Self-regulation and academic achievement in the transition to school

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Significant advances in our understanding of children’s cognitive and social development have occurred over the last three decades. Particularly with regard to those skills critical for academic success, research has revealed that multiple, interacting factors in the child, home, school, and larger sociocultural context all contribute to children’s literacy, numeracy, language and social skills starting early in life and continuing throughout the school years (Morrison, Bachman & Connor, 2005). One factor, self-regulation, has surfaced recently as a crucial skill which uniquely predicts children’s early school success. Poor self-regulation has been linked to high rates of expulsion, most dramatically in preschool classrooms (Gilliam & Shahar, 2006).

Self-regulation refers to a complex of acquired, intentional skills involved in controlling, directing, and planning one’s cognitions, emotions, and behavior (Schunk & Zimmerman, 1997). In investigations beyond the classroom, scientists from a broad range of perspectives have converged on the centrality of successful self-regulation as a marker of adaptive development. Findings demonstrate, at an emerging level of specificity, how biological and neurological processes interact with psychological and experiential factors to determine how children regulate themselves in a given setting. Biological factors such as temperament, or an individual’s predisposed reactivity and regulation of reactions to stimuli, underpin these additive and interactive processes. Self-regulation also develops through early experiences and social interactions, where caregivers and other significant individuals structure and shape children’s trajectories (Grolnick & Farkas, 2002; Kopp, 1982).

In this chapter, we examine self-regulation and its role in academic development, focusing on the transition to formal schooling. We posit that adaptive development depends upon children’s ability to manage their reactions and specifically, their task-related behaviors in the school context. Moreover, successfully self-regulating depends upon environmental influences
and interactions with others as well as child factors and predispositions. We focus on the construct of *behavioral self-regulation*, which is closely aligned with executive function, and which we define as the execution and manifestation of cognitive processes in overt behavior. Remembering and using information, attending to and understanding what others are saying, directing motor actions, and persisting toward goals are all indicators of adaptive behavioral regulation (McClelland, Cameron, Wanless, & Murray, 2007).

Our goals in the chapter are to examine behavioral regulation in the context of early childhood and the transition to school, elucidating how children’s skills contribute to achievement. First, we demonstrate links between behavioral regulation and academic achievement prior to formal schooling and throughout elementary school; second, we summarize evidence on the relations between behavioral regulation and emotion regulation; third, we discuss individual differences and proximal influences on regulatory skill growth; fourth, we explore risk factors in the school setting important for the development of behavioral regulation. We end the chapter with practical implications and suggestions for future research.

*Behavioral Regulation and Academic Achievement*

Multiple underlying cognitive skills are involved in overt behavioral regulation. This complex of cognitive processes involves processing and manipulating stimuli (working memory); inhibiting automatic reactions to stimuli while initiating unnatural yet adaptive reactions (inhibitory control); and managing one’s attention to appropriate stimuli, including resisting distraction and shifting tasks when necessary (attentional or cognitive flexibility).

Evidence has linked these individual cognitive components to achievement prior to formal schooling (Blair, 2002; Blair & Razza, 2007; McClelland, Cameron, Connor et al., 2007) and throughout elementary school (Alexander, Entwisle, & Dauber, 1993; McClelland,
Morrison, & Holmes, 2000; McClelland, Acock, & Morrison, 2006). For example, the NICHD Early Child Care Research Network (2003) found that better attention on a tedious computer task predicted better reading and math achievement in 54-month-old children. In another study, kindergarteners with better attention scored significantly higher than those with poorer attention skills on achievement tests (Howse, Lange et al., 2003). A third study of working memory showed that children who could keep better track of the number of dots on multiple cards had higher mathematics achievement. Finally, Blair and Razza (2007) found that preschool levels of inhibitory control predicted kindergarten reading and mathematics achievement.

These studies demonstrate that performing well on tasks requiring focused, vigilant attention; remembering multiple pieces of information; and inhibiting automatic actions to activate non-automatic responses predict higher levels of early achievement. As such, these individual cognitive components comprise a critical aspect of school readiness. The construct of executive function, widely used in the neuropsychological and cognitive literatures, refers to these multiple components operating together (Miyake, Friedman, Emerson, Witzki, & Howerter, 2000; Zelazo, Müller, Frye, & Marcovitch, 2003). A quintessential measure of executive function is the Dimensional Change Card Sort (DCCS) task, where children must sort cards with pictures of red and blue trucks and boats by color, and then, switch and sort by shape (Müller, Dick, Gela, Overton, & Zelazo, 2006). Another popular executive function measure is the Tower of London or Tower of Hanoi, where children are presented with rings of varying size on a three-pegged board; they must move the rings from one peg to another and match a particular ring sequence using as few moves as possible (Bull, Espy, & Senn, 2004). These tasks require remembering rules or holding ring/peg locations in mind; inhibiting the tendency to use the old rule or move a peg incorrectly, and attending to the current rule or ring sequence.
Kindergarten teachers agree that similar skills – like following directions, paying attention, and working independently – while critical for school success, are deficient in many children (McClelland, Morrison, & Holmes, 2000; Rimm-Kaufman, Pianta, & Cox, 2000). These surveys highlight a practical need to bridge the gap between findings from the laboratory and the classroom to understand how behavioral regulation develops over the school transition. Currently researchers are developing structured observational measures that can be used in school settings over the transition years, but do not require use of computers or specialized equipment (Griffin, 2008). The Head-to-Toes Task (HTT) is one measure, which activates multiple cognitive skills (Ponitz et al., 2008). The task requires children to remember and respond to two conflicting spoken commands with gross motor actions (i.e., children are instructed to touch their toes when the examiner tells them to touch their head, and vice versa). Results indicate that higher fall prekindergarten behavioral regulation scores significantly predict stronger spring achievement levels. More strikingly, greater behavioral regulation gains over the prekindergarten year predict greater gains in early mathematics, literacy, and vocabulary skills after controlling for fall achievement levels (McClelland, Cameron, Connor et al., 2007).

A follow-up study in kindergarten used a more complex version of the HTT, called Head-Toes-Knees-Shoulders (HTKS). This version builds on the HTT by requiring children to remember and respond to four (vs. two) different behavioral commands in conflict with the correct response (Ponitz, McClelland, Matthews, & Morrison, in press). Findings revealed that stronger levels of behavioral regulation in the fall predict higher fall and spring levels of mathematics, literacy, and vocabulary skills, as well as teacher-rated classroom behavioral regulation. Behavioral regulation gains also predicted mathematics gains (controlling for fall mathematics levels).
Multiple explanations may be offered for the consistent association between behavioral regulation tasks and academic success: first, they require executive function, which is a strong predictor of cognitive ability and academic performance (Mazzocco & Kover, 2007; Miyake et al., 2000). Second, they require responses similar to behaviors required in classrooms: for example, the inhibition required in HTT generically taps processes similar to remembering to raise one’s hand before speaking in class. Third, instructions and commands are delivered in the school setting, by an adult in authority. The first explanation has been well-established in the literature, while the second and third have received less attention. Studies that examine differences in trial delivery (e.g., an examiner taps a pencil, states a command, or provides a laptop or other object to deliver the trial stimulus) and task response modality (e.g., fine motor, gross motor, oral responses) would further illuminate the measures that most closely map onto school-related outcomes (Diamond, 2000).

Undoubtedly, executive function and behavioral regulation overlap – indeed, it is fair to ask whether both terms are necessary. To indicate the manifestation of multiple cognitive processes in overt behavior, we use the higher-order term behavioral regulation instead of executive function (McClelland, Cameron, Wanless et al., 2007). In the literature, behavioral regulation has been typically situated within naturalistic, non-laboratory contexts such as the classroom, which may present unique regulatory challenges (Calkins, 2007; Howse, Calkins, Anastopoulous, Keane, & Shelton, 2003). For example, in the classroom, children need to maintain attention on one project and remember to clean up before moving to free choice activity. A child might score well on the DCCS when it is administered in an individualized setting, but the same child may have difficulty completing the classroom project and cleaning up. Though studies using traditional executive function measures along with behavioral regulation
assessments are rare, correlations among executive function measures and behavioral outcomes that have been documented are modest (Blair, 2003; Lan & Morrison, 2008). For example, Blair (2003) found that teacher ratings of preschoolers’ on-task behavior correlated $r = .24$ (ns) with executive function performance on the peg-tapping and Day/Night tasks.

Providing further impetus to understand the development and effective measurement of behavioral regulation, or “executive function in context,” is mounting evidence establishing that behavioral regulation contributes significant, unique variance to children’s academic achievement and growth trajectories between preschool years, elementary, middle school, and even to high school. In one study following children to middle school, kindergarten behavioral regulation (as part of a broader learning-related skills construct measured via teacher report) predicted reading and math achievement between kindergarten and sixth grade, and growth in literacy and math from kindergarten to second grade (McClelland et al., 2006). Another inquiry spanning early childhood to young adulthood showed kindergarteners with poor behavioral regulation (teacher-rated attention problems and hyperactivity) were less likely to graduate from high school than their well-regulated peers (Vitaro, Brendgen, Larose, & Trembaly, 2005).

**Intersection of Emotion and Behavioral Regulation**

Children’s self-regulation extends to managing their emotions as well (Calkins, 2007; Eisenberg & Spinrad, 2004). We adopt Eisenberg and Spinrad’s definition of emotion regulation as the deliberate modification and modulation of emotional reactions. Considerable evidence links children’s effective management of their emotions to positive behavioral and academic outcomes (Eisenberg, Smith, Sadovsky, & Spinrad, 2004; Graziano, Reavis, Keane, & Calkins, 2006; Howse et al., 2003). In contrast, children who cannot control their emotions are more
likely to act out, behave aggressively, and oppose the perspectives and requests of others (Graziano et al., 2006; Raver, 2004).

Theoretical efforts (e.g., Blair, 2002) have sought to identify conceptual and empirical relations between emotional and behavioral regulation (and its underlying executive processes). For example, Blair notes that stronger negative emotional reactions (e.g., anger and anxiety) may impede children’s ability to regulate their behavior in school settings where they need to deploy attention and persist in their work. Calkins (2007) concurs that variability in emotion regulation is related to, and may challenge or enhance, children’s ability to manage their task-related behavior. For example, children who are easily angered will have more difficulty concentrating on schoolwork than those who can effectively modulate their emotional reactions. An emerging theme from this and other work is that strong behavioral regulation, particularly attentional flexibility, may ameliorate the otherwise negative effects of poor emotion regulation. Thus, the link between emotion regulation and other developmental outcomes depends on children’s choices about where to direct their attention and overt behavior (Henderson & Fox, 1998; Rothbart, Posner, & Kieras, 2006).

For example, one study of toddlers found those with strong negative emotionality actually achieved greater readiness for school (measured by knowledge related to colors, letters, counting, shapes, and conceptual comparisons), but only when children had strong attention (Belsky, Friedman, & Hsieh, 2001). Another recent study revealed that teacher ratings of children’s emotional regulation in kindergarten positively predicted first grade teachers’ ratings of attention, which then predicted first grade achievement (Trentacosta & Izard, 2007). These findings indicate that extreme emotional liability – while previously considered a risk factor – need not be detrimental if children handle their extreme reactions in an adaptive way, such as
directing their attention to something else. Thus, compared with emotional regulation, behavioral regulation may be the operable determinant of adjustment and academic success. Howse, Calkins et al. (2003) found that preschool behavioral regulation mediated the contribution of emotion regulation on kindergarten mathematics and literacy achievement. Together, these findings provide empirical support for a hierarchical conceptualization of self-regulation, whereby children who react strongly emotionally, but who can successfully control their attention and behavior, fare better compared to children with little capacity to regulate their behavior.

Sources of Influence

We distinguish among child factors, originating and measured within the child, and external factors, originating and measured in the child’s environment. Throughout, we note how individual factors interrelate with environmental influences in their associations with self-regulation. We consider biological findings first, then parenting, and then move to a discussion of the emerging evidence on the role of schooling in the development of self-regulation.

Child and Family Factors

Brain and biological development. Early work seemed to suggest that higher-order skills underlying executive function did not really emerge until at least pre-adolescence (Golden, 1981). At present, it is clear that executive skills emerge early in life and grow steadily through at least early adolescence, with this position corroborated by evidence from neurological research (Diamond, 2000). Three major cycles paralleling data on cortical development have been identified: 18 months to 5 years; 5 to 10 years; and 10 to 14 years, with the cycle from late preschool through elementary school being perhaps the most dynamic. During early childhood, the parts of the brain that help children control, direct, and plan their actions undergo significant maturation, including myelination and pruning. In addition, research on brain-behavior relations
Self-regulation and academic achievement in the transition to school reveals that site-specific cortex activation co-occurs with particular behavioral responses (Blair, 2002; Shonkoff & Phillips, 2000)). For example, deliberate cognitive processing operates through dorsolateral prefrontal pathways, whereas spontaneous responses to emotionally-relevant stimuli operate through ventromedial pathways (Zelazo, Müller, & Goswami, 2002). These processes together contribute to a child’s regulatory functioning (Rothbart et al., 2006).

In a recent review of findings from brain research, Lewis and Todd (2007) suggest that optimal regulation means the coordination of activation in different areas of the brain. Studies indicate that after processing emotional stimuli, our brains then engage areas associated with cognitive and attentional tasks (e.g., the anterior cingulate cortex or ACC) to manage emotional reaction. For example, heightened amygdala activity – a site commonly linked to the processing of emotional information – is followed by prefrontal cortex activity to regulate the amygdala. Thus, in general, recent trends have been to move away from pitting emotion regulation against cognitive regulatory skills (Zelazo et al., 2002), toward a conceptualization of these two sets of processes as interactive and reciprocally regulating. This argument parallels our claim that adaptive behavior in school depends not just on children’s overall emotional reactivity, but on managing extreme reactions through directing their attention and ultimate behavior. The theme of achieving an optimal balance of reactions and regulation of those reactions is further reflected in research on temperament, another child factor implicated in self-regulation.

**Temperament.** How a child reacts and regulates his or her reactions has biological origins in a construct known as temperament, which presages later personality tendencies (Kochanska, Murray, & Harlan, 2000). In general, temperament broadly refers to levels of reactivity and regulation of that reactivity in early development. One factor, effortful control, contributes to the degree to which children can manage and direct their own actions in cognitive, social, emotional,
and behavioral domains (e.g., Rothbart & Rueda, 2005). For example, effortful control helps children inhibit a behavior (e.g., grabbing for a cookie) and control their emotional reactivity (e.g., stop from having a tantrum). Effortful control also shapes how children relate to others, including conscience development (e.g., Kochanska, Murray, & Harlan, 2000), and social outcomes (e.g., Eisenberg, Smith, Sadowsky, & Sprinrad, 2004; Eisenberg et al., 2005).

As shown in brain research with adults, the anterior attentional systems underlie children’s effortful control, which predicts both emotional and behavioral regulation (Rothbart et al., 2006; Rueda, Posner, & Rothbart, 2005). Rothbart and colleagues place particular emphasis on the role of executive attention in effortful control, noting how some infants are more likely to selectively orient their attention as a means of soothing their distress. For example, at seeing a colorful, multi-armed mobile, one child might become distressed, communicating this by crying, fussing, and kicking. However, the child might look into his mother’s face, and slowly calm down. Greater use of early attentional strategies, like directing attention away from the stressful stimulus, predicts later levels of strong effortful control. To describe how early attentional strategies and later behavioral outcomes interrelate, Calkins (2007) has proposed a hierarchical, interactive model of self-regulation where physiological, attentional, and emotional regulation in the first 3 years of life form a network of reactive and regulatory tendencies, within which intentional regulatory functions emerge as children enter the early school years.

**Parent-child attachment.** Regulation of distress, attention, and behavior does not emerge in isolation; caregivers are immensely important in helping children learn to regulate themselves. Caregivers – most often parents – are the infants’ first indicators about the world. Through their actions, reactions, and interactions, parents help children learn whether the world is generally a safe, consistent place that can be reliably affected by signaling for help, distress, or happiness; or
whether the world is a scary, unpredictable place where one’s actions go unnoticed. Parents who match their infants’ signals with appropriate levels of help and soothing when the infant is distressed, or positive affect when the infant is happy, are more likely to develop a secure attachment with their child (De Wolff & van Ijzendoorn, 1997). A secure parent-child attachment is thus seen as enabling children to express emotion appropriately and develop strong behavioral regulation (Waters, Weinfield, & Hamilton, 2000). Studies of attachment also highlight the importance of the child’s reactivity and responsiveness in shaping caregiver responses (Calkins, 2004). For example, infants with an easy temperament are easier interaction partners for parents than infants who are reactive and negative (i.e., those with a difficult or slow-to-warm-up temperament). Despite these themes, connections among parenting, attachment, and the development of self-regulation are not consistent and require more research using a transactional lens.

Parenting styles. As infants become toddlers with a will of their own, parenting behaviors to discipline or control their child’s misbehavior add to factors contributing to the development of self-regulation. Studies show that authoritative parenting styles characterized by maintaining consistency, reasoning with the child about discipline decisions, and supporting the child’s autonomy are linked with stronger behavioral regulation (Tudge, Odero, Hogan, & Etz, 2003). In one study, mothers who were physically controlling with their 4-year-old during a regulation clean-up task had children who were more likely to cheat on a game at 56 months (Kochanska & Knaack, 2003). Furthermore, maternal power assertion predicted cheating even after the child’s own behavior during the clean-up tasks (e.g., defiance) was controlled. Thus, parents may be both mediators and moderators of the relation between children’s experiences and their developing behavioral regulation.
School Factors

So far we have identified the importance of behavioral regulation for academic achievement, described how being able to direct attention is important for regulating emotional responses and subsequent behavior, and shown the role of biological and parenting behaviors in whether children appropriate regulatory strategies. The next section focuses more squarely on behavioral regulation situated within early school settings.

Child factors interacting with early school experiences. Similar to themes from parent-child research, children’s behavioral regulation in school depends upon multiple factors, including children’s prior characteristics and experiences as well as characteristics of the classroom. For example, in one study, kindergarteners with poor parent-rated inhibitory control were rated with more difficulty adjusting to the classroom by their teachers. Furthermore, those with low inhibitory control, whose parents also reported lax parenting behaviors (e.g., letting their kindergartener decide what to eat and when to go to bed) had the most difficulty adjusting. Lax parenting had no relation with adjustment for children with strong inhibitory control (Nathanson, Rimm-Kaufman, & Brock, in press).

Another study used observational measures to classify participants as socially bold or wary, where bold infants showed little distress at the stranger’s appearance, and wary children tended to cry, or look worriedly at their mothers (Rimm-Kaufman et al., 2002). In classrooms with sensitive teachers, the children classified as bold at 15 months exhibited stronger behavioral regulation, whereas these children were more often off-task and less self-reliant in classrooms with less sensitive teachers. In another study, children rated by their teachers as impulsive but who engaged in more complex play, had stronger behavioral regulation measured by persistence
during clean-up six months later, compared with impulsive children engaging in less complex 
play. No such relation was found for children rated low on impulsivity (Elias & Berk, 2002).

These studies highlight the role of child factors like temperament in school functioning 
and demonstrate how they interact with the environmental context. Together, research suggests 
that caregivers including preschool providers contribute to children’s developing behavioral 
regulation directly and through complex, yet systematic, interactions with child factors. In 
general, the literature suggests that providing a secure base, communicating consistent 
expectations for behavior, and helping children develop their own regulatory strategies without 
being didactic or directive, are associated with development of successful self-regulation. This 
conclusion dovetails nicely with theoretical work on the development of self-regulation, 
emphasizing the transition from “other” regulation by adults to eventually being able to control 
one’s own actions and reactions (Grolnick & Farkas, 2002; Kopp, 1982). However, specific 
experiences may be more important for some children than others. The studies we reviewed 
indicate that children with a history of lax parenting, or those with bold behavioral 
predispositions, may be particularly sensitive to the experiences they have in classrooms, and 
appear to benefit from extra time to practice behavioral regulation – as in complex play – and 
from teachers who are sensitive to their emotional signals and cues.

Observational studies of classroom factors. In addition to teacher sensitivity and 
responsiveness, observational studies demonstrate that teachers who provide organizational 
information about classroom rules, procedures, and activities have students with strong 
behavioral regulation (Pressley, Rankin, & Yokoi, 1996). Teacher organization may be 
especially important in the primary grades, when students are being socialized to classroom 
environments and learning how to regulate themselves in that context (Patrick, 1997; Wentzel,
In one study, Cameron, Connor, and Morrison (2005) found that a pattern of classroom activity characterized by high amounts of teacher organization in the fall of first grade, which decreased as the year progressed, was associated with greater amounts of classroom-level independent work and word-reading skills in the spring (Cameron, Connor, Morrison, & Jewkes, 2008). Although direct measures of behavioral regulation were not gathered, these findings suggest that classroom organization at the beginning of the school year, positively predicts growth of regulatory skills, and may contribute to enhanced literacy achievement at the end of the year. However, children with low initial vocabulary levels had higher literacy scores when they were in classrooms practicing high organization in the fall and the winter, compared with children who had high vocabularies; these children achieved higher reading when they were in classrooms with high organization in the fall only. This suggests that organization may be more important for some children than others.

A separate child by classroom interaction emerged in a study of chaos in preschool settings; boys but not girls in chaotic, disorganized settings exhibited lower levels of behavioral regulation than boys in well-organized settings (Wachs, Gurkas, & Kontos, 2004). Finally, in another study, stronger teacher organization interacted with child gender, such that boys in well-organized first grade classrooms made greater gains in mathematics, whereas girls made progress regardless of the level of organization in their classrooms (Ponitz, Rimm-Kaufman, Brock, & Nathanson, 2009). These last preliminary findings suggest looking more closely at sources of gender by organization interactions, which hint that girls do better than boys regardless of the organization levels of their classrooms. Future research is needed, but it is possible that boys are particularly susceptible to environmental disorganization, or that boys contribute to a chaotic setting while girls remain less affected.
Experimental and quasi-experimental evidence. A second line of work using experiments and quasi-experiments complements naturalistic studies suggesting that schooling-related experiences can affect children’s behavioral regulation (McCrea, Mueller, & Parrila, 1999). One recent study utilized the school cut-off technique, which separates developmental and schooling effects by studying children of similar age who, because of arbitrary school entry dates set by the state or district, enroll in different years in school. Burrage et al. (2008) used the Head-Toes-Knees-Shoulders Task (HTKS) as a measure of behavioral regulation and a separate working memory task, with prekindergarten and kindergarten children who were on average 2 months apart in chronological age. They found distinct schooling effects, such that working memory improved with both prekindergarten and kindergarten attendance. In contrast, overall behavioral regulation showed a marginally significant effect for prekindergarten only. These findings indicate that growth in behavioral regulation may be influenced by schooling, and also document how working memory and overall behavioral regulation maybe differentially shaped by schooling influences (Miyake et al., 2000). Additional data confirm that regulatory skills can be improved through training in both laboratory and school-based settings (Klingberg, Fernell, & Olesen, 2005). Evidence also suggests attention can be trained in early childhood and that after training, changes occur in the underlying neurological networks responsible for attention (Rueda, Rothbart, McCandliss, Saccomanno, & Posner, 2005).

The extent to which skills taught in the laboratory transfer to real-world settings has been less clear, but recent efforts to develop classroom-based interventions are encouraging. In a quasi-experiment, Rimm-Kaufman and her colleagues measured the effects of the Responsive Classroom Approach (RC; Elliot, 1995) which is a teacher intervention aimed at creating a sense of community within the classroom, establishing and maintaining rules and consequences,
enhancing student independence, and minimizing problem behaviors. Students in RC settings exhibited better social skills, decreased problem behaviors, and higher academic performance compared to participants in control classrooms (Rimm-Kaufman & Chiu, 2007). Finally, evidence suggests that the more students are exposed to RC practices within a school year and over multiple years, the more benefits to their behavior (Rimm-Kaufman, Fan, Chiu, & You, 2007). In a true experiment, Diamond and colleagues recently evaluated a Vygotskian, classroom-based curriculum called Tools of the Mind, which is intended to enhance children’s preschool behavioral regulation through classroom activities (e.g., buddy reading requiring children to take turns; Diamond, Barnett, Thomas, & Munro, 2007). Children in the Tools of the Mind classrooms for one or two years scored higher on behavioral regulation compared for children with no program experience, and participation in the curriculum predicted better academic performance. Together, evidence demonstrates that behavioral regulation skills are amenable to school experiences; identifying the experiences and dosage required to see results are important next steps.

*Risk Factors*

Despite this promising work, many children remain at a critical disadvantage when it comes to learning the regulatory skills they need in school. In the United States, children experiencing risk due to socioeconomic disadvantage, family background, or neighborhood violence, have poorer self-regulation and academic achievement than those not experiencing such risks (Fantuzzo et al., 2005; McClelland et al., 2000; Howse, Lange, et al., 2003; Wanless, Sektnan, & McClelland, 2007). For example, children from disadvantaged backgrounds have been shown to be less able to regulate their attention in goal-directed tasks than their more advantaged peers (Howse, Lange, et al., 2003). Another study found that disadvantaged Spanish-
speaking children had significantly poorer behavioral regulation (assessed with the Spanish version of the HTT) in preschool and kindergarten compared to English-speaking participants (Wanless et al.). Although preliminary, these results suggest that low-income Spanish-speaking children may be at risk for developing poor behavioral regulation prior to school entry.

Research on stressful early environments suggests how they may shape particular patterns of brain activation and behavior (Shonkoff & Phillips, 2000). Stressful situations require constant attention to and maintenance of intense emotional information, leaving little opportunity for the intellectual exploration and learning that a stimuli-rich environment affords (Baumeister, Zell, & Tice, 2007). Examples of early stressors associated with poor developmental outcomes include severe stimulus deprivation; inconsistent or volatile parenting; frequent moves or change in caregivers; intense and frequent violence, abuse, or neglect; or membership in an underrepresented, historically disadvantaged ethnic minority group (Morales & Guerra, 2006).

Recently, being male has also surfaced as a potential “risk factor” for developing poor self-regulation, as survey data document the relatively high levels of boys diagnosed with behavioral maladies such as Attention Deficit Hyperactivity Disorder and Conduct Disorder (e.g., Barkley, 2000; Clark et al., 2002). New evidence placing boys at an educational disadvantage contrasts with past findings that classrooms and schools favored male students (Fergusson, Lloyd, & Horwood, 1991). For example, Matthews, Ponitz & Morrison (in press) found that kindergarten boys scored significantly worse on self-regulation, measured objectively (by HTKS) as well as via teacher report in both fall and spring of the school year. Entwisle Alexander, and Olson (2007) posited that while today’s model student is perceived as female (e.g., studious, conscientious, and compliant), more educated families are likely to support academic behaviors in both their male and female children. Indeed, among middle-class families,
boys typically do as well or better than girls on academic achievement measures (Entwisle et al.). Poor families, however, are more likely to endorse and support stereotypes of boys as active and aggressive, and girls as quiet and well-behaved, which may give girls overall an advantage in classroom settings. Thus, parents as well as teachers and students themselves may contribute to socializing poorly regulated behaviors in male students from socioeconomically disadvantaged backgrounds. Research by Duckworth and Seligman (2006) also shows that throughout the school years, girls demonstrate stronger “self-discipline” (e.g., spending more time doing homework) than boys.

We do not yet understand how the beliefs and practices of preschool and pre-service elementary teachers, who are predominantly female and of majority ethnic status, may translate into variation in classroom experiences of male students, or children of different backgrounds. Researchers have suggested that the priorities of teachers who are Caucasian and from middle- to upper-middle SES backgrounds may not match the priorities and characteristics of individuals from minority cultures (such as being African-American or lower income level; Delpit, 1993, 1995). Moreover, one study showed that teachers’ assessments of the number of children experiencing difficulty with aspects of behavioral regulation (e.g., following directions) increases when the responders are non-minority teachers in classrooms with a high composition of minority children (Rimm-Kaufman et al., 2000). These findings encourage us to take a complex view of the origins of poor self-regulation in many children, considering individual as well as environmental sources of the problem as well as possible solutions.

Solving the Problem: Implications for Research and Practice

The foregoing discussion documents multiple child and family contributors to the development of behavioral regulation, while also strengthening the claim that behavioral
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regulation is amenable to experience. Yet clearly children and behavioral regulation do not develop in a vacuum, and some young students are at risk for developing ineffective ways of regulating their emotional reactions and directing their attention and behavior. Based on current findings, we propose four suggestions for future scientific and practical endeavors to promote behavioral regulation in the early school years.

First, specifying aspects of behavioral regulation that are particularly strong predictors of academic success is critical; a simultaneous goal must be developing effective measures of these skills. One recent study found that after early mathematics achievement, preschool levels of attention were the strongest predictors of mathematics and reading achievement measured up to 9 years later (Duncan et al., 2007), leading some to suggest that educators should work to promote mathematics achievement in young children. However, achievement tests were given directly, whereas most attention measures relied on teacher or parent report. Developing sensitive, predictive, and longitudinally-valid measures of behavioral regulation and related skills can help illuminate this issue. Until then, we will lack precise information on how behavioral regulation and achievement truly relate, and chase the “chicken or the egg” question of which skill deserves our focus and funding (achievement or behavioral regulation).

Second, further research is needed to examine how child factors and classroom contexts interact. This is based on several accumulating studies indicating social boldness or wariness, impulsivity, or gender – to name a few examples – interact with classroom factors to predict behavioral regulation (Ponitz, Rimm-Kaufman, et al, 2009; Rimm-Kaufman et al., 2002; Wachs et al., 2004). Though still considered preliminary, research indicates that boys, and children entering classrooms with poor behavioral regulation, have more difficulty functioning adaptively, compared to girls and to children who can better control their attention and behavior.
A third, related implication is that some children may need to be explicitly taught the behavioral regulation skills expected in the classroom and have the opportunity to practice them. Observational evidence as well as experimental evidence provides the basis for this claim, indicating positive relations among certain experiences and children’s development of behavioral regulation (Burrage et al., 2008; Cameron et al., 2005; Diamond et al., 2007; Rueda, Rothbart et al., 2005). Spending time orienting children about the purposes of learning activities and offering information about how to complete tasks may help students behaviorally self-regulate and plan their future actions. Diamond’s work (e.g., Diamond et al., 2007) also emphasizes the importance of giving children time to practice their attention, working memory, and inhibitory control skills. Although fairly new, the importance of strong teacher organization and behavioral regulation can be seen in the vast parenting literature documenting the regulatory benefit for children when their parents provide consistent, clear expectations about behavior, and support their independence (Grolnick & Farkas, 2002). Moreover, research indicates that incorporating time to practice regulating need not detract from the other priorities of preschool. Children can benefit from practicing behavioral regulation in both whole-group and small-group settings and activities can be built into a variety of curricula activities in developmentally appropriate ways (Stipek et al., 1998).

Promoting behavioral regulation in the classroom seems especially relevant given the mandates of the No Child Left Behind Act, which requires increased classroom time spent in instructional content earlier in children’s school lives than in the past (Stipek, 2006). Although increasing the quantity and quality of instruction in content areas is important, the degree to which children can benefit from learning activities depends largely on their ability to respond to challenging and complex classroom settings in a regulated, deliberate manner.
Conclusion

In this chapter, we identified four emerging themes of research on behavioral regulation. First, behavioral regulation and its underlying cognitive components are strongly linked to academic achievement. Second, compared to emotional regulation, children’s behavioral regulation is most predictive of their achievement. This may be due to the importance of the attentional focusing aspects of behavioral regulation for learning to regulate emotional reactivity and behavior, as well as to direct relations among behavioral regulation skills and academic tasks. Third, in the parenting and emerging educational literature, environments and interactions that provide structure, organization, and opportunities for children to practice regulating are associated with positive behavioral regulation in the early school years. Fourth, children whose disruptive behavior does not allow them to participate adaptively in school are at significantly greater risk for school failure relative to children who successfully regulate.

Success early in school, which is founded upon children’s ability to regulate their overt behavior in practical tasks like remembering instructions and working independently, is highly predictive of later academic and social functioning (McClelland et al., 2006; Vitaro et al., 2005). A confluence of factors – including individual, parenting, and teacher characteristics – clearly work together to contribute to children’s behavioral regulation. An overarching implication from these findings is that factors such as child attributes, as well as the classroom context, must be considered as possible influences on developing behavioral regulation skills and intervention efforts. However, directly teaching classroom expectations and giving all children time to practice their behavioral regulation skills, will help ensure that children who enter formal schooling without strong self-regulation have the opportunity to hone this critical skill set.
References


Tudge, J. R. H., Odero, D. A., Hogan, D. M., & Etz, K. E. (2003). Relations between the
everyday activities of preschoolers and their teachers' perceptions of their competence in the first years of school. *Early Childhood Research Quarterly, 18*, 42-64.


