551-174.
- Hrabok, M., & Kerns, K. A. (2010). The development of self-regulation: A neuropsychological perspective. In M. Hrabok & K. A. Kerns (Eds.), *Self and social regulation: Social interaction and the development of social understanding and executive functions* (pp. 129-154). New York, NY: Oxford University Press.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55. doi: 10.1080/10705519909540118
- Izard, C., Tretacosta, C., King, K., Morgan, J., & Diza, M. (2007). Emotions, emotionality, and intelligence in the development of adaptive behavior. In G. Matthews, M. Zeidner, & R. Roberts (Eds.), *The science of emotional intelligence: Knowns and unknowns* (pp. 127-150). New York, NY: Oxford University Press.
- Jahromi, L. B., Bryce, C. I., & Swanson, J. (2013). The importance of self-regulation for the school and peer engagement of children with high-functioning autism. *Research in Autism Spectrum Disorders, 7*, 235-246. doi: 10.1016/j.rasd.2012.08.012

- Jahromi, L. B., & Stifter, C. A. (2008). Individual differences in preschoolers' self-regulation and theory of mind. *Merrill-Palmer Quarterly*, *54*, 125-150. doi: 10.1353/mpq.2008.0007
- John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: theory and research* (2nd. ed., pp. 102-138). New York: Guilford.
- Kenny, D. A. (2014). *Measures of fit* [PowerPoint slides]. Retrieved from <http://davidakenny.net/webinars/listpp.htm#Fit>
- Kochanska, G., Murray, K., & Coy, K. C. (1997). Inhibitory control as a contributor conscience in childhood: From toddler to early school age. *Child Development*, *68*, 263-277.
- Ladd, G. W., & Dinella, L. M. (2009). Continuity and change in early school engagement: Predictive of children's achievement trajectories from first to eighth grade? *Journal of Educational Psychology*, *101*, 190-206. doi: 10.1037/a0013153
- Lewis, M. D., & Todd, R. M. (2007). The self-regulating brain: Cortical-subcortical feedback and the development of intelligent action. *Cognitive Development*, *22*, 406-430. doi: 10.1016/j.cogdev.2007.08.004
- Lewit, E. M., & Baker, L. S. (1995). School readiness. *The Future of Children*, *5*, 128-139. doi: 10.2307/1602361
- Li-Grining, C., Votruba-Drzal, E., Maldonado-Carreño, C., & Haas, K. (2010). Children's early approaches to learning and academic trajectories through fifth

- grade. *Developmental Psychology*, 46, 1062-1077. doi: 10.1037/a0020066
- Lin, H., Lawrence, F. R., & Gorrell, J. (2003). Kindergarten teachers' views of children's readiness for school. *Early Childhood Research Quarterly*, 18, 225-237. doi: 10.1016/S0885-2006(03)00028-0
- MacCoon, D. G., Wallace, J. F., & Newman, J. P. (2004). Self-regulation: Context-appropriate balanced attention. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 422-444). New York, NY: Guilford Press.
- Marks, P. E. L., Babcock, B., Cillessen, A. H. N., & Crick, N. R. (2012). The effects of participation rate on the internal reliability of peer nomination measures. *Social Development*. Advance online publication. doi: 10.1111/j.1467-9507.2012.00661.x
- Mashburn, A. J., & Pianta, R. C. (2006). Social relationships and school readiness. *Early Education and Development*, 17, 151-176. doi: 10.1207/s15566935eed1701_7
- Masten, A. S., Morrison, P., & Pellegrini, D. S. (1985). A revised class play method of peer assessment. *Developmental Psychology*, 21(3), 523-533.
- Matthews, J. S., Kizzie, K. T., Rowley, S. J., & Cortina, K. (2010). African Americans and boys: Understanding the literacy gap, tracing academic trajectories, and evaluating the role of learning-related skills. *Journal of Educational Psychology*, 102, 757-771. doi: 10.1037/a0019616
- McClelland, M. M., Acock, A. C., & Morrison, F. J. (2006). The impact of kindergarten learning-related skills on academic trajectories at the end of elementary school.

Early Childhood Research Quarterly, 21, 471-490. doi:

10.1016/j.ecresq.2006.09.003

McClelland, M. M., Cameron, C. E., Wanless, S. B., & Murray, A. (2007). Executive function, behavioral self-regulation, and social-emotional competence: Links to school readiness. In O. N. Saracho & B. Spodek (Eds.), *Contemporary perspectives on research in social learning in early childhood education* (pp. 83-107). Greenwich, CT: Information Age.

McClelland, M. M., Ponitz, C. C., Messersmith, E. E., & Tominey, S. (2010). Self-regulation: Integration of cognition and emotion. In M. M. McClelland, C. C. Ponitz, E. E. Messersmith, & S. Tominey (Eds.), *The handbook of lifespan development, vol. 1: Cognition, biology, and methods* (pp. 509-553). Hoboken, NJ: John Wiley & Sons, Inc.

McGrew, K. S., Flanagan, D. P., Keith, T. Z., & Vanderwood, M. (1997). Beyond g: The impact of *Gf-Gc* specific cognitive abilities research on the future use and interpretation of intelligence tests in the schools. *School Psychology Review*, 26(2), 189-210.

Miller, A. L., Gouley, K. K., Seifer, R., Dickstein, S., & Shields, A. (2004). Emotions and behaviors in the head start classroom: Associations among observed dysregulation, social competence, and preschool adjustment. *Early Education and Development*, 15, 147-165. doi: 10.1207/s15566935eed1502_2

Miller, K. F., Kelly, M., Zhou, X., & Campbell, J. I. D. (2005). Learning mathematics in China and the United States: Cross-cultural insights into the nature and course of

preschool mathematical development. In K. F. Miller, M. Kelly, & X. Zhou (Eds.), *Handbook of mathematical cognition* (pp. 169-177). New York, NY: Psychology Press.

Morrison, F. J., Ponitz, C. C., & McClelland, M. M. (2010). Self-regulation and academic achievement in the transition to school. In F. J. Morrison, C. C. Ponitz, & M. M. McClelland (Eds.), *Child development at the intersection of emotion and cognition* (pp. 203-224). Washington, DC: American Psychological Association.

Müller, U., Dick, A. S., Gela, K., Overton, W. F., & Zelazo, P. D. (2006). The role of negative priming in preschoolers' flexible rule of use on the Dimensional Change Card Sort Task. *Child Development, 77*, 395-412. doi: 10.1111/j.14678624.2006.00878.x

Murray, K. T., & Kochanska, G. (2002). Effortful control: Factor structure and relation to externalizing and internalizing behaviors. *Journal of Abnormal Child Psychology, 30*, 503-514. doi: 10.1023/A:1019821031523

Muthén, L. K., & Muthén, B. O. (1998-2012). Mplus user's guide (Version 7) [Computer software]. Los Angeles, CA: Muthén & Muthén.

Nathanson, L., Rimm-Kaufman, S. E., & Brock, L. L. (2009). Kindergarten adjustment difficulty: The contribution of children's effortful control and parental control. *Early Education and Development, 20*, 775-798. doi: 10.1080/10409280802571236

Pintrich, P. R. (2000). The role of goal-orientation in self-regulated learning. In M.

- Boekarts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451-502). San Diego, CA: Academic Press.
- Preacher, K. J., Wichman, A. L., MacCallum, R. C., & Briggs, N. E. (2008). Introduction. In T. F. Liao (Ed.), *Latent growth curve modeling* (pp. 1-21). Thousand Oaks, CA: Sage.
- Raffaelli, M., Crockett, L. J., & Shen, Y. (2005). Developmental stability and change in self-regulation from childhood to adolescence. *The Journal of Genetic Psychology, 166*(1), 54-75.
- Raver, C. C., Li-Grining, C., Bub, K., Jones, S. M., Zhai, F., & Pressler, E. (2011). CSRP's impact on low-income preschoolers' preacademic skills: Self-regulation as a mediating mechanism. *Child Development, 82*, 362-378. doi: 10.1111/j.14678624.2010.01561.x
- Ready, D., LoGerfo, L., Burkam, D., & Lee, V. (2005). Explaining girls' advantage in kindergarten literacy learning: do classroom behaviors make a difference? *The Elementary School Journal, 106*, 21-38. doi: 10.1086/496905
- Rimm-Kaufman, S. E., Early, D. M., Cox, M. J., Saluja, G., Pianta, R. C., Bradley, R. H., & Payne, C. (2002). Early behavioral attributes and teachers' sensitivity as predictors of competent behavior in the kindergarten classroom. *Applied Developmental Psychology, 23*, 451-470. doi: 10.1016/S0193-3973(02)00128-4
- Rimm-Kaufman, S. E., La Paro, K. M., Downer, J. T., & Pianta, R. C. (2005). The contribution of classroom setting and quality of instruction to children's behavior in kindergarten classrooms. *The Elementary School Journal, 105*, 377-394. doi:

10.1086/429948

Rothbart, M. K., & Rueda, M. R. (2005). The development of effortful control. In M. K. Rothbart & M. R. Rueda (Eds.), *Developing individuality in the human brain: A tribute to Michael I. Posner* (pp. 167-188). Washington, DC: American Psychological Association.

Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika*, *66*(4), 507-514.

Schunk, D. H. (2005). Commentary on self-regulation in school contexts. *Learning and Instruction*, *15*, 173-177. doi: 10.1016/j.learninstruc.2005.04.013

Schunk, D. H., & Zimmerman, B. J. (1997). Social origins of self-regulatory competence. *Educational Psychology*, *32*, 195-208. doi: 10.1207/s15326985ep3204_1

Sektnan, M., McClelland, M. M., Acock, A., & Morrison, F. J. (2010). Relations between early family risk, children's behavioral regulation, and academic achievement. *Research Quarterly*, *25*, 464-479. doi: 10.1016/j.ecresq.2010.02.005

Snow, C. E., Burns, M. S., & Griffin, P. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Sonnenschein, S., Stapleton, L. M., Benson, A. (2010). The relation between the type and amount of instruction and growth in children's reading competencies. *American Educational Research Journal*, *47*, 358-389. doi: 10.3102/0002831209349215

- St. Clair-Thompson, H. L., & Gathercole, S. E. (2006). Executive functions and achievements in school: Shifting, updating, inhibition, and working memory. *The Quarterly Journal of Experimental Psychology*, *59*, 745-759. doi: 10.1080/17470210500162854
- Stipek, D., Newton, S., & Chudgar, A. (2010). Learning-related behaviors and literacy achievement in early elementary school-aged children. *Early Childhood Research Quarterly*, *25*, 385-395. doi: 10.1016/j.ecresq.2003.12.001
- Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development*, *59*(2/3), 25-52.
- Tominey, S. L., & McClelland, M. M. (2011). Red light, purple light: Findings from a randomized trial using circle time games to improve behavioral self-regulation in preschool. *Early Education and Development*, *22*, 489-519. doi: 10.1080/10409289.2011.574258
- Trentacosta, C. J., & Izard, C. E. (2007). Kindergarten children's emotional competence as a predictor of their academic competence in first grade. *Emotion*, *7*, 77-88. doi: 10.1037/1528-3542.7.1.77
- Vitiello, V. E., Greenfield, D. B., Munis, P., George, J. (2011). Cognitive flexibility, approaches to learning, and academic school readiness in Head Start preschool children. *Early Education and Development*, *22*, 388-410. doi: 10.1080/10409289.2011.538366

- West, S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation models with nonnormal variables: Problems and remedies. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 56-75). Thousand Oaks, CA: Sage.
- Whitehurst, G.J., & Lonigan, C.J. (2002) Emergent literacy: Development from pre-readers to readers. In S. Neuman & D. Dickinson (Eds.), *Handbook of Early Literacy Development* (pp.11-29). New York, NY: Guilford Publications.
- Williford, A. P., Whittaker, J. E. V., Vitiello, V. E., & Downer, J. T. (2013). Children's engagement within the preschool classroom and their development of self regulation. *Early Education and Development, 24*. 162-187. doi: 10.1080/10409289.2011.628270
- Wise, B. W., Ring, J., & Olson, R. K. (1999). Training phonological awareness with and without explicit attention to articulation. *Journal of Experimental Child Psychology, 72*, 271-304. doi: 10.1006/jecp.1999.2490
- Woodcock, R. W., & Mather, N. (1989, 1990). WJ-R Tests of Achievement: Examiner's Manual. In R. W. Woodcock & M. B. Johnson, *Woodcock-Johnson Psycho Educational Battery – Revised*. Allen, TX: DLM Teaching Resources.
- Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III Tests of Achievement*. Itasca, IL: Riverside Publishing.

- Woodcock, R. W., & Muñoz-Sandoval, A. F. (1993). *Woodcock–Muñoz Language Survey*. Itasca, IL: Riverside Publishing.
- Woodcock, R. W., & Muñoz-Sandoval, A. F. (1996). *Woodcock-Muñoz Pruebas de aprovechamiento-Revisada*. Itasca, IL: Riverside Publishing.
- Wu, W., West, S. G., & Hughes, J. N. (2008). Effect of retention in first grade on children's achievement trajectories over 4 years: A piecewise growth analysis using propensity score matching. *Journal of Educational Psychology, 100*, 727-740. doi: 10.1037/a0013098
- Zelazo, P. D., & Müller, U. (2002). Executive function in typical and atypical development. In P. D. Zelazo & U. Müller (Eds.), *Blackwell handbook of childhood cognitive development* (pp. 445-469). Malden: Blackwell Publishing.
- Zimmerman, B. J. (2001). Theories of self-regulated learning and academic achievement: An overview and analysis. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives* (pp. 1-38). Mahwah, NJ: Erlbaum.

APPENDIX A

FIGURES

Figure A-1
Final Structural Equation Model for Reading Achievement

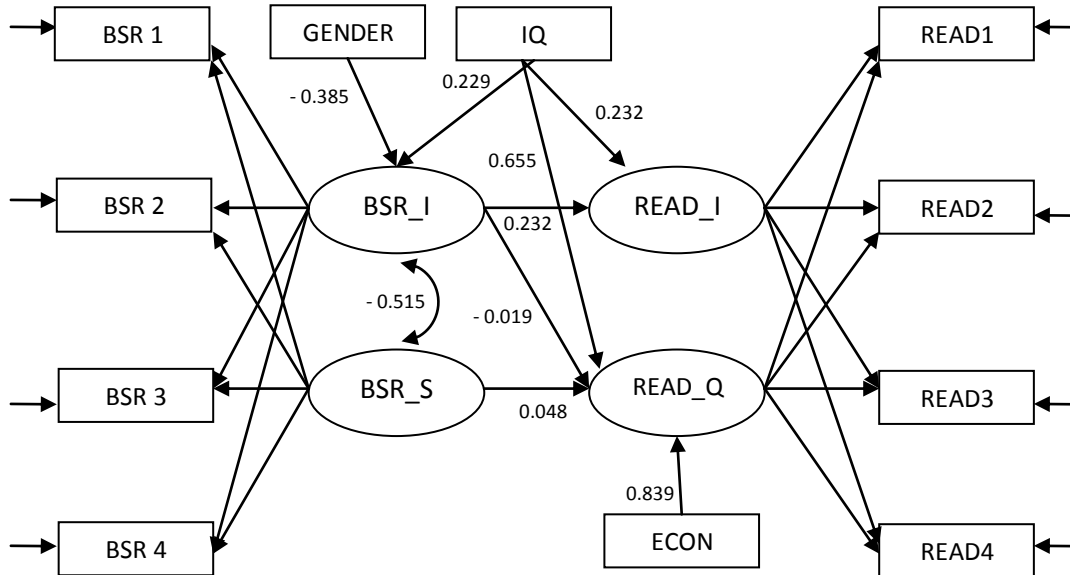


Figure A-1. $\chi^2(39) = 67.364$, $p = .003$; CFI = .990; RMSEA = .031. All coefficients are standardized estimates and significant at $p < .01$ (two-tailed), excluding the coefficients for READ_Q on BSR_I and READ_Q on BSR_S. BSR = Behavioral Self-Regulation (composite score for BSR at grade 1, 2, 3, 4); READ = Reading Achievement (WJ-III ACH Broad Reading W score at grades 1, 2, 3, 4). BSR_I = intercept of BSR (average level of BSR in grade 1). BSR_S = linear slope of BSR (average level of growth in BSR from grades 1-4). READ_I = intercept of reading achievement (average level of reading achievement in grade 1). READ_Q = quadratic slope of reading achievement (average level of growth in reading achievement from grade 1 – 4). GENDER = children’s gender (covariate; 1 = male; 0 = female). IQ = children’s IQ level at grade 1 (covariate; Abbreviated Battery of UNIT). ECON = children’s economic adversity status at grade 1 (covariate; 1 = economically disadvantaged; 0 = not economically disadvantaged). The non-significant effects of covariates on trajectory parameters were trimmed from the final model; thus, only significant covariates are depicted in the figure above.

Figure A-2
Final Structural Equation Model for Math Achievement

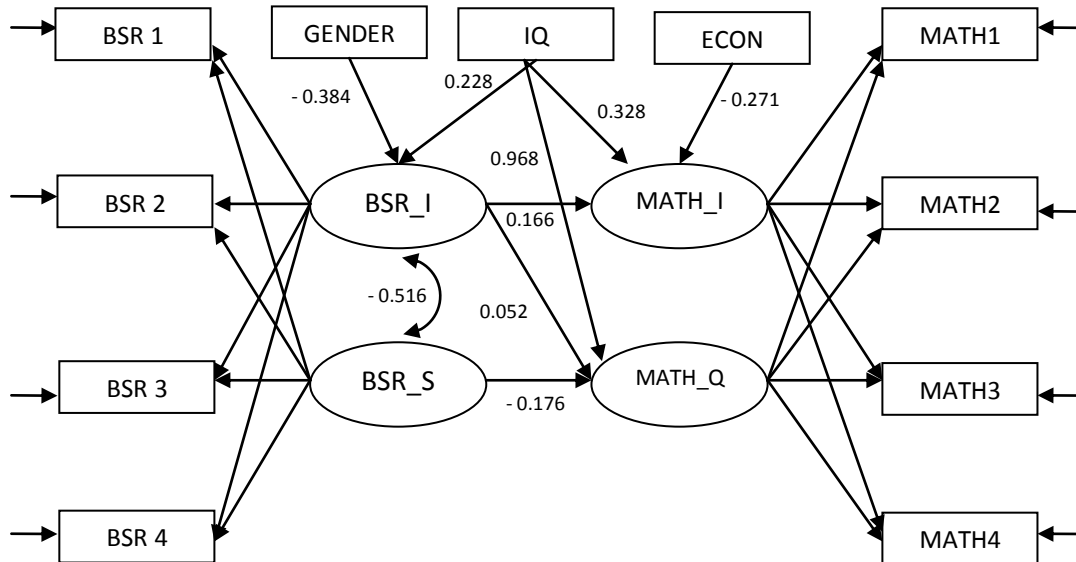


Figure A- 2. $\chi^2(40) = 64.206$, $p = .009$; CFI = .992; RMSEA = .029. All coefficients are standardized estimates and significant at $p < .01$ (two-tailed), excluding the coefficients for MATH_Q on BSR_I and MATH_Q on BSR_S. BSR = Behavioral Self-Regulation (composite score for BSR at grade 1, 2, 3, 4); MATH = Math Achievement (WJ-III ACH Broad Math W score at grades 1, 2, 3, 4). BSR_I = intercept of BSR (average level of BSR in grade 1). BSR_S = linear slope of BSR (average level of growth in BSR from grades 1-4). MATH_I = intercept of math achievement (average level of math achievement in grade 1). MATH_Q = quadratic slope of math achievement (average level of growth in math achievement from grade 1 – 4). GENDER = children’s gender (covariate; 1 = male; 0 = female). IQ = children’s IQ level at grade 1 (covariate; Abbreviated Battery of UNIT). ECON = children’s economic adversity status at grade 1 (covariate; 1 = economically disadvantaged; 0 = not economically disadvantaged). The non-significant effects of covariates on trajectory parameters were trimmed from the final model; thus, only significant covariates are depicted in the figure above.

APPENDIX B

TABLES

Table B-1
Correlations and descriptives for BSR indicators T1-T4

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Time 1</i>	1	T1 ACBC	-														
	2	T1 CENG	.782**	-													
	3	T1 BCOM	.530**	.438**	-												
	4	T1 BCON	.517**	.429**	.770**	-											
<i>Time 2</i>	5	T2 ACBC	.571**	.562**	.498**	.474**	-										
	6	T2 CENG	.555**	.616**	.446**	.409**	.789**	-									
	7	T2 BCON	.502**	.410**	.565**	.536**	.508**	.462**	-								
	8	T2 BCOM	.514**	.429**	.657**	.593**	.525**	.473**	.814**	-							
<i>Time 3</i>	9	T3 ACBC	.573**	.483**	.483**	.446**	.598**	.546**	.469**	.507**	-						
	10	T3 CENG	.449**	.476**	.390**	.356**	.493**	.543**	.325**	.384**	.721**	-					
	11	T3 BCOM	.455**	.351**	.513**	.521**	.466**	.380**	.525**	.602**	.470**	.383**	-				
	12	T3 BCON	.411**	.286**	.456**	.468**	.446**	.341**	.474**	.541**	.497**	.370**	.763**	-			
<i>Time 4</i>	13	T4 ACBC	.519**	.474**	.500**	.459**	.567**	.512**	.475**	.514**	.599**	.484**	.459**	.422**	-		
	14	T4 CENG	.416**	.467**	.339**	.303**	.432**	.476**	.338**	.395**	.474**	.521**	.332**	.286**	.700**	-	
	15	T4 BCOM	.418**	.292**	.532**	.511**	.468**	.392**	.583**	.587**	.439**	.344**	.652**	.582**	.467**	.335**	-
	16	T4 BCON	.423**	.299**	.461**	.455**	.434**	.363**	.475**	.453**	.411**	.329**	.544**	.509**	.425**	.310**	.815**
	N	680	681	599	599	607	607	582	582	540	540	619	619	520	520	575	575
	Mean	0.00	0.00	-0.06	-0.05	0.00	0.00	-0.05	-0.10	0.00	0.00	-0.07	-0.07	0.00	0.00	-0.05	-0.04
	SD	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	0.99	0.98	1.00	1.00	1.00	0.97
	Missing (%)	8.72	8.59	19.60	19.60	18.52	18.52	21.88	21.88	27.52	27.52	16.91	16.91	30.20	30.20	22.82	22.82

Note. T1 = time 1. T2 = time 2. T3 = time 3. T4 = time 4. ACBC = teacher-rated attention control & behavioral control. CENG = teacher-rated classroom engagement. BCOM = peer-rated behavioral compliance. BCON = peer-rated behavioral control.

** p < .001

Table B-2
Correlations between covariates, reading, math, and BSR composites T1-T4

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Covariates	1 GENDER	1														
	2 ECON	-.003	1													
	3 IQ	.039	-.117**	1												
Reading	4 READ_T1	-.060	-.037	.249**	1											
	5 READ_T2	-.075	-.110**	.219**	.706**	1										
	6 READ_T3	-.099*	-.185**	.216**	.633**	.829**	1									
	7 READ_T4	-.070	-.185**	.276**	.598**	.787**	.877**	1								
Math	8 MATH_T1	.057	-.331**	.347**	.408**	.237**	.256**	.301**	1							
	9 MATH_T2	.074	-.334**	.278**	.296**	.379**	.388**	.426**	.688**	1						
	10 MATH_T3	.037	-.329**	.296**	.371**	.439**	.512**	.494**	.606**	.758**	1					
	11 MATH_T4	.047	-.261**	.324**	.425**	.506**	.553**	.584**	.541**	.726**	.826**	1				
BSR Composites	12 BSR_T1	.329**	-.010	.193**	.235**	.259**	.246**	.253**	.155**	.194**	.232**	.225**	1			
	13 BSR_T2	-.303**	-.061	.195**	.226**	.213**	.226**	.273**	.186**	.209**	.219**	.241**	.711**	1		
	14 BSR_T3	-.366**	-.058	.181**	.186**	.153**	.197**	.224**	.151**	.167**	.180**	.161**	.636**	.653**	1	
	15 BSR_T4	-.372**	-.051	.179**	.179**	.120**	.167**	.181**	.151**	.177**	.187**	.183**	.613**	.626**	.677**	1
	N	745	718	738	728	682	663	656	727	682	662	655	722	688	667	630
	Mean	0.52	0.61	93.11	434.13	461.53	477.33	488.41	462.91	475.66	486.56	496.38	-0.03	-0.04	-0.02	-0.01
	SD	0.50	0.49	14.66	26.82	22.34	19.45	18.59	13.31	11.04	11.07	10.82	0.85	0.86	0.83	0.82
	Missing (%)	0.00	3.62	0.94	2.28	8.46	11.01	11.95	2.42	8.46	11.14	12.08	3.09	7.65	10.47	15.44

Note. GENDER = children's gender (covariate; 1 = male; 0 = female). ECON = children's economic adversity status at grade 1 (covariate; 1 = economically disadvantaged; 0 = not economically disadvantaged). IQ = children's IQ level at grade 1 (covariate; Abbreviated Battery of UNIT). _T1 = time 1. _T2 = time 2. _T3 = time 3. _T4 = time 4. READ = reading achievement (WJ-III ACH Broad Reading W score). MATH = math achievement (WJ-III ACH Broad Math W score). BSR = behavioral self-regulation (composite score for BSR).

*p < .05
** p < .001

Table B-3

Unstandardized model results of the unconditional linear growth model for BSR

Parameter	Estimate	SE
Fixed Effect		
Intercept	-0.039	0.030
Linear Slope	0.010	0.010
Random Effect		
Variance in intercept	0.563**	0.037
Variance in linear slope	0.021**	0.006
Covariance between intercept & linear slope	-0.048**	0.013
Residual variance at grade 1	0.174**	0.026
Residual variance at grade 2	0.240**	0.019
Residual variance at grade 3	0.236**	0.021
Residual variance at grade 4	0.193**	0.038

** $p < .01$.

Table B-4

Unstandardized model results of the conditional linear growth model for BSR

Parameter	Estimate	SE
Effect of Covariates on Growth Parameters		
Gender on intercept	-0.552**	0.061
Econ on intercept	-0.009	0.058
IQ on intercept	1.221**	0.174
Gender on linear slope	-0.016	0.019
Econ on linear slope	-0.013	0.020
IQ on linear slope	-0.036	0.064
Random Effect of Growth Parameters		
Variance of intercept	0.445**	0.036
Variance of linear slope	0.020**	0.006
Covariance between intercept and linear		
Slope	-0.049**	0.012
Residual variance at grade 1	0.175**	0.026
Residual variance at grade 2	0.239**	0.019
Residual variance at grade 3	0.231**	0.021
Residual variance at grade 4	0.196**	0.038

** $p < .01$.

Table B-5
 Unstandardized model results of the unconditional quadratic growth model for reading achievement

Parameter	Estimate	<i>SE</i>
Fixed Effect		
Intercept	4.355**	0.017
Linear slope	0.284**	0.009
Quadratic slope	-0.036**	0.002
Random Effect		
Variance in intercept	0.049**	0.005
Variance in linear slope	0.002**	0.000
Variance in quadratic slope	0.000 ^a	0.000
Covariance between intercept & linear slope	-0.006**	0.001
Residual variance at grade 1	0.028**	0.004
Residual variance at grade 2	0.008**	0.001
Residual variance at grade 3	0.005**	0.001
Residual variance at grade 4	0.002**	0.001

^a Fixed at 0.

** $p < .01$.

Table B- 6

Unstandardized model results of the conditional quadratic growth model for reading achievement

Parameter	Estimate	SE
Effect of Covariates on Growth Parameters		
Gender on intercept	-0.032	0.018
Econ on intercept	-0.001	0.026
IQ on intercept	0.432**	0.071
Gender on linear slope	-0.013	0.015
Econ on linear slope	-0.054**	0.015
IQ on linear slope	-0.126*	0.050
Gender on quadratic slope	0.004	0.004
Econ on quadratic slope	0.012**	0.004
IQ on quadratic slope	0.031*	0.013
Random Effect of Growth Parameters		
Variance of intercept	0.045**	0.005
Variance of linear slope	0.002**	0.000
Variance of quadratic slope	0.000 ^a	0.000
Covariance between intercept and linear Slope		
	-0.006**	0.001
Residual variance at grade 1	0.027**	0.004
Residual variance at grade 2	0.009**	0.001
Residual variance at grade 3	0.005**	0.001
Residual variance at grade 4	0.002**	0.001

^a Fixed at 0.** $p < .01$.* $p < .05$.

Table B-7

Unstandardized model results of the unconditional quadratic growth model for math achievement

Parameter	Estimate	SE
Fixed Effect		
Intercept	4.629**	0.009
Linear slope	0.135**	0.005
Quadratic slope	-0.008**	0.001
Random Effect		
Variance in intercept	0.012**	0.001
Variance in linear slope	0.001**	0.000
Variance in quadratic slope	0.000 ^a	0.000
Covariance between intercept & linear slope	-0.001**	0.000
Residual variance at grade 1	0.006**	0.001
Residual variance at grade 2	0.003**	0.000
Residual variance at grade 3	0.003**	0.000
Residual variance at grade 4	0.001**	0.000

^a Fixed at 0.** $p < .01$.

Table B-8

Unstandardized model results of the conditional quadratic growth model for math achievement

Parameter	Estimate	SE
Effect of Covariates on Growth Parameters		
Gender on intercept	0.013	0.008
Econ on intercept	-0.076**	0.012
IQ on intercept	0.262**	0.034
Gender on linear slope	0.003	0.008
Econ on linear slope	0.005	0.008
IQ on linear slope	-0.089**	0.028
Gender on quadratic slope	-0.002	0.002
Econ on quadratic slope	0.001	0.002
IQ on quadratic slope	0.025**	0.007
Random Effect of Growth Parameters		
Variance of intercept	0.009**	0.001
Variance of linear slope	0.001**	0.000
Variance of quadratic slope	0.000 ^a	0.000
Covariance between intercept and linear Slope		
	-0.001**	0.000
Residual variance at grade 1	0.006**	0.001
Residual variance at grade 2	0.003**	0.000
Residual variance at grade 3	0.003**	0.000
Residual variance at grade 4	0.001*	0.000

^a Fixed at 0.** $p < .01$.* $p < .05$.

Table B-9

Unstandardized model results of the final structural equation model for reading achievement		
Parameter	Estimate	SE
Effect of Interest		
BSR intercept → Reading intercept	0.068**	0.011
BSR intercept → Reading quadratic slope	0.000	0.001
BSR linear slope → Reading quadratic slope	0.002	0.006
Covariates		
Gender → BSR intercept	-0.584**	0.048
IQ → BSR intercept	1.187**	0.160
IQ → Reading intercept	0.352**	0.069
Econ → Reading quadratic slope	0.012**	0.003
IQ → Reading quadratic slope	0.031*	0.012
Covariance		
BSR intercept with BSR linear slope	-0.052**	0.012
Standardized model results of the final structural equation model for reading achievement		
Parameter	Estimate	SE
Effect of Interest		
BSR intercept → Reading intercept	0.232**	0.035
BSR intercept → Reading quadratic slope	-0.019	0.103
BSR slope → Reading quadratic slope	0.048	0.130
Covariates		
Gender → BSR intercept	-0.385**	0.030
IQ → BSR intercept	0.229**	0.032
IQ → Reading intercept	0.232**	0.047
Econ → Reading quadratic slope	0.839**	0.132
IQ → Reading quadratic slope	0.655**	0.182
Covariance		
BSR intercept with BSR slope	-0.515**	0.056

** $p < .01$.* $p < .05$.

Table B-10

Unstandardized model results of the final structural equation model for math achievement		
Parameter	Estimate	SE
Effect of Interest		
BSR intercept → Math intercept	0.024**	0.005
BSR intercept → Math quadratic slope	0.000	0.001
BSR linear slope → Math quadratic slope	-0.004	0.005
Covariates		
Gender → BSR intercept	-0.581**	0.048
IQ → BSR intercept	1.184**	0.161
Econ → Math intercept	-0.060**	0.008
IQ → Math intercept	0.243**	0.032
IQ → Math quadratic slope	0.023**	0.007
Covariance		
BSR intercept with BSR slope	-0.050**	0.012
Standardized model results of the final structural equation model for math achievement		
Parameter	Estimate	SE
Effect of Interest		
BSR intercept → Math Intercept	0.166**	0.038
BSR intercept → Math quadratic slope	0.052	0.136
BSR slope → Math quadratic slope	-0.176	0.209
Covariates		
Gender → BSR intercept	-0.384**	0.030
IQ → BSR intercept	0.228**	0.032
Econ → Math intercept	-0.271**	0.037
IQ → Math intercept	0.328**	0.042
IQ → Math quadratic slope	0.968**	0.046
Covariance		
BSR intercept with BSR slope	0.516**	0.058

** $p < .01$.