Two-Generation Approach to Improving Emotional and Behavioral Regulation:

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TWO-GENERATION APPROACH TO IMPROVING EMOTIONAL AND BEHAVIORAL REGULATION

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ABSTRACT

Two-Generation Approach to Improving Emotional and Behavioral Regulation

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Increasing evidence indicates that exposure to poverty in early childhood may undermine neural growth that is critical to developing executive functions (EF) and, in turn, emotional and behavioral regulation (Blair et al. 2011; Kim et al., 2013; Raver et al., 2013). There is, however, also increasing evidence indicating that high-quality Early Childhood Education (ECE) (a) buffers children from risks associated with early exposure to poverty and (b) supports healthy socio-emotional development (Bierman et al., 2008; Raver, 2002; Yoshikawa et al., 2013). One line of this intervention work has focused on two-generation programs that pair high-quality ECE with supports for parents that are designed to improve parenting and the home environment. Although evidence on two-generation programs is mixed (Grindal et al., 2016; Neville et al., 2013), it is clear that much of the risk of poverty is relayed to children through their homes, and parenting is among the most critical influences on child emotional and behavioral self-regulation in infancy and early childhood (Bradley & Corwyn, 2004; Calkins & Johnson, 1998; Calkins et al., 1998).

The present study builds on existing theoretical and empirical prior work indicating that children's EF skills are important precursors to emotional and behavioral regulation that may be best promoted when addressed in both classroom *and* home contexts. Specifically, the present study uses a randomized design to evaluate the effects of classroom-based activities that target children's executive functioning and the value

added by training parents to better support their children's EFs. Children were evaluated pre- and post-intervention on EF skills and prosocial and adaptive problem-solving behavior. In general, few significant effects of either the child training or the added parent component were evident. These findings are discussed with special attention to the fact that fidelity of implementation of the classroom and parent trainings was low, with less than half of teachers incorporating games at least once a week and only 13 percent of parents attending the trainings. In addition, implications for future empirical work as well as policy and practice are discussed with special attention given to further inquiry into the malleability of EF.

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CHAPTER 1: PROBLEM STATEMENT

Low-income children are at exceptional risk for developing emotional and behavioral problems, with most evidence indicating that stress accumulates inside and outside the family to undermine their perceptions of control, social-information processing, and self-regulation efforts (Bradley & Corwyn, 2002; Dodge, Pettit, & Bates, 1994; Duncan, Brooks-Gunn, & Klebanov, 1994; Evans, 2004; McLoyd, 1998; National Scientific Council on the Developing Child (NSCDC), 2005). For many children growing up poor, chronic stress exposure is typical, which impairs brain functioning and increases vulnerability to physical and mental illness (NSCDC, 2005; 2007). In part, this stress is relayed to children through parenting, which can become inconsistent and sometimes harsh because the chaos of poverty depletes parents' psychological resources (McLoyd, 1998).

While most children who display emotional and behavioral dysfunction in early childhood do not develop chronic problems, persistently high social and emotional problems during childhood can have consequences that extend into adulthood, increasing the likelihood of educational failure, unemployment, psychiatric disorder, suicide attempts, and criminality problems (e.g., Gilliam, 2005; Kazdin, 1997; Raver, 2002; Roza, Hofstra, van der Ende, & Werhulst, 2003). Indeed, teachers rate emotional and behavioral skills (e.g., being able to understand the feelings of others, control one's own feelings and behaviors, and get along with peers and teachers) as more important to school success than being able to hold a pencil or read (Boyd et al., 2005). Kindergarten teachers also report, however, that many of their students, especially those from low-income families, are not emotionally or behaviorally ready for school (Boyd et al., 2005).

With most low-income children under 5 in some form of part- or full-time non-parental early childhood education (ECE), there is evidence that ECE can be critical to promoting socio-emotional adjustment when quality of care is high (Garces, Thomas, & Currie, 2002; Loeb, Bridges, Bassok, Fuller, & Rumberger, 2005; Loeb, Fuller, Kagan, & Carrol, 2004; Peisner-Feinberg et al., 2001; Zill et al., 2003). Indeed, Head Start, our nation's largest and most comprehensive early childhood intervention program, seeks to prepare low-income children for the cognitive and socio-emotional demands of formal schooling and has the strategic opportunity to address and promote the school readiness of children from low-income families (Administration for Children and Families (ACF), 2014; Snyder & Dillow, 2011). Yet, research indicates that the pre-K expulsion rate is surprisingly high, suggesting that many ECE teachers may not be adequately prepared or supported to address young children's emotional and behavioral regulation (Gilliam, 2005). Furthermore, parents also need this preparation and support; Head Start parents, for example, frequently request services to help them understand their children's development (National Academies of Sciences, Engineering, and Medicine (NASEM), 2016; Y. Rodriquez, personal communication, May 13, 2014). Little research to date, however, has investigated classroom training coupled with parent training intervention in order to improve children's emotional and behavioral outcomes.

The present study complimented existing Head Start practices and goals, evaluating a theoretically-informed, two-generation intervention designed to support children's executive functioning (EF) and, in turn, their emotional and behavioral regulation. Specifically, EF, emotional, and behavioral consequences were examined for: (1) classroom-based activities with Head Start children aimed at promoting social-

cognitive mechanisms that are central to emotional and behavioral regulation and (2) coupling the classroom activities with parent trainings that emphasize parallel developmental goals for children.

Early Childhood Education and Head Start

Forty-two percent of the more than 31 million children in the U.S. live in low-income families (i.e., families whose incomes fall below 200 percent of the federal poverty level), while 24 percent of children under 6 live in poor families (i.e., families whose incomes fall below 100 percent of the federal poverty level; Wight, Chau, & Aratani, 2011). Most low-income children under the age of 5 with employed mothers regularly spend time in some form of non-parental ECE: approximately 39 percent are in full-time care (at least 35 hours per week), 19 percent are in care for 15-34 hours per week, 14 percent are in care for 1-14 hours per week, and 28 percent spend no time in such care (Capizzano & Main, 2005). In terms of type of ECE, 26 percent of low-income children with working mothers spend their days in center-based programs (including child care centers, Head Start, preschool, and pre-kindergarten), 28 percent are cared for by a relative, 14 percent are in family child care homes, and 4 percent are cared for by a nanny or babysitter (Capizzano, Adams, & Ost, 2006). Importantly, these ECE environments may be contexts in which low-income children's socio-emotional adjustment can be promoted, when quality of care is high (ACF, 2006; Garces et al., 2002; Lee, Brooks-Gunn, Schnur, & Liaw, 1990; Loeb et al., 2005; Loeb et al., 2004; Peisner-Feinberg et al., 2001; U.S. Department of Health and Human Services (USHHS), 2002, 2005; Votruba-Drzal, Coley, & Chase-Lansdale, 2004; Zill et al., 2003).

ECE policy and practice are at a crossroads today. Head Start was due up for

reauthorization in 2012, and, as such, there are new regulations for grantees to comply with leading policymakers to grapple with how to improve its effectiveness. Funding for Head Start has grown modestly over the past several years, and approximately 813,313 children were enrolled in Head Start programs in 2014, up from previous years (New America Foundation, 2014). Meanwhile, President Obama's Pre-K for All initiative funded in 2014 expands our nation's birth to five system in the areas of home-visiting, Early Head Start-Child Care partnerships, and the development of a four-year old state-based pre-k system (National Head Start Association, 2013). In light of all this, states must decide whether to put their early education dollars toward Head Start or pre-K and how to improve the quality of these systems.

Head Start, our nation's largest and most comprehensive early childhood intervention program, seeks to prepare low-income children for the cognitive and socio-emotional demands of formal schooling and has the strategic opportunity to address and promote the school readiness of children from low-income families (ACF, 2014; Snyder & Dillow, 2011). This dissertation sought to further inform those efforts, with an approach that compliments existing Head Start practices and goals. But Head Start is more than just ECE. There is a strong family involvement and family engagement component to the program (National Head Start Association, 2013). Complementing the Head Start mission, the current study took a theoretically-informed, two-generation approach to supporting children's emotional and behavioral regulation. Head Start is a critical setting in which to intervene because low-income children are at particular risk for difficulties in school, and recent research indicates that Head Start quality in the area of emotional and behavioral supports could be improved (Garces et al., 2002). In fact, of

particular importance to Head Start is the transition from Head Start to kindergarten (ACF, 2014).

The Home Context

The home context is just one of the many environments in which stress permeates the lives of low-income children (NSCDC, 2005). These environments then, in turn, lead to poorer EF and emotional and behavioral regulation (Center on the Developing Child at Harvard University (CDCHU), 2011). While most interventions try to resolve this problem by targeting EF and other skills in the classroom, added value might be gained by targeting these skills *across* contexts. In fact, within the home environment, the quality of parenting is a strong predictor of resilience or risk (CDCHU, 2011; NSCDC, 2010; 2012). When parents are warm and supportive, the effects of stress are mitigated and children show greater emotional and behavioral regulation (Bernier, Carlson, & Whipple, 2010). However, when parent interaction is unpredictable and harsh, children do not learn the appropriate skills to effectively regulate their emotions and behaviors (Bernier et al., 2010). Therefore, in order to develop coherence across contexts that could potentially lead to longer lasting and stronger gains in emotional and behavioral regulation, parents also need to be taught how to develop these skills in their children and themselves. In fact, research on two-generation approaches that pair classroom intervention with supports for adult outcomes is one of the main goals of the Head Start program.

The Present Study

The present study built on theoretical and empirical prior work indicating that children's EF skills are important precursors to emotional and behavioral regulation and

that these skills are likely best promoted when addressed across classroom and home contexts. Specifically, the current study exploited a randomized experimental design to evaluate the effects of a classroom training targeting EF on children's emotional and behavioral regulation. The classroom training targeted EF with whole class activities once a week for a portion of the school year. In addition, the present study examined the potential value added of training both children and parents in these areas. Children were evaluated on their EF and emotional and behavioral regulation competency both directly pre- and post-intervention to test for impacts.

Direct child training. Children randomly assigned to the classroom training condition and the classroom training plus parent training condition took part in teacher-led classroom activities designed to improve EF and self-regulation. These activities were modeled after Tominey and McClelland's (2011) circle time games and focused on directly teaching children how to switch between two different sets of rules (i.e., cognitive flexibility) and inhibit automatic responses (i.e., inhibitory control).

Mind Matters parent training. In addition to classroom training, the present study evaluated a two-generation model for promoting emotional and behavioral regulation. While children randomly assigned to the classroom training plus parent training condition experienced the same classroom training described above, their parents participated in the Mind Matters curriculum. Mind Matters is a parenting curriculum focused on developing strong parent-child interactions with a specific emphasis placed on teaching parents the developmental importance of EF. Each training session taught parents a new skill and gave them the tools to foster these new skills in their children. They created games to play with their children at home based on what they learned.

Additionally, the parents received weekly updates about the games played in class with their children and how to play those games at home.

Finally, it is important to investigate mechanisms through which interventions may influence emotional and behavioral regulation in order to understand the particular aspects of the intervention that are most effective. This study added to the research base by examining whether the intervention components have indirect effects on children's emotional and behavioral regulation by affecting developmental mechanisms that have been empirically identified as underlying emotional and behavioral regulation for low-income children. Exploratory mediation analyses were conducted to determine whether the mechanisms, specifically children's EF, led to emotional and behavioral regulation.

CHAPTER 2: LITERATURE REVIEW

Theoretical Framework

An overarching bioecological basis was used to frame the theories investigated in the present study. Specifically, the critical importance of executive function (EF) for children's emotional and behavioral regulation is discussed. An emphasis is placed on the chaos and stress that poverty can exert on EF and that high quality early childhood education (ECE) can buffer these affects. Finally, in line with Bronfenbrenner's ecological model, two-generation approaches addressing issues in multiple systems (i.e., micro and meso) may have added value for improving children's EF skills and emotional and behavioral regulation (Bronfenbrenner & Morris, 2006).

What Is Emotional and Behavioral Regulation?

Children's *emotional regulation* includes their regulation of positive and negative affect, response to stressful situations, and ability to monitor others' emotional states (Calkins, Gill, Johnson, & Smith, 1999; Cole, Martin, & Dennis, 2004; Garner & Spears, 2000). Children's emotional regulation is correlated with their concurrent social competence, and their regulation, expression, and knowledge of emotion are predictive of later social and academic competence (Denham et al., 2003; Izard et al., 2001; Schultz, Izard, Ackerman, & Youngstrom, 2001). Closely related, *behavioral regulation* requires cognitively-based operations and can be defined as the manifestation of EF in overt, observable responses also important for success in classrooms (Baumeister & Vohs, 2004; Blair, 2002; McClelland et al., 2007). Prior research has examined EF as a critical construct underling emotional and behavior regulation.

Executive function (EF). EF is theorized to be a foundational cognitive system

that controls and manages many other cognitive processes related to self-regulation and achievement, including rule acquisition, selecting relevant sensory information for decision making, handling conflicting stimuli, retaining information, and planning future actions as well initiating appropriate actions and inhibiting inappropriate actions (Blair & Diamond, 2008; CDCHU, 2011; Hofmann, Schmeichel, & Baddeley, 2012; Riggs, Jahromi, Razza, Dillworth-Bart, & Mueller, 2006). Most theorists agree on three core system elements of EF: working memory, cognitive flexibility, and inhibitory control.

Working memory. Working memory is the ability to hold or maintain information (despite potential distracting stimuli) and to mentally work with or manipulate that information, making it possible to remember plans and instructions, consider alternatives, make mental calculations, and relate the present to the future or past. Moreover, there is increasing evidence that high working memory capacity leads to better emotional and behavioral regulation (Hofmann et al., 2012; Schmeichel, Volokhov, & Demaree, 2008).

Cognitive flexibility. Cognitive flexibility is the ability to nimbly adjust to changed demands or priorities. It is the ability to consider something from a fresh or different perspective, switch between perspectives, adjust to change, and think abstractly or outside of the box. Little research has examined a direct link between cognitive flexibility and emotional and behavioral regulation. However, high cognitive flexibility may facilitate goal pursuit (implicit in self-regulation) by allowing individuals to identify and abandon suboptimal means and instead pursue alternative means to reach the same goal (Hofmann et al., 2012; Marien, Aarts, & Custers, 2011). Greater cognitive flexibility may also allow people to temporarily disengage from a self-regulatory goal and pursue tempting alternatives potentially resulting in better long-term goal attainment (Carver,

2004; Dreisbach & Goschke, 2004; Fishbach, Zhang, & Koo, 2009; Hofmann et al., 2012).

Inhibitory control. Inhibitory control is the ability to resist a strong inclination to do one thing in order to do what is most appropriate or needed. Inhibitory control is important because inhibiting attention to distraction makes possible selective, focused, and sustained attention; inhibiting a strong behavioral inclination helps make discipline and change possible (Hofmann et al., 2012). In addition, the development of inhibitory control (via development of the prefrontal cortex) serves to modulate, either by enhancing or inhibiting, the reactive state of our arousal systems (Blair & Diamond, 2008; Derryberry & Rothbart, 1997). More generally, researchers and theorists agree that inhibitory control and emotional regulation are integrally connected (Blair & Diamond, 2008; Cole et al., 2004).

Implications of Low Family Income for Emotional and Behavioral Regulation

Growing up in poverty has been linked to a host of negative outcomes (Brooks-Gunn & Duncan, 1997; McLoyd, 1998). During early childhood, the stress of growing up poor is, in part, relayed to children via parenting practices that are hampered by the economic stress. High economic stress increases the likelihood of depressive symptoms, depleting cognitive and emotional resources for positive parenting that help children regulate emotions and model good emotional regulation (Bernier et al., 2010; Brooks-Gunn, Duncan, & Aber, 1997; CDCHU, 2009; 2011; NSCDC, 2005; 2010; 2012; Yeung, Linver, & Brooks-Gunn, 2002). In other words, children growing up in poverty are exposed to environments that have high levels of stress and low levels of regulatory supports.

Infants and young children in poverty are more likely to be exposed to multiple ecological stressors such as residential instability, higher levels of neighborhood and family violence, greater psychological distress among adult caregivers, and a range of other factors that appear to place children's EF, effortful control, and processing of emotional information at risk (Ackerman, Kogos, Yongstrom, Schoff, & Izard, 1999; Blair, Granger, & Razza, 2005; CDCHU, 2011; NSCDC, 2005; 2010; Pollack, 2003). Yet, for these children, the risk may be alleviated through interventions that target these skills in preschool (Bierman, Nix, Greenberg, Blair, & Dormitrovich, 2008; Diamond, Barnett, Thomas, & Munro, 2007; Domitrovich, Cortes, & Greenberg, 2007; Izard, Trentacosta, King, & Mostow, 2004). Moreover, although children in low-income families are at greater risk for developing emotional and behavioral difficulties, those who effectively handle their emotions and behavior despite exposure to multiple stressors are likely to do better, academically, than their peers (Raver & Zigler, 1997).

The Developmental Importance of Emotional and Behavioral Regulation

The risks that low-income children face are of concern because early risks compound over time, increasing chances of later negative outcomes (Brooks-Gunn & Duncan, 1997; McLoyd, 1998; NICHD Early Child Care Research Network, 2001, 2002; 2005). Children who become easily upset, angered, and disruptive are likely to have greater difficulty learning and retrieving new information (Blair et al., 2005; Quas, Bauer, & Boyce, 2004; Tomaka, Blascovich, Kelsey, & Leitten, 1993). Specifically, children who have difficulty regulating their emotions and behaviors have been found to receive less instruction, to be less engaged and less positive about their role as learners, and to have fewer opportunities for learning from peers (Arnold, McWilliams, & Arnold, 1998;

Ladd, Birch, & Buhs, 1999; McLelland, Morrison, & Holmes, 2000; Raver, Garner, & Smith-Donald, 2007). In addition, children's behavioral orientations at school entry affect the types of relationships they form with peers and teachers, with these relationships, in turn, influencing children's classroom participation in kindergarten (Ladd et al., 1999). More generally, behavior problems in early childhood are a strong predictor of low peer acceptance and maladaptive teacher-child relationships through middle childhood, as well as delinquency and antisocial disorders in adolescence (especially among boys) and unemployment in adulthood (Broidy et al., 2003; Kokko & Pulkkinen, 2000; Ladd & Burgess, 1999; White, Moffitt, Earls, Robins, & Silva, 1990). In contrast, children's positive emotions facilitate effort and persistence in completing academic tasks (Lazarus, 1991; Schutz & Davis, 2000). Children who regulate their emotions to remain engaged with positive feelings about school (in the face of academic challenge) demonstrate higher school performance and standardized test scores than other children (Lepper, Corpus, & Iyengar, 2005).

Head Start Program Impacts on Emotional and Behavioral Regulation

Overall, research on Head Start has found initial positive benefits of the program with more mixed long-term effects. Findings from the Head Start Impact Study demonstrate that initially, for 3-year-olds, participation in Head Start is associated with reductions in overall problem behaviors across multiple reporters (i.e., teacher and parent; USHHS, 2005). In addition, by kindergarten and first grade, parents reported children in the 3-year-old cohort as closer to and having more positive relationships with them and in the 4-year-old cohort as being less withdrawn; however, teachers reported 4-year-old children who participated in Head Start to be shyer and more socially reticent and have

more problems with student and teacher interactions than other children (USHHS, 2010). Moreover, the comparison group caught up to the Head Start group in most behavioral and achievement domains by kindergarten (USHHS, 2010).

According to the Head Start Family and Child Experiences Survey (FACES), children show growth in social skills (such as cooperative behavior), more positive approaches to learning, and reductions in hyperactive and total problem behavior during the Head Start year, including children with particularly high levels of shy, aggressive, or hyperactive behaviors (Aikens, Kopack Klein, Tarullo, & West, 2013; Zill et al., 2003). Additionally, in the most recent report, children ages 4 and older did better in the pencil tap task by the end of Head Start as compared to when they first entered the program; however, researchers suspect that these results were largely due to typical maturation in these domains for 3-year-olds (Aikens et al., 2013).

More generally, Head Start has demonstrated robust immediate, small-to-moderate positive effects on children's socio-emotional adjustment (McKey et al., 1985). Evaluations of longer-term effects indicate that former Head Start participants continue to score higher on measures of social behavior than non-Head Start children two years after the program, but then drop to the level of comparison children by the end of the third year. Yet, Garces and collegues (2002) find that African-American adults who attended Head Start as children are substantially less likely to have been arrested or charged with a crime than their siblings who attended another preschool, which has been shown to save taxpayers money (Belfield, Nores, Barnett, & Schweinhart, 2006).

Despite these generally positive effects, policy makers have grappled with how to improve Head Start's effectiveness in socioemotional and behavioral domains and have

hesitated with reauthorization, instead creating new regulations for grantees. This is demonstrated through funding for research investigating improvements to the Head Start curriculum, such as the Head Start CARES project. Head Start CARES produced positive impacts in some soicoemotional and behavioral domains but not all and only for two out of the three interventions evaluated (Morris et al., 2014). No consistent evidence on children's EF or pre-academic skills was found during preschool, and there were virtually no impacts on outcomes in kindergarten as reported by teachers and parents (Morris et al., 2014). All of these findings indicate that further research is needed on the appropriate Head Start add on supports that will show strong, lasting effects for children's emotional and behavioral regulation. The current study bridged this gap by evaluating the effectiveness of an intervention aimed at improving EF and emotional and behavioral skills, thereby improving the quality of Head Start.

Promoting Emotional and Behavioral Regulation in ECE Classrooms

The following reviewed preschool interventions take into account prior research and examine different methods to promote young children's emotional and behavioral regulation. Curriculum approaches include promoting a positive emotional climate in the classroom, modeling positive emotions more frequently, and helping children improve their EF. Ultimately, the findings from classroom-only interventions are mixed, although generally positive (Diamond & Lee, 2011; Zelazo & Carlson, 2012).

One such intervention is the teacher-training curriculum of the Incredible Years (IY) program (Webster-Stratton & Reid, 2004; Webster-Stratton. Reid, & Hammond, 2001). It focuses on instructing teachers in how to implement classroom-wide positive management and discipline strategies and how to promote social competence in the

classroom. The approach is systematic, and includes attention to positive behavioral support, classroom organization (rules and routines), clear commands and consistent limit setting, positive reward structures, and providing positive teacher attention to support child prosocial and social problem-solving skills. The model includes the use of incentives and proactive approaches to reducing problem behavior, builds these strategies on a foundation of positive relationships with students, emphasizes teachers' labeling of children's emotions during play time, and teaches children social problem solving skills (Webster-Stratton & Reid, 2004). Children participating in IY showed significantly fewer conduct problems at school and at home than control children, including those children with highest rates of noncompliant and aggressive behavior at baseline, and these results were maintained one year later (Webster-Stratton et al., 2001).

Similarly, the preschool PATHS (Domitrovich et al., 2007) program involves training teachers in the delivery of an emotions-skill and social-skill curriculum. The curriculum, provided in the classroom by Head Start teachers, targets cooperation, communication, self-control, social problem-solving skills, and the identification of emotions. Teachers are also trained in "induction strategies" which include the use of emotion coaching, positive support, and social problem-solving dialoguing, designed to enhance the children's use of prosocial and self-regulation strategies in the context of classroom interactions and challenges (Domitrovich et al., 2007). Bierman and collegues (2008) found that children in the intervention with low, pre-intervention, behavioral EF performance showed higher levels of social competence, reduced aggression, and improved print knowledge compared with control group children. The intervention also positively affected attention and inhibitory control (Bierman et al., 2008).

Also relevant, is a teacher-implemented emotion-centered program (Izard et al., 2004) developed for Head Start that focuses primarily on the four "basic" emotions: happiness, sadness, anger, and fear. The emotions-centered program lessons and activities help children identify the cues for recognizing and labeling these basic emotions as well as ways to regulate them and utilize moderated emotion motivation constructively. In an evaluation of the pilot program, intervention children showed larger increases in emotions knowledge and less growth in negative emotion expression than control children (Izard et al., 2004).

Much attention has also been given to Tools of the Mind (TOM), a Vygotskian-based curriculum (Diamond et al., 2007). TOM targets cooperative play skills, self-regulation, and social problem-solving skills, but compared with similar programs there is a more extensive emphasis on fostering EF and related approaches to learning (Diamond et al., 2007). After evaluating the intervention Diamond and colleagues (2007) found that children participating in the intervention did better on tasks that required the use of all three EF components than a control group and that performance on these tasks was correlated with academic achievement measures (see also Barnett et al., 2008). However, recent evaluations of TOM have not been as positive, showing no differences between TOM and control students in self-regulation domains and illustrating the difficulty of training teachers in this method (Clements, Sarama, Unlu, & Layzer, 2012; Farran, Wilson, Lipsey, & Turner, 2013; Lonigan & Phillips, 2012; Morris et al., 2014; Wilson & Farran, 2012).

Finally, Tominey and McClelland (2011) investigated the effectiveness of a series of circle time games aimed at increasing behavioral regulation. In a random assignment

evaluation of an economically-diverse sample, they found that children in the intervention group with initially low levels of EF showed gains in behavioral regulation as compared to similarly low-functioning children in the control group (no impacts of the intervention were found for the full sample; Tominey & McClelland, 2011). Additionally, children in the intervention group showed gains in early literacy as compared to the control group (Tominey & McClelland, 2011).

Two-Generation Interventions for Emotional and Behavioral Regulation

Parenting has been shown to be among the most critical influences on child emotional and behavioral regulation in infancy and early childhood (Bradley & Corwyn, 2004; Calkins & Johnson, 1998; Calkins et al., 1998; Derryberry & Rothbart, 1997; Kopp, 1982). By using social referencing, very young children pick up on their parents' subtle emotional cues and use them to direct their own emotions (Saarni, Mumme, & Campos, 1998). Moreover, parents' involvement, support for autonomy, and support for the development of social competence have been shown to influence inner motivational resources that, in turn, are related to self-regulation and school achievement (Bradley & Corwyn, 2004; Grolnick, Kurowski, & Gurland, 1999; Grolnick & Ryan, 1989). Given the importance of both classroom and home influences on children's development of emotional and behavioral regulation skills, it was hypothesized that an intervention that combines the efforts of classroom and parents would show effects above and beyond that of a strictly classroom-based intervention.

Of particular importance to Head Start is research on two-generation approaches that pair intensive and intentional supports for adult outcomes with effective approaches for supporting children's school readiness. According to social learning theory, children

learn emotional and behavioral regulation strategies through observing social situations and emotional cues in their environment (Bandura, 1977). As parents cope with emotionally challenging situations, children learn and emulate the regulation strategies their parents display. Consistent with social learning theory, Campos and Barrett (1984) argue that children learn from their parents' emotional regulation strategies through modeling. Specifically, Barrett and Campos (1987) theorized parental emotions serve as models for their children, with parents' reactions to events being imitated by the child, including both effective and ineffective coping responses (Barrett & Campos, 1987). Moreover, children model idiosyncratic expressions that a parent frequently uses, such as the use of sarcastic intonations (Barrett & Campos, 1987).

Additionally, the emotional climate of the home is critical for children's development of emotional and behavioral regulation. Barrett and Campos (1987) theorize parental emotions capture the attention of their children in the overall emotional climate in the home, which can influence the child's development of emotional and behavioral regulation. This theory is also useful because once the mechanisms through which parental emotions inform children's emotions (there are four that Barrett and Campos discuss) are understood, it is then possible to instruct parents in how to model positive emotions and coping strategies for their children. Complementary to this theory, Conger and colleagues (1992; 2000) theorize in the family stress model that long-term poverty not only negatively influences child health and behavior directly but also indirectly through family stress. Family stress indicators such as family dysfunction, conflictual adult relationships, and depression lead to hostile-ineffective parenting, which in turn undermines parental support of children's regulatory efforts (Conger et al., 1992; 2000).

Given this significant influence that parenting has on emotions and behavior, interventions that address parenting, especially in the context of poverty, can capitalize on this theoretical research by teaching parents to foster their children's positive emotional and behavioral development.

Moreover, interventions that take two-generation approaches have the potential to improve the well-being and psychological functioning of parents, creating an additional buffer from risk in deprived homes. As noted earlier, low-income parents often experience significant economic and generalized stress. Frequent or sustained activation of brain systems that respond to stress can lead to heightened vulnerability to a number of stress-related disorders affecting both mental and physical health over a lifetime and to significant changes in a person's ability to control impulsive behaviors, contextualize decision-making, solve problems, and realize long-term goals (NSCDC, 2005).

In fact, innovative approaches to combating poverty have targeted EF skills in parents. One such intervention, Mobility Mentoring, targets family stability, maternal well-being (including building EF through scaffolding), education and training, financial management, and employment and career management as a way to reduce the stress that influences the lives of low-income mothers (Babcock, 2012). Results of initial pilot data indicate that more mothers enrolled in education or training programs and have college degrees at the end than at the start of the intervention and that families have been able to create savings accounts (Babcock, 2012). All of these factors have led to a reduction in stress that will likely spill over into positive impacts for children through more positive interactions with their parents.

Additionally, pre/post-test evaluation of Mind Matters, the parent training used in

the current study, was previously conducted. Members of the community that were considered mentors administered the 10-week intervention for parents. Thirty minority, low-income parents living in 3 Boston neighborhoods reported on family income, education levels, parental rules, how they try to calm upset children, parent and child EF, parent and child persistence, and family conflict and conflict resolution both prior to and immediately following completion of the intervention. Post-intervention, parents report greater child persistence and more positive family conflict outcomes. Specifically, families were better able to talk calmly about problems, displayed less avoidance of conflict, and engaged in less threatening behaviors (Sheridan & Floyd, 2013). Finally, parents reported being better able to ignore children's bad behavior in the past week, which they indicated as essential to helping their children calm down (Sheridan & Floyd, 2013). While these findings are promising, further research on the effectiveness of this intervention is needed due to the small sample size and the non-randomized nature of the prior study. In this way the present study extended this research by increasing the number of parents assessed and using a randomized design to evaluate the effectiveness of the intervention on child outcomes.

Moreover, prior research suggests developmental coherence and consistency across home and classroom environments can have greater positive impacts on children, than positive climates in either one alone. Recent meta-analysis of parent training programs combined with ECE shows when ECE is paired with parent training that incorporates modeling of necessary skills, children show greater gains in cognitive and pre-academic skills over and above ECE alone (Grindal et al., 2016). With regards to dosage, home visits need to happen at least once a month for this significant positive

effect to be evident (Grindal et al., 2016). Additionally, Neville and colleagues (2013) evaluated an intervention which teaches parents strategies targeting family stress regulation, contingency-based discipline, parental responsiveness and language use, and facilitation of child attention through links to child training exercises and teaches children how to regulate their attention and emotions. The intervention for children included eight, 50-minute sessions, while the intervention for parents included eight weekly, two-hour sessions with one follow-up phone call per week (actual dosage information not reported; Neville et al., 2013). They found that compared to children enrolled in Head Start alone children in the treatment group performed better on measures of selective attention, cognition, and parent-reported child behaviors (Neville et al., 2013). Additionally, parents reported less stress and had more observed positive interactions with their children (Neville et al., 2013).

In evaluations of the Chicago Child-Parent Centers, which emphasizes comprehensive services and parent participation and includes strong transition services, Reynolds and colleagues (1998; 2001) find that children who participated in the program benefited from higher cognitive skills, greater school achievement, and improved consumer skills, lower incidence of school remedial services in early adolescence, lower rates of official juvenile arrests, violent arrests, and multiple arrests by age 18, higher rates of school completion by age 20, and lower rates of special education services and grade retention.

Furthermore, an evaluation of the IY curriculum by Webster-Stratton and colleagues (2001, 2004) found that when a parent training is included in the treatment model children have fewer conduct problems, and these effects are sustained into the next

year after the intervention (see description in previous section). These findings of positive impacts of combining teacher and parent components on child behavior and emotion regulation are promising (Webster-Sratton et al., 2001; 2004). Moreover, these positive impacts were found even though random assignment was not completely successful (i.e., the experimental group had more behavior problems than the control group at baseline; Webster-Sratton et al., 2001). When dosage of the intervention model is considered, these and other studies using the IY program indicated parental attendance rates of about 60 percent (e.g., just over half sessions attended; Baker, Arnold, & Meagher, 2011; Gross et al., 2003; Webster-Stratton et al., 2001). Despite the success of these models, interventions that combine parent and classroom training in promoting children's emotional and behavioral regulation and EF abilities are not widely available nor has the effectiveness of such interventions been widely evaluated.

Conceptual Model and Study Objectives

The conceptual model (see Figure 1) for the current study places children's EF and emotional and behavioral regulation as the primary targets of the intervention model. The intervention emphasized parent and child EF through instruction and modeling. The central role these skills played in the theory of change for this program model is indicated by the arrows. It was through changes in EF that the intervention was initially intended to influence children's emotional and behavioral regulation (Ladd, Buhs, & Seid, 2000; McClelland, Acock, & Morrison, 2006). Moreover, for the parent training pathway, it was through improved parent skills that there may be changes in children's EF and emotional and behavioral regulation. Ultimately, it was hypothesized that these improvements in both parents' and children's skills would lead to improvements in

children's EF and emotional and behavioral regulation.

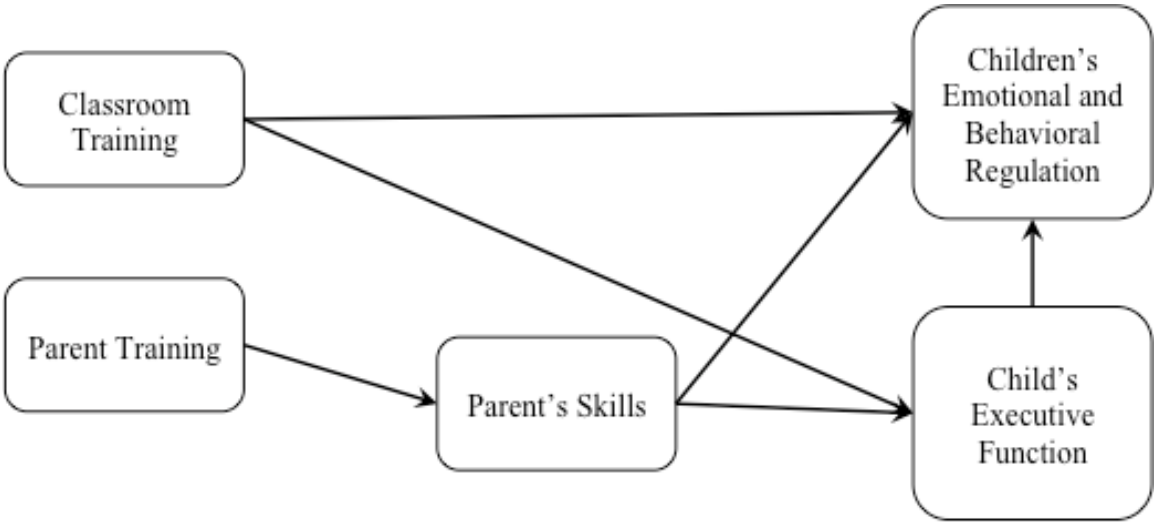

Figure 1: Conceptual model

The current study focused on the following research questions:

Question 1: Is a classroom training targeting low-income 3- and 4-year-old children's emotional and behavioral regulation through direct child training of EF effective? It was expected that direct child, classroom-based instruction in EF would result in improved EF.

Question 2: Is a classroom training plus parent training targeting low-income 3- and 4-year-old children's emotional and behavioral regulation and parental knowledge of social problem solving skills and EF development effective? It was expected that classroom-based training that was paired with parent training in social problem solving skills and child EF development would produce larger improvements in these developmental domains than classroom-based training alone.

Question 3: Does improved EF result in improved emotional and behavioral regulation? The intervention was expected to result in a chain of mediated effects with the most distal outcome being improved child emotional and behavioral regulation.

Specifically, children who experienced child and parent training were expected to display better regulation than children who experienced only child training and, in turn, children who experienced only child training were expected to display better regulation than those who experienced no training. In addition, the impacts of the intervention on emotional and behavioral regulation were expected to be mediated by the more proximal impacts of the intervention on children's EF.

CHAPTER 3: RESEARCH DESIGN

Direct child assessments and parent surveys were examined to evaluate the effectiveness of a classroom training and classroom training plus parent training. Change in executive function (EF) was examined across the year in Head Start.

Participants

Three- and four-year-old, Head Start children and their parents were recruited from 32 Head Start classrooms (from 4 centers across 5 sites).[1] All parents and children in classrooms were approached for participation in the study, leading to an initial sample size of 331 (out of a possible 544; see Table 1 for breakdown of sample by site). Participating families represented several racial/ethnic backgrounds (see Table 3 in Chapter 4 for sample details), and children were on average 4 years old. After attrition, the final sample size was 305, representing only an 8 percent attrition rate.

Table 1
Sample Distribution

	Site 1	Site 2	Site 3	Site 4	Site 5
Number of classrooms	17	2	1	7	5
Total number of participants recruited	160	22	18	81	50
Sample after attrition	144	22	12	77	50
Average number of participants per classroom	8	11	12	11	10

Procedure

The current study made use of a clustered (classroom-level) randomized design with outcomes measured at the individual child and parent levels. Specifically, 32 classrooms with an average of 15 students were randomly assigned to one of three conditions: (1) the control condition, in which children and families received standard

[1] One center had classrooms across 3 different sites; two of which were included in this study.

Head Start intervention components; (2) the classroom training treatment condition, in which children took part in whole-class activities designed to improve EF and self-regulation modeled after Tominey and McClelland's (2011) circle time games; and (3) the classroom training plus parent training treatment condition, in which children received the classroom-based treatment condition, and in addition, their parents received the Mind Matters parenting curriculum focused on developing strong parent-child interactions with a specific emphasis placed on teaching parents the developmental importance of EF. Data was collected both pre- and post-intervention. Time between pre- and post-intervention varied by site ranging from 4 months to 6 months.

Classrooms randomly assigned to the intervention were intended to participate in a total of twenty activity sessions over ten weeks. Following previous research on the feasibility and effects of similar interventions (e.g., Pears et al., 2007), the activity sessions were intended to be held twice weekly, lasting about 30 minutes. Teachers were encouraged to choose times that best accommodate their classroom needs/priorities. Teachers encouraged all children to participate, but were instructed to allow children to decline or quit participation at any time.

Teacher training. Once random assignment was complete, classroom teachers in both intervention groups were trained in the classroom intervention. Teachers participated in three professional development workshops prior to the beginning of the intervention during which they were trained to deliver the 6 circle-time activities. Each hour-long workshop began with a brief introduction about the importance of these types of activities. Teachers were then taught how to play each of the 6 activities and given materials to facilitate the activities. They were encouraged to try at least one of the

activities before the next workshop. The second workshop took place one week after the first and included a Q & A session where teachers had the opportunity to report how the activities went and ask questions that might have come up during the trial. The third workshop was similar to the second and teachers had the opportunity to give more feedback. During the intervention phase, two classes for each teacher were attended to answer questions and to rate adherence to the intervention model. During these visits, field notes were taken related to teacher fidelity to the intervention model (not on child behavior).

Classroom training. Children in classrooms randomly assigned to the classroom training condition and the classroom training plus parent training condition took part in, 20-30 minute, whole-classroom, teacher-led play sessions using the six activities designed to improve EF and self-regulation. These activities were modeled after Tominey and McClelland's (2011) circle time games, with a focus on teaching children how to switch between two different sets of rules (i.e., cognitive flexibility) and inhibit automatic responses (i.e., inhibitory control).[2] Playgroup sessions were modeled on conventional preschool classroom circle time activities, with a total of six unique activities to be presented over the 20 sessions.

Teachers in classrooms randomly assigned to two treatment conditions (classroom training and classroom training plus parent training) were expected to conduct a total of

[2] There were two modifications to Tominey and McCLelland's (2011) original games and procedure in the current study. First, teachers instead of trained researchers delivered the activities in order to enhance the real world applicability of the intervention. Second, the training for teachers included concepts and classroom applicable games from the Mind Matters curriculum in addition to training on the six activities in order to better align the two interventions.

twenty activity sessions (max 30 minute sessions) over ten weeks (i.e., twice weekly). Integrated into regular classroom activities, children were invited by teachers to participate in the activities as part of the daily classroom routine, but were allowed to decline or quit participation at any time during or prior to participating in the activities. The teachers rolled out the activities across the 20 sessions such that not all activities were played every week, but the children were supposed to learn all of the activities by the end of the 20 sessions. On average one activity was played each session. On average teachers repeated some activities 5 to 10 times (i.e., Red Light, Purple Light; The Freeze Game, Drum Beats; see below for a description of activities), but only played other activities once or twice (i.e., Cooperative Freeze, Sleeping, Sleeping, Conducting an Orchestra), playing Red Light, Purple Light; The Freeze Game, Drum Beats the most.

Activity sessions. The activities – previously piloted in pre-kindergarten classrooms (Tominey & McClelland, 2011) – were intended to help children practice attention and working memory by encouraging them to remember and follow through with multi-step instructions. Children also practiced inhibitory control by starting and stopping to different cues (oral and visual), performing specific behaviors in response to cues, and performing opposite behaviors. Each activity included music and movement components to promote engagement and children's positive feelings about the activities. Children were also given the opportunity to lead activities when appropriate (e.g., select and hold up colors for Red Light, Purple Light). Teachers reported that these activities were easy to implement in a circle time setting with large groups of children with varying developmental levels and self-regulation abilities. Specifically, the following activities were implemented:

1. Red light, purple light: Similar to the popular children's game Red Light, Green Light, a teacher acts as a stoplight by standing at the opposite end of the room from the children and holding up different-colored construction paper circles to represent stop and go. Children respond to specific color cues (e.g., purple is stop and orange is go) and then opposite cues (e.g., purple is go and orange is stop) as well as to different shapes representing stop and go (e.g., any color circle is go and any color square is stop). This game mainly focuses on children's inhibitory control, but does also incorporate working memory.

2. The freeze game: Children dance when music played and freeze when the teacher stops the music. Children dance slowly to slow songs and quickly to fast songs, alternating between different slow and fast songs. Children were then asked to respond to opposite cues: dancing quickly to slow songs and slowly to fast songs. This game mainly focuses on children's inhibitory control, but does also incorporate working memory.

3. Color-Matching/Cooperative freeze: In this game, which is related to The Freeze Game, children dance when music plays and freeze when the music is stopped; however, children were asked to perform an additional step before freezing. Teachers tape different-colored pieces of construction paper to mats placed on the ground. When the music stops, the teacher held up a specific color and children were instructed to find and stand on a mat of that color. As an added challenge, teachers removed mats as the game went along so that children had to cooperate and stand together when the music stopped. This game mainly focuses on children's cognitive flexibility.

4. Sleeping, sleeping, all the children are sleeping: Children pretend to sleep when the teacher sings, "Sleeping, sleeping, all the children are sleeping." While children

pretend to sleep, the circle leader gives an additional instruction for children to wake up and act out an animal (e.g., "And when they woke up…they were monkeys!"). Additional rules were added to make the game more complicated. This game mainly focuses on children's working memory, but does also incorporate inhibitory control.

5. Conducting an orchestra: The teacher used a stick as a conducting baton to lead children in playing musical instruments (e.g., jingle bells or maracas). When the conductor waved the baton, children played their instruments. When the conductor put the baton down, children stopped. The conductor then instructed children to play their instruments quickly when the baton moved quickly and slowly when the baton moved slowly. Children were also asked to respond to opposite cues. When the conductor waved the baton, children stopped playing their instruments, and when the conductor set the baton down, children played their instruments. This game mainly focuses on children's inhibitory control, but does also incorporate working memory.

6. Drum beats: Children respond to different drum cues with body movements. Teachers choose actions for children to perform while sitting (e.g., clapping or stomping) and while moving around the room (e.g., walking or dancing). For example, children were instructed to walk quickly to fast drumming, walk slowly to slow drumming, and freeze when the drumming stopped. Teachers also asked children to respond to opposite cues (walking slowly to fast drum beats and quickly to slow drum beats) and associate different actions with specific drum cues (e.g., hopping to fast drum beats and crawling to slow drum beats). This game focuses on children's inhibitory control and working memory.

Mind Matters parent training. For children assigned to the classroom training

plus parent training condition, in addition to child exposure to the teacher-led classroom activities, parents participated in the Mind Matters curriculum. Mind Matters is a culturally sensitive parenting curriculum focused on developing strong parent-child interactions with a specific emphasis placed on teaching parents the developmental importance of EF. Each training session taught parents a new skill and gave them the tools to foster these new skills in their children. Originally implemented in 2008 to 2011 as Mind in the Making for ECE professionals in Boston Public Schools, the training explained the research behind the social-emotional-intellectual development of children from birth to age 8 years old. In response to a number of requests to provide a similar workshop series for families, an early version of Mind Matters, Families Engaged in Learning, was developed and piloted in 2012. The pilot advised the development of the current 20-hour Mind Matters: Families Make a Difference Workshop Series developed by Joan Matsalia. Mind Matters was informed by research from the National Scientific Council on the Developing Child at Harvard, Mind in the Making: Seven Essential Skills Every Child Needs by Ellen Galinsky, Second Step: Social Skills for Early-Childhood-Grade 8 from the Committee for Children (curriculum used in many Boston Public Schools), and The Search Institute Developmental Assets Approach.

The Mind Matters training consists of 10, 2-hour sessions, called modules, all with an underlying theme of the importance of EF development in children. The specific order of the modules is as follows:

1. Introduction and Relationships are Important;
2. Building a Foundation;
3. Focus and Self-Control;

4. Perspective Taking;
5. Communication;
6. Making Connections;
7. Critical Thinking;
8. Taking on Challenges;
9. Perseverance;
10. A Learning Community.

Each module began with the parents learning about the concept of the day and how to identify it in their own lives. Parents listened to an informative lecture including research by experts in the field of child development about how the concept is developing in their child and worked collaboratively in groups to share what they learned. At the end of each session, parents worked together to create take-home games that they could play with their child that would foster the development of the concept for the day. Additionally, the parents received weekly updates about what games were played in class with their children and how to play those games at home.

To encourage parent attendance at these trainings, several methods were employed. First, a survey of parent availability was conducted to ascertain the best time of the day to hold the training at each site. Based on restrictions placed on the study by the Head Start centers, available times were constrained to during the typical work day (i.e., 8am-5pm).[3] Next, parents were made aware that breakfast or lunch (depending on the time of day of the training) would be provided every session. Prior to each session,

[3] A discussion about how this likely impacted parent attendance can be found in the fidelity section of Chapter 4 as well as in the limitations section of Chapter 5.

parents received a phone call reminding them about the session the next day and encouraging them to pick up the materials associated with that session if they could not attend. Additionally, teachers reminded parents about session days and times during drop off or pick up, and there were flyers posted in the classrooms with pertinent information about the sessions. Moreover, to accommodate parents with primary languages other than English, sessions were conducted in and materials were translated into Spanish and Haitian Creole and ASL interpreters translated sessions for a mother who is deaf. Finally, drawings were held at each session for small tokens of appreciation for attendance (e.g., $5 Dunkin Donuts gift cards).

Project timeline. Approval for the proposed study was obtained from the director of Boston Head Start, the Parent Policy Council, and the Boston College Institutional Review Board. During the 2014-2015 and 2015-2016 school years, individual centers, the Executive Director of the NHSA, Yasmina Vinci, and the vice president of the Action for Boston Community Development (ABCD) Head Start program, Yvette Rodriguez, were worked with to recruit Head Start centers to participate in the project. Consent was first obtained from the center directors and ABCD followed by teachers and parents in participating classrooms.

The research design began with the sample of Head Start centers willing to participate in the study. Participating Head Start classrooms within each center were then randomized to a treatment group which received one of the interventions being tested (either the solo classroom training or the combined classroom training plus Mind Matters parent training) or a control group, which did not receive either of these interventions. In this way, randomization of classrooms was “blocked” by center (see Table 2 for

breakdown of random assignment status by site). All children and their parents within classrooms were included in the treatment group or control group to which their classroom was randomized.

Table 2
Random Assignment Breakdown

	Site 1	Site 2	Site 3	Site 4	Site 5	Total
Total number of classrooms	17	2	1	7	5	32
Mind Matters	6	1	0	2	2	11
Classroom only	6	0	1	2	2	11
Control	5	1	0	3	1	10
Total number of participants	144	22	12	77	50	305
Mind Matters	45	13	0	22	25	105
Classroom only	54	0	12	22	20	108
Control	45	9	0	33	5	92

Pretest data on both children and parents was collected in the fall of 2015/winter 2016. Training was conducted in January 2016 for teachers and intervention activities began in February 2016 and continued through April 2016 for 3 out of the 4 centers.[4] Outcome data on children and parents was collected in May/June 2016 after the conclusion of the intervention. In spring of 2017, those classrooms and parents in the control condition are scheduled to receive the classroom and parent trainings (see Figure 2 for exact timing of activities).

All data was securely stored to ensure confidentiality of information collected. Paper records were stored in locked filing cabinets and only approved research staff had access to records. Research staff coming in contact with the data had certification from CITI Protection of Human Subjects Research, in addition to a background check. Paper records were entered into an electronic database, which was housed on a secure,

[4] One center was delayed in all aspects of data collection and intervention participation due to late indication that the center was interested in participation.

password-protected network. Participating parents and children were assigned a unique numeric identification number such that data used for analyses were de-identified.

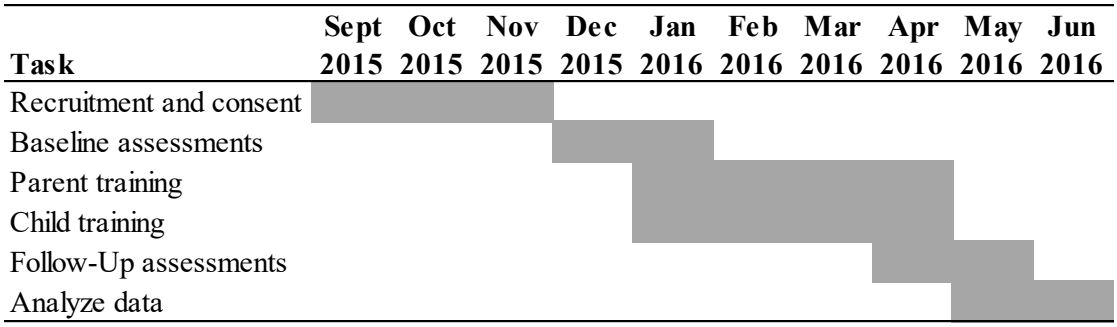

Figure 2: Project timeline

Dosage

Classroom training dosage. Teachers overwhelmingly reported (during trainings and weekly check-ins) that the children enjoyed the activities when they played them. They noted that at first the switching components of the activities were too difficult for the students but that over time they began to catch on, and some classrooms were even able to progress to the final stage where children led the activities themselves. However, only a little over half of the teachers (59%) were actually playing the activities consistently for the full duration of the intervention (as determined by teacher report; see Table 3). Additionally, they tended to stick to certain activities over others instead of playing all 6 activities with the children (i.e., Red Light, Purple Light; Freeze Game; Drum Beats). Therefore, an indicator of dosage was used to examine treatment on the treated: low versus higher fidelity to the classroom training intervention model was less than one circle time activity per week over 10 weeks and higher dosage was at least one circle time activity session per week. How these differences in dosage influenced child outcomes is shown in Chapter 4, and a discussion of how this could have impacted the results of the study can be found Chapter 5.

Table 3
Actual Teacher Participation Rates

	Site 1	Site 2	Site 3	Site 4	Site 5	Total
Original number of participants	12	1	1	4	4	22
Teachers playing at least 1 activity/week	7	1	0	2	3	13
Teachers playing at least 1 activity/week (%)	58%	100%	0%	50%	75%	59%

Parent intervention dosage. Parent participation in the trainings varied greatly across the sites (see Table 4). At the largest site (N=144), of the 45 parents who were supposed to attend, only two (4%) showed up regularly and five others attended once or twice. At the other three locations, parent participation ranged from 20 to 40 percent, which meets or exceeds (respectively) expectations for participation rates in this population (Spoth & Redmond, 2000). Therefore, an indicator of dosage was used to examine treatment on the treated: low versus higher fidelity to the parent training intervention model was less than 50 percent attendance (i.e., 4 or less sessions) and higher dosage was at least 50 percent attendance (5 or more sessions). However, once parents came they attended regularly and participated fully in all intervention components and activities. As intended a sense of community and camaraderie developed between the parents at each site. How these differences in participation influenced child outcomes is shown in Chapter 4, and how this very low participation rate may have influenced the impact results is discussed in Chapter 5.

Table 4
Actual Mind Matters Parent Participation Rates

	Site 1	Site 2	Site 3	Site 4	Site 5	Total
Original number of participants	45	13	N/A	22	25	105
Parents attending in 5+ sessions	2	4	N/A	9	5	20
Parents attending 5+ sessions (%)	4%	31%	N/A	41%	20%	19%

Measures

This research project took advantage of a multiple measure approach to data

collection, capitalizing on the value of direct assessments of child behavior and parent and teacher reports. One-on-one, direct child assessments, parent and teacher surveys, and fidelity field notes were collected. All child assessments and parent and teacher surveys have previously been used with other samples from this population and have excellent psychometrics. Parents and teachers filled out baseline and follow-up questionnaires about themselves and children. Please refer to Table 5 for alignment of measures, classroom activities, and EF skill and Table 6 at the end of this section for a visual representation of the measures used (and Appendix Table A.1 for all data collected, some not analyzed here). Specifically, a survey of family background characteristics and other measures were sent home with students of consenting parents (hand delivered to teachers) with instructions to send the completed survey forms back if they were willing to participate.

Measures directly assessing children. Children‘s ability to regulate their emotions, behaviors, and cognitions was collected through the following direct child assessments and observational rating: To measure the primary outcome of interest, emotional and behavioral regulation, the *Challenging Situations Task* (CST) was used (Denham, Bouril, & Belouad, 1994). CST assesses both emotions labeling and social problem skills. Children were presented with pictures of four peer scenarios (e.g., a peer knocking down blocks, being hit, entering a group, and a peer taking a ball). The stories focus on peer entry and peer provocation, both challenging situations likely to elicit an affective response from young children. After each scenario, children were asked what they would do in the situation. Their responses are coded as competent/prosocial (i.e., appropriately asserting oneself or calmly negotiating a solution, $\alpha = .68$), aggressive (i.e.,

responding with verbal or physical antagonism, intimidation, or force, α = .77), avoidant (i.e., passive avoidance, α = .68), or adult-dependent (e.g., telling the teacher, α = .73). Frequency counts for each behavioral response were calculated across the four situations. An adaptive problem solving composite score was created by reverse coding the aggressive and avoidant scores and adding these to the prosocial and adult-dependent scores. The REDI trial found that this measure was sensitive to the teaching of social-emotional skills and, thus, was critical in that trial (Bierman et al., 2008).

The *Something's The Same* game was used to assess children's attention shifting capabilities. This task was derived from Jacques and Zelazo's (2001) flexible item selection task. In this task, children were shown a page containing two pictures that are similar along one dimension (content, color, or size); the experimenter explicitly states the dimension of similarity. The next page presents the same two pictures, plus a new third picture. The third picture is similar to one of the first two pictures along a dimension that is different from that of the similarity of the first two pictures (e.g., if the first two pictures are similar along the dimension of shape, the third card would be similar to one of the first two along the dimension of color or size). Children were asked to choose which of the two original pictures was the same as the new picture. This required the child to shift his or her attention from the initial dimension of similarity to a new dimension of similarity. Interviewers only recorded the picture the child touched on each trial. Twenty trials were presented with responses (correct, incorrect) to all but the first item used for scoring (the first item was excluded from scoring because incorrect answers are corrected in order to teach the task). Reported Cronbach's alphas range from α = .41 to α = .85 across studies using the measure.

The *Pencil Tap Task* was used to measure children‘s EF by tapping working memory, attention, and inhibitory control (Diamond & Taylor, 1996). This task has been included in several recent efficacy trials with low-income preschool children (including REDI, Chicago School Readiness Project (CSRP), and Head Start CARES) and has demonstrated high levels of validity in a large preschool study (including low-income Head Start children) conducted by Blair and Razza (2007). Children were asked to tap twice with a pencil when the experimenter taped once and once when the experimenter taped twice. The task required children to inhibit a natural tendency to mimic the action of the experimenter while remembering the rule for the correct response. After practice trials, the child was administered a series of 16 trials in a counter-balanced sequence (8 one-tap and 8 two-tap trials). A proportion score – the number of correct responses divided by the total number of trials – was used as a measure of performance on the task. Cronbach’s alpha is $\alpha = .93$ for this study.

As another measure of children‘s self-regulation/EF, the *Head-to-Toes* task was used (Pontz et al., 2008). The Head-to-Toes task taps a composite assessment of children‘s ability to suppress a dominant response in order to carry out a subdominant response and draws on children‘s inhibitory control, attention, and working memory. This measure has been used in recent preschool-focused efficacy trials and it appeared promising, having shown robust validity in studies of young children’s self-regulation and school readiness, and offers clear methodological benefits including ease of administration and scoring (see Pontz et al., 2008 for validity statistics). Children were asked to play a game where they are instructed to touch their head, and then to do the opposite, and touch their toes. Children were scored based on accuracy of their response.

The Head-to-Toes Task takes about 5 minutes to administer and has been tested on a group of Spanish-speaking children in Spanish, as well as other ethnic minority children. This task has been preferred over other behavioral regulation tasks because it does not require fine motor coordination (i.e., children may fail at other tasks because they do not have the fine motor coordination to complete the task, not because they lack behavioral regulation skills) and because children respond in ways that are comparable to demands in classrooms, namely controlling and directing overt behavior. Cronbach's alpha is α = .94 for this study.

Upon completion of the direct assessments, the interviewer filled out an additional brief report describing the levels of attention, emotion, and behavioral regulation demonstrated by the child during the assessment period using the *Adapted Leiter-R Assessor Report* (Smith-Donald, Raver, Hayes & Richardson, 2007). In the Smith-Donald et al. (2007) measure, 25 items from the five subscales of the Leiter-R (Roid & Miller, 1997) tapping attention, impulse control, activity, sociability, and affect regulation were substantially revised to fit preschool assessment contexts and to include descriptors with clear, behavioral anchors. Factor analyses with samples of low-income, ethnic minority, and ethnic majority preschool-aged children have yielded two factors of Attention/Impulse Control and Positive Emotion, with high levels of internal consistency and have reflected program impact in two randomized trials (REDI and CSRP). Factor analysis of the current sample produced identical factors (called attentiveness/inhibitory control and positive engagement in the current study; see Appendix Table A.2 for factor loadings). Cronbach's alphas for this study are α = .97 and α = .89 for attentiveness/inhibitory control and positive engagement, respectively.

Table 5
Alignment of Executive Function Skill to Classroom Activities and Outcome Measures

Executive Function Skill	Classroom Activity	Outcome Measure
Working memory	Sleeping, sleeping, all the children are sleeping; *Red light, purple light; The freeze game; Conducting an orchestra; Drum beats*	Pencil tap; Head-to-Toes
Cognitive flexibility	Color-Matching/Cooperative freeze	Something's the same
Inhibitory control	Red light, purple light; The freeze game; Conducting an orchestra; Drum beats; *Sleeping, sleeping, all the children are sleeping*	Pencil tap; Head-to-Toes; Something's the same; PSRA

Note: Classroom activities in *italics* indicate that the executive function skill is not the primary target of the activity.

The baseline and follow-up assessments of children's EF and self-regulation took 15-20 minutes to complete. Most children found the games entertaining and fun. Children were rewarded with stickers for participation. All interviewers were fully trained to deliver all child assessment measures.

Measures filled out by parents. Parents were asked about demographic information, including racial and ethnic background, family structure, household composition, marital status, levels of educational attainment, and employment levels in the baseline survey which were included as covariates. The baseline parent questionnaire took about 25 minutes to fill out, and the follow-up parent questionnaire took about 15 minutes to fill out. Parents were compensated with a $15 gift card for return of both questionnaires.

Table 6
Measures Used in Current Study

Construct	Measure	Assessment Type	Time Point Assessed: Pre-Intervention	Time Point Assessed: Post-Intervention
Emotional and behavioral regulation	Challenging Situations Task (CST; Denham, Bouril, &	Direct Child	X	X
	Adapted Leiter-R Assessor Report (Smith-Donald, Raver, Hayes & Richardson, 2007)	Observer Rating	X	X
Executive function	Head-to-Toes (Cameron et al., 2008)	Direct Child	X	X
	Pencil Tap Task (Diamond & Taylor, 1996)	Direct Child	X	X
	Something's the Same Game (Willoughby et al., 2010)	Direct Child	X	X
	Adapted Leiter-R Assessor Report (Smith-Donald, Raver, Hayes & Richardson, 2007)	Observer Rating	X	X
Family characteristics	Survey: demographic information, including racial and ethnic background, family structure, household composition, marital status, maternal levels of educational attainment, and maternal employment	Parent Report	X	

Analytic Approach

All analyses (except multiple imputation) were conducted in STATA Version 14 (StataCorp, 2015). Every effort was taken to reduce the amount of missing data. However, for those items that were missing, the appropriateness of missing data adjustments was examined and determined to be missing at random such that multiple imputation could be employed. Since the missing data was missing at random, then it is not correlated to the particular variables in the survey, and therefore, can be ignored. To account for missing data multiple imputation was used for children who were missing

dependent variables and covariates (i.e., EF scores, CST, and PSRA; missing: N = 12-50 (3-17%); von Hippel, 2007). The greatest amount of missing data from any of the models' variables is 53 percent (for maternal education level; N = 161/305).[5] In the case of missing data, data was imputed using the multiple imputation (20 imputations) command in R. For all analyses, standard errors were clustered by classroom (N = 32) to help account for possible correlations among students in the same classroom.

The impact analysis for the proposed study was conducted using multilevel analyses that took into account the classroom-level clustering of children (and intervention status) and allowed for difference-in-difference estimates of the pre-test/post-test comparisons of the treatment and control groups. Initially, random effects were estimated at three levels (students, classrooms, and centers), with pre-test/post-test differences and treatment effects (condition by pretest/post-test interaction) estimated at the student level (level 1). Consider, for example, the underlying three-level model, simplified by including only one treatment versus control comparison:

Level 1: Students/Parents in classrooms

$$Y_{skc} = \alpha_{0kc} + \sum_{i>0} \alpha_i X_{iskc} + \varepsilon_{skc} \qquad (1)$$

Level 2: Classrooms in centers

$$\alpha_{0kc} = \sum_{m} \beta_{0c} Z_{mc} + \beta_{1c} T_{kc} + \mu_{kc} \qquad (2)$$

Level 3: Centers

$$\beta_{1c} = \beta_1 + \upsilon_c \qquad (3)$$

[5] The next largest variable with missing data was 52% (N = 156/305). Parent response rate for the baseline demographic questionnaire was 55%, and within the questionnaire missing data ranged from 51% (on marital status) to 81% (on total family savings).

where:

Y_{skc} = the outcome for student s from classroom k in center c,

X_{iskc} = baseline characteristics i for student s from classroom k in center c,

Z_{mc} = an indicator variable for center,

T_{kc} = the treatment indicator, which equals one if classroom k from center c was randomized to treatment (an intervention) and zero if ti was randomized to control status,

ε_{skc} = a random error for student s from classroom k in center c that is independently and identically distributed across students in classrooms,

μ_{kc} = a random error for classroom k in center c that is independently and identically distributed across classrooms in centers,

υ_c = a random error for the true intervention effect at center c which is independently and identically distributed across centers.

However, model convergence was problematic with random effects at the center level compared with two level models (child and classroom) that adjusted for average center-level differences. Given that no discernable differences in the pattern of results were evident between two and three level models, results are presented from the two level models, which effectively handled classroom correlated errors and correctly estimated treatment effects at the classroom level.

In order to answer primary research questions 1 and 2 (i.e., classroom training will improve regulation over no intervention and classroom plus parent training will improve behavior above and beyond classroom training alone), impact analysis were conducted in several steps. First, unadjusted outcome differences were analyzed. Second, outcome differences were adjusted for baseline scores on EF or positive behavior. Third, the full battery of covariates including child and parent age, child gender, race/ethnicity,

primary language, and mother's education level and marital status were also included in models. Finally, as a fourth step, the variations in treatment fidelity with regard to dosage of classroom activities and parent trainings were examined as predictors of child outcomes; this fourth step was primarily descriptive and exploratory given that dosage was not randomly assigned.

In order to examine exploratory research question 3, mediation analyses were conducted within the multilevel model. In the present study, a Level-2 antecedent (i.e., treatment status) influences a Level-1 mediator (i.e., children's EF skills) which then affects a Level-1 outcome (i.e., children's emotional and behavioral regulation). Researchers have suggested that bootstrapping and the empirical-M test (see MacKinnon, Lockwood, & Williams, 2004) are preferable for testing multilevel mediation effects. First, a relationship needs to be identified between treatment status and regulation. Then, a relationship needs to be identified between treatment status and the mediator of interest (i.e., either EF skills). Finally, it needs to be demonstrated that after adding the mediator (i.e., either EF skills) to the model at Level-1, the effect of the classroom based intervention or the classroom based intervention plus parent training on children's emotional and behavioral regulation is reduced in magnitude, whereas the mediator is still a statistically significant predictor of the outcome. Under grand-mean centering, a t statistic was used to test the significance of the reduction in the coefficients. Using the product-of-coefficients method, a Sobel z statistic can be used to test the significance of this effect.

Power analysis. Power analyses were conducted using Optimal Design Plus Empirical Evidence Version 3.01, assuming a cluster randomized trial with person level

outcomes and the treatment at level 2 (classroom level). For the present study, assuming a two-tailed estimate of 0.05 and having about 13 students per classroom and 32 classrooms were randomly assigned: an effect size of 0.50 produced a power of 0.98; an effect size of 0.40 produced a power of 0.88; and an effect size of 0.30 produced a power of 0.65. In other words, without including any covariates, if moderate effect sizes are found, there should be sufficient power to find effects of the intervention answering research questions 1 and 2. When controls for common covariates (e.g., race) are added, preliminary power analyses indicate that power will increase. From a power perspective, including a covariate can be extremely helpful because if the covariate is strongly correlated with the outcome, it can greatly increase the precision of the estimate and hence the power of the study. Moreover, some of the variation will be explained using the level-two classroom covariates. In the present study, including a covariate that has an R^2 of 0.40 (e.g., pretest scores) increased the power: an effect size of 0.50 produced a power of 0.99; an effect size of 0.40 produced a power of 0.93; and an effect size of 0.30 produced a power of 0.72. An acknowledgement must be made that there will be less power to examine mediation in research question 3 given the current sample size and complexity of mediation analyses. That is why this question was considered exploratory and not of primary interest to this study.

Effect sizes from previously examined interventions in similar populations on the current study's outcomes of interest vary greatly, with lows of 0.06 to highs of 0.89 and many outcomes in the 0.15 to 0.50 range. With regard to the practical significance of effects in this range, an assessment of the benefits and costs of Head Start using effect sizes from the national HSIS provides some guidance (Ludwig & Phillips, 2007).

Building their case on both effects from the HSIS as well as other studies of early intervention programs (e.g., Currie & Thomas, 1995), Ludwig and Phillips conclude that "there is a plausible case to be made that positive impacts on achievement tests scores on the order of 0.1 to 0.2 standard deviation (and perhaps even much smaller than that) would be large enough to generate long-term dollar-value in benefits that outweigh program costs" (2007, pp. 5-6). This report focuses primarily on a set of achievement outcomes (i.e., PPVT), and the authors indicated that parallel comprehensive analyses of benefits and costs of early childhood programs using standardized measures in the social-emotional domain have yet to be conducted.

However, there is some evidence from other types of analyses that indicate important long-term benefits of intervention impacts in the social-emotional domain. For example, Currie and Thomas (1995) indicate that participation in Head Start results in sizable reductions in grade retention in elementary school. In addition, evidence from a paper by Greg Duncan and colleagues using a set of parallel analyses across a number of large scale studies indicated that children's attention skills in Kindergarten were an important and consistent predictor of 3rd grade achievement, with an average effect size of 0.10 (Duncan et al., 2007). Employing a more comprehensive body of research on the impact of school-based interventions targeting social-emotional and aggressive behavior in elementary school, Lipsey and colleagues using a series of meta-analyses, indicated that there was evidence that average effect sizes of 0.18 in aggression outcomes translates into sizable reductions in children's behavior (e.g., a 5 percentage point reduction in fighting; Wilson, Lipsey, & Derzon, 2003; Wilson & Lipsey, 2005; 2007).

CHAPTER 4: RESULTS

Sample Characteristics, Group Covariate Balance, and Descriptive Statistics

Descriptive statistics for the full sample separated by treatment status are presented in Table 7. Several of the demographic indicators were well balanced across groups with no significant differences, including parent age (ranged, on average, from 32 to 34), racial/ethnic composition (in general, African American and Hispanic were the two most highly represented groups), education levels (ranging from a mean of 23.4% to 33.8% with a high school diploma or GED). Two demographic indicators approached significance: marital status (ranged from 15.4% in the control group to 36.3% married in the parent training group and ranged from 50.4% in the parent training group to 71.9% single in the control group; both differences $p < 0.10$) and languages spoken at home (with Spanish being the most common language other than English, and English spoken at home ranged from 47.6% in the parent plus group to 63.0% in the control group; $p < 0.10$). Child age and gender proportions, however, significantly differed ($p < 0.001$ and $p < 0.05$, respectively) across groups such that girls made up a larger portion of both the classroom training and parent training groups (while boys made up a larger portion of the control group) and children were more likely to be older in the control and parent training groups than the classroom training group.

Additionally, two indicators of dosage were used to examine treatment on the treated: low versus higher fidelity to the classroom training intervention model and low versus higher fidelity to the parent training intervention model. Specifically, low classroom dosage was less than one circle time activity per week over 10 weeks and higher dosage was at least one circle time activity session per week, and low parent

Table 7
Sample Characteristics Table by Treatment Status

	Full Sample *(N=305)*		Control *(N=92)*		Classroom Only *(N=108)*		Mind Matters *(N=105)*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Child characteristics								
Age (months)	49.71	(7.78)	51.11	(7.85) [a]	47.97	(6.59) [c,a]	50.27	(8.50) [c]
Female (%)	53.87	(49.85)	44.57	(49.70) [c]	62.27	(48.47) [c]	53.38	(49.88)
Primary language (%)								
English	54.89	(49.76)	63.04	(48.27) [d]	55.00	(49.75)	47.62	(49.94) [d]
Spanish	22.97	(42.06)	21.74	(41.25)	21.34	(40.97)	25.71	(43.71)
Haitian Creole	9.54	(29.38)	5.43	(22.67)	10.28	(30.36)	12.38	(32.94)
Cape Verdean	5.67	(23.13)	4.35	(20.39)	7.69	(26.62)	4.76	(21.30)
Other	6.93	(25.40)	5.43	(22.67)	5.69	(23.16)	9.52	(29.35)
Race/Ethnicity (%)								
White	8.93	(28.44)	7.83	(26.65)	9.49	(28.92)	9.33	(28.86)
Black	33.36	(47.07)	36.25	(47.87)	34.63	(47.41)	29.52	(45.53)
Hispanic	38.93	(48.67)	40.98	(48.92)	35.23	(47.62)	40.95	(49.05)
Asian	7.20	(25.74)	5.65	(22.69)	7.55	(26.13)	8.19	(27.25)
Other	11.57	(31.87)	9.29	(28.51)	13.10	(33.50)	12.00	(32.35)
Parent characteristics								
Age (years)	33.01	(7.63)	32.24	(6.81)	32.66	(8.31)	34.03	(7.45)
Marital status (%)								
Single	60.08	(48.89)	71.90	(44.72) [d]	59.40	(48.82)	50.43	(49.83) [d]
Cohabitating	13.72	(34.31)	12.66	(32.95)	15.09	(35.50)	13.24	(33.72)
Married	26.20	(43.89)	15.43	(35.87) [d]	25.51	(43.37)	36.33	(47.84) [d]
Parental education (%)								
Less than high school	25.46	(43.43)	20.00	(39.56)	28.66	(44.82)	26.95	(44.15)
High school diploma or GED	27.98	(44.85)	33.80	(47.22)	23.38	(42.23)	27.62	(44.62)
Some college	23.16	(42.09)	21.58	(40.78)	26.76	(44.13)	20.86	(40.38)
Associates degree	11.75	(32.09)	11.58	(31.73)	11.62	(31.87)	12.05	(32.15)
Bacelors degree or higher	11.64	(31.85)	13.04	(33.05)	9.58	(29.04)	12.52	(32.73)

Notes: Superscript letters indicate statistically significant differences between the dosage variables and the control group such that a indicates $p < 0.001$; b indicates $p < 0.01$; c indicates $p < 0.05$; d indicates $p < 0.10$

training dosage was less than 50 percent attendance (i.e., 4 or less sessions) and higher dosage was at least 50 percent attendance (5 or more sessions).[6] When descriptive statistics are examined for these indicators, similar patterns emerge (see Table 8). Two of the demographic indicators were well balanced across groups with no significant differences, including racial/ethnic composition (in general, African American and

[6] Of note, only 20 parents fall into this category whereas the low/higher balance for classroom dosage was more even 55% vs. 45%, respectively.

Hispanic were the two most highly represented groups) and education levels (ranging from a mean of 23.1% to 33.8% with a high school diploma or GED for the classroom dosage indicator and a mean of 21.0% to 33.8% with a high school diploma or GED for the parent dosage indicator). Differences in languages spoken at home approached significance – for the classroom dosage indicator Cape Verdean was more likely to be spoken in the low dosage group than for the control or higher dosage groups (12.3% as compared to 4.4% and 2.0%, respectively; $p < 0.10$). There were no significant differences in age or gender for the parent dosage groups as compared to the control group.

Child age and gender proportions, however, significantly differed ($p < 0.001$ and $p < 0.05$, respectively) across the classroom dosage and control groups such that girls made up a larger portion of both the classroom dosage groups (boys made up a larger portion of the control group) and children were more likely to be older in the control group than the classroom dosage groups. Finally, parent age and marital status, too, significantly differed across the parent dosage and control groups such that parents in the higher dosage group were significantly older than both the low dosage and control groups (37 years as compared to 33 years and 32 years, respectively; $p < 0.05$ and $p < 0.001$, respectively) and parents in the higher dosage group were significantly less likely to be single and more likely to be married as compared to both other groups (ranging from 15.4% in the control group to 34.3% in the low parent dosage group to 48.0% married in the higher parent dosage group, differences of $p < 0.05$ and $p < 0.001$, respectively; and ranging from 71.9% in the control group to 51.5% in the low parent dosage group to 44.0% single in the higher parent dosage group, differences of $p < 0.05$ for both).

Table 8
Sample Characteristics by Intervention Dosage

	Full Sample (N=305)		Control (N=92)		Classroom Only				Mind Matters			
					Low Dosage (N=59)		Higher Dosage (N=49)		Low Dosage (N=86)		Higher Dosage (N=20)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Child characteristics												
Age (months)	49.71	(7.78)	51.11	(7.85) [c,a]	47.93	(7.13) [a]	48.02	(5.87) [c]	50.08	(8.55)	50.69	(8.23)
Female (%)	53.87	(49.85)	44.57	(49.70) [c]	62.36	(48.46) [c]	62.30	(48.47) [c]	52.38	(49.94)	60.00	(48.99)
Primary language (%)												
English	54.89	(49.76)	63.04	(48.27) [d]	56.65	(49.55)	53.06	(49.91)	46.51	(49.88) [d]	50.00	(50.00)
Spanish	22.97	(42.06)	21.74	(41.25)	15.34	(36.03)	28.57	(45.18)	29.07	(45.41)	10.00	(30.00)
Haitian Creole	9.54	(29.38)	5.43	(22.67)	13.74	(34.41)	6.12	(23.97)	10.47	(30.61)	20.00	(40.00)
Cape Verdean	5.67	(23.13)	4.35	(20.39) [d]	12.31	(32.91) [d,d]	2.04	(14.14) [d]	5.81	(23.40)	0.00	(0.00)
Other	6.93	(25.40)	5.43	(22.67) [d]	1.96	(13.69)	10.20	(30.27)	8.14	(27.34)	20.00	(40.00) [d]
Race/Ethnicity (%)												
White	8.93	(28.44)	7.83	(26.65)	12.31	(32.79)	6.84	(24.64)	8.55	(27.59)	11.67	(32.50)
Black	33.36	(47.07)	36.25	(47.87)	37.56	(48.19)	30.97	(46.05)	29.42	(45.44)	28.67	(44.79)
Hispanic	38.93	(48.67)	40.98	(48.92)	29.26	(45.22)	42.26	(49.20)	44.19	(49.51)	25.67	(43.11)
Asian	7.20	(25.74)	5.65	(22.69)	5.62	(22.16)	10.08	(30.16)	8.43	(27.63)	0.00	(0.00)
Other	11.57	(31.87)	9.29	(28.51)	15.25	(35.53)	9.84	(30.45)	9.42	(28.93)	27.67	(44.53)
Parent characteristics												
Age (years)	33.01	(7.63)	32.24	(6.81) [a]	33.37	(7.47)	31.80	(9.15)	33.32	(7.57) [c]	37.32	(5.74) [c,a]
Marital status (%)												
Single	60.08	(48.89)	71.90	(44.72) [c]	66.46	(46.85)	49.70	(49.59)	51.51	(49.70) [c]	44.00	(49.35) [c]
Cohabitating	13.72	(34.31)	12.66	(32.95)	12.76	(32.76)	18.37	(38.10)	14.19	(34.68)	8.00	(27.16)
Married	26.20	(43.89)	15.43	(35.87) [a,c]	20.79	(40.26)	31.93	(45.97)	34.30	(47.12) [c]	48.00	(49.81) [a]
Parental education (%)												
Less than high school	25.46	(43.43)	20.00	(39.56)	27.65	(44.19)	29.89	(45.24)	28.20	(44.75)	21.00	(39.29)
High school diploma or GED	27.98	(44.85)	33.80	(47.22)	23.55	(42.24)	23.05	(41.88)	30.00	(45.73)	21.00	(40.47)
Some college	23.16	(42.09)	21.58	(40.78)	28.10	(44.44)	25.93	(43.12)	15.76	(35.97)	41.00	(49.00)
Associates degree	11.75	(32.09)	11.58	(31.73)	9.99	(29.62)	13.09	(33.63)	12.97	(33.08)	8.00	(26.29)
Bacelors degree or higher	11.64	(31.85)	13.04	(33.05)	10.70	(30.57)	8.04	(26.69)	13.08	(33.17)	9.00	(28.29)

Notes: Superscript letters indicate statistically significant differences between the dosage variables and the control group such that a indicates $p < 0.001$; b indicates $p < 0.01$; c indicates $p < 0.05$; d indicates $p < 0.10$

Prior to the intervention, children were assessed for their EF and positive behavior skills using Something's the Same Game, Pencil Tap, Head-to-Toes, Challenging Situations Task, and the interviewer assessment (PSRA). All three groups were very similar on all of these measures; specifically, as Table 9 indicates the groups were not statistically different from one another at baseline on these assessments, with one exception. Children in the classroom training group showed lower anger and aggression than children in the control and parent training groups ($p < 0.001$). With regard to the measures that did not differ across groups: scores for Something's the Same Game were about 10 (out of 19) on average for all groups; percent correct on the Pencil Tap ranged from 32.8% to 37.0% across groups; scores for Head-to-Toes ranged from about 2 to 3 (out of 10) on average for all groups; attentiveness and inhibitory control behavior as measured by the PSRA was about 3 (out of 4) on average for all groups; adaptive problem solving skills as measured by the Challenging Situations Task were about 8 (out of 12) on average across groups; and positive engagement and low worry/anxiety as measured by the PSRA were about 3 and 4 (out of 4), respectively, on average for all groups.

A similar pattern of results emerged at baseline among the classroom dosage and parent dosage groups as well. All five groups (i.e., including the control group) were very similar on all of the EF and positive behavior measures; specifically, as Table 10 indicates the groups were not statistically different from one another at baseline on these assessments, with one exception. Children in the higher classroom dosage group showed lower anger and aggression than children in the control group ($p < 0.05$) and children in the low classroom dosage group similarly showed lower anger and aggression as

Table 9
Baseline Measures by Treatment Status

	Full Sample *(N=305)*		Control *(N=92)*		Classroom Only *(N=108)*		Mind Matters *(N=105)*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Executive function (EF) measures								
Somethings the same game (# correct out of 19)	10.14	(4.51)	10.04	(4.56)	10.25	(4.78)	10.11	(4.17)
Pencil tap (% correct out of 16)	34.49	(33.54)	32.84	(35.62)	33.43	(30.23)	37.02	(34.69)
Head-to-toes (# correct out of 10)	2.43	(4.13)	2.50	(4.18)	2.15	(4.13)	2.65	(4.05)
PSRA: Attentiveness/Inhibitory control (out of 4)	3.17	(0.81)	3.10	(0.84)	3.23	(0.80)	3.18	(0.78)
Positive behavior measures								
Challenging situations task - adaptive problem solving (out of 12)	8.84	(2.05)	9.03	(1.82)	8.63	(2.13)	8.88	(2.14)
PSRA: Positive engagement (out of 4)	3.02	(0.65)	2.95	(0.66)	3.00	(0.66)	3.11	(0.61)
PSRA: Low anger/aggression (out of 4)	3.15	(0.44)	3.05	(0.53) [a]	3.25	(0.30) [a]	3.14	(0.45)
PSRA: Low worry/anxiety (out of 4)	3.72	(0.56)	3.73	(0.54)	3.69	(0.59)	3.76	(0.55)

Notes: Superscript letters indicate statistically significant differences between the dosage variables and the control group such that a indicates $p < 0.001$; b indicates $p < 0.01$; c indicates $p < 0.05$; d indicates $p < 0.10$

Table 10
Baseline by Intervention Dosage

					Classroom Only				Mind Matters			
	Full Sample *(N=305)*		Control *(N=92)*		Low Dosage *(N=59)*		High Dosage *(N=49)*		Low Dosage *(N=86)*		High Dosage *(N=20)*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Executive function (EF) measures												
Somethings the same game (# correct out of 19)	10.14	(4.51)	10.04	(4.56)	10.13	(5.04)	10.40	(4.44)	9.76	(4.31)	11.70	(2.91)
Pencil tap (% correct out of 16)	34.49	(33.54)	32.84	(35.62)	31.61	(29.40)	35.62	(31.04)	37.36	(35.43)	33.74	(31.16)
Head-to-toes (# correct out of 10)	2.43	(4.13)	2.50	(4.18)	1.97	(3.90)	2.36	(4.37)	2.51	(4.16)	3.13	(3.34)
PSRA: Attentiveness/Inhibitory control (out of 4)	3.17	(0.81)	3.10	(0.84)	3.19	(0.85)	3.27	(0.74)	3.10	(0.81)	3.52	(0.53)
Positive behavior measures												
Challenging situations task - adaptive problem solving (out of 12)	8.84	(2.05)	9.03	(1.82)	8.36	(2.02)	8.95	(2.21)	8.78	(2.18)	9.28	(1.84)
PSRA: Positive engagement (out of 4)	3.02	(0.65)	2.95	(0.66)	2.98	(0.62)	3.03	(0.70)	3.10	(0.61)	3.07	(0.70)
PSRA: Low anger/aggression (out of 4)	3.15	(0.44)	3.05	(0.53) [c,a]	3.25	(0.31) [a]	3.25	(0.29) [c]	3.11	(0.47)	3.24	(0.33)
PSRA: Low worry/anxiety (out of 4)	3.72	(0.56)	3.73	(0.54)	3.63	(0.61)	3.76	(0.55)	3.73	(0.57)	3.89	(0.37)

Notes: Superscript letters indicate statistically significant differences between the dosage variables and the control group such that a indicates $p < 0.001$; b indicates $p < 0.01$; c indicates $p < 0.05$; d indicates $p < 0.10$

compared to children in the control group ($p < 0.001$). With regard to the measures that did not differ across groups: scores for Something's the Same Game were about 10 (out of 19) for both classroom dosage groups, control, and low parent dosage groups and about 12 for the higher parent dosage group; percent correct on the Pencil Tap ranged from 31.6% to 37.4% across groups; scores for Head-to-Toes ranged from about 2 to 3 (out of 10) on average for all groups; attentiveness and inhibitory control behavior as measured by the PSRA was about 3 (out of 4) on average for all groups; adaptive problem solving scores as measured by the Challenging Situations Task were about 8 or 9 (out of 12) on average across groups; and positive engagement and low worry/anxiety as measured by the PSRA were about 3 and 4 (out of 4), respectively, on average for all groups.

Concerning the level of relation between outcome measures, correlations at baseline range from weak (a low of -0.03 between the Head-to-Toes and the low anger/aggression subscale of the PSRA) to moderate (a high of 0.59 between low anger/aggression and attentiveness/inhibitory control subscales of the PSRA; see Table 11). Similarly, results at follow-up indicate that correlations range from weak (a low of 0.02 between the Pencil Tap and the positive engagement subscale of the PSRA) to moderate (a high of 0.54 between Pencil Tap and Head-to-Toes; see Table 12). Unsurprisingly, all EF measures were related to all other EF measures in some capacity. See Appendix Table A.3 for the full list of pair-wise correlations. In addition, as a final descriptive step before analyzing the intervention results, dependent t-tests were estimated to determine if children demonstrated growth over time on the primary constructs of interest; on average, children showed growth over time on all of the

measures except the Challenging Situations Task with effect sizes ranging from 0.01 to 0.47.

Table 11
Correlations Table - Outcome Measures at Baseline

	1	2	3	4	5	6	7
1 Something's the same	1						
2 Pencil tap	0.37 ***	1					
3 Head-to-Toes	0.18 **	0.38 ***	1				
4 Challenging situations task	0.30 ***	0.27 ***	0.19 **	1			
5 Attentiveness/Inhibitory control	0.44 ***	0.47 ***	0.16 **	0.19 ***	1		
6 Positive engagement	0.15 **	0.19 **	0.16 **	0.14 *	0.14 *	1	
7 Low anger/aggression	0.15 **	0.24 ***	-0.03	0.14 *	0.59 ***	0.11 +	1
8 Low worry/anxiety	0.22 **	0.06	0.03	0.09	0.26	0.25	0.13

Notes: Significance indicated for pair-wise correlations *** p-value < 0.001, ** p-value < 0.01, * p-value < 0.05, + p-value < 0.10.

Table 12
Correlations Table - Outcome Measures at Follow-Up

	1	2	3	4	5
1 Something's the same	1				
2 Pencil tap	0.46 ***	1			
3 Head-to-Toes	0.38 ***	0.54 ***	1		
4 Challenging situations task	0.22 ***	0.21 ***	0.19 **	1	
5 Attentiveness/Inhibitory control	0.47 ***	0.49 ***	0.28 ***	0.23 ***	1
6 Positive engagement	0.06	0.02	0.07	0.05	-0.03

Notes: Significance indicated for pair-wise correlations *** p -value < 0.001, ** p- value < 0.01, * p -value < 0.05, + p -value < 0.10.

Intervention Results

To evaluate the effects of the intervention, individual outcome score differences across treatment conditions were examined in multilevel models – treatment group specified at the second (classroom) level – adjusting for correlated errors within classrooms. First, unadjusted scores were examined. Second, score differences were estimated while controlling for baseline assessment performance. Third, score differences were estimated controlling baseline performance and the full battery of covariates displayed in Table 7. Finally, given the wide variation in treatment fidelity with regard to dosage, differences as a function of dosage were examined as a fourth analytic step. For

this final set of analyses, however, note that the results are purely descriptive given that dosage was not randomly assigned.

Unadjusted results. Comparing the unadjusted means for the classroom training group with the control group, there were no significant differences as a function of treatment group for the four EF or the two positive behavior outcomes. Specifically, the control group did not differ from the classroom training group on correct answers in Something's the Same (b = 0.52; p = 0.47), percent correct in Pencil Tap (b = -0.06; p = 0.31), successful trials in Head-to-Toes (b = -0.09; p = 0.88), or displays of attentiveness or inhibitory control (b = -0.01; p = 0.95). See top panel of Table 13 ("Model 1: (unadjusted)") for detailed model information. In addition, the control group did not differ from the classroom training group on adaptive problem-solving strategies as measured by the Challenging Situations Task (b = -0.13; p = 0.70). However, one result did approach significance: displays of positive engagement (b = 0.17; $p < 0.10$), with children in the classroom training displaying somewhat more positive engagement with the tasks and interviewer than children in the control group. See top panel of Table 14 ("Model 1: (unadjusted)") for detailed model information.

Similarly, the control group did not differ from the parent training group on correct answers in Something's the Same (b = 0.62; p = 0.39), percent correct in Pencil Tap (b = -0.05; p = 0.39), successful trials in Head-to-Toes (b = 0.07; p = 0.91), or displays of attentiveness or inhibitory control (b = -0.09; p = 0.36). See top panel of Table 13 ("Model 1: (unadjusted)") for detailed model information. In addition, the control group did not differ from the parent training group on adaptive problem-solving strategies as measured by the Challenging Situations Task (b = -0.52; p = 0.10) or on

displays of positive engagement ($b = 0.12$; $p = 0.22$). See top panel of Table 14 ("Model 1: (unadjusted)") for detailed model information.

Table 13
Impacts on Executive Function by Treatment Status (N=305)

	Measures of Executive Function																	
	Something's the Same				Pencil Tap				Head-to-Toes				Attentiveness/ Inhibitory Control					
	b	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value			
Model 1: (unadjusted)																		
Intercept	11.89	0.53	0.00	***	0.53	0.04	0.00	***	2.87	0.45	0.00	***	3.34	0.07	0.00	***		
Parent training (N=105)	0.62	0.72	0.39		-0.05	0.05	0.39		0.07	0.60	0.91		-0.09	0.10	0.36			
Classroom training (N=108)	0.52	0.71	0.47		-0.06	0.05	0.31		-0.09	0.62	0.88		-0.01	0.10	0.95			
Model 5: (adjusted)																		
Intercept	6.97	0.76	0.00	***	0.28	0.03	0.00	***	1.59	0.60	0.01	*	1.61	0.13	0.00	***		
Parent training (N=105)	0.52	0.71	0.46		-0.08	0.04	0.05	*	-0.01	0.56	0.99		-0.13	0.07	0.07	+		
Classroom training (N=108)	0.40	0.66	0.54		-0.06	0.04	0.14		0.12	0.62	0.85		-0.08	0.07	0.28			
Baseline executive function score	0.49	0.06	0.00	***	0.76	0.05	0.00	***	0.50	0.13	0.00	***	0.56	0.04	0.00	***		
Model 6: (adjusted)																		
Intercept	-1.00	2.33	0.67		-0.22	0.16	0.15		-7.79	1.84	0.00	***	1.27	0.26	0.00	***		
Parent training (N=105)	0.75	0.68	0.27		-0.05	0.04	0.24		0.00	0.57	1.00		-0.13	0.07	0.07	+		
Classroom training (N=108)	0.83	0.64	0.20		-0.01	0.04	0.75		0.63	0.62	0.31		-0.05	0.07	0.47			
Baseline executive function score	0.38	0.06	0.00	***	0.63	0.06	0.00	***	0.36	0.12	0.00	**	0.51	0.04	0.00	***		
Child characteristics																		
Age (months)	0.17	0.04	0.00	***	0.01	0.00	0.00	***	0.19	0.04	0.00	***	0.01	0.00	0.00	**		
Male	-0.31	0.54	0.57		-0.01	0.03	0.79		0.14	0.39	0.73		-0.08	0.06	0.14			
Spanish	-0.74	0.83	0.38		-0.11	0.06	0.04	*	-1.39	0.69	0.05	*	-0.06	0.11	0.61			
Haitian Creole	-0.83	0.97	0.39		0.00	0.06	0.96		0.71	0.85	0.41		0.05	0.12	0.70			
Cape Verdean	0.21	1.34	0.88		-0.02	0.08	0.85		1.25	1.02	0.22		0.09	0.14	0.53			
Other	0.91	1.50	0.55		0.08	0.09	0.36		0.26	1.15	0.82		0.25	0.17	0.13			
White	0.33	1.49	0.82		-0.05	0.08	0.57		0.39	1.11	0.73		-0.02	0.17	0.92			
Black	-0.71	0.91	0.44		-0.04	0.06	0.50		-1.63	0.70	0.02	*	-0.16	0.12	0.19			
Asian	0.71	1.67	0.67		-0.05	0.10	0.58		-1.18	1.36	0.39		-0.16	0.19	0.38			
Other	0.00	1.14	1.00		0.01	0.07	0.86		-1.71	0.89	0.06	+	-0.12	0.14	0.41			
Parent characteristics																		
Age (years)	0.01	0.04	0.85		0.00	0.00	0.55		0.02	0.03	0.51		0.00	0.00	0.78			
Cohabitating	0.52	0.93	0.57		-0.07	0.06	0.31		0.38	0.95	0.69		0.01	0.10	0.90			
Married	-0.82	0.77	0.29		-0.07	0.05	0.13		0.54	0.66	0.41		-0.01	0.10	0.89			
Less than high school	1.36	0.82	0.10		-0.04	0.06	0.54		-0.32	0.74	0.67		0.01	0.10	0.88			
Some college	1.00	0.76	0.19		0.03	0.05	0.57		0.65	0.66	0.33		0.02	0.09	0.81			
Associates degree	0.49	1.17	0.68		0.05	0.07	0.44		0.73	0.87	0.40		0.05	0.11	0.67			
Bacelors degree or higher	-0.21	1.06	0.84		0.09	0.08	0.24		1.55	0.79	0.05	+	-0.06	0.12	0.63			

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 14

Impacts on Positive Behavior by Treatment Status (N=305)

	Measures of Positive Behavior							
	Challenging Situations Task				Positive Engagement			
	b	SE	*p*-value		*b*	SE	*p*-value	
Model 1: (unadjusted)								
Intercept	9.03	0.23	0.00	***	2.96	0.07	0.00	***
Parent training (N=105)	-0.52	0.32	0.10		0.12	0.10	0.22	
Classroom training (N=108)	-0.13	0.32	0.70		0.17	0.10	0.09	+
Model 5: (adjusted)								
Intercept	6.84	0.58	0.00	***	2.01	0.19	0.00	***
Parent training (N=105)	-0.47	0.32	0.14		0.08	0.11	0.49	
Classroom training (N=108)	-0.01	0.35	0.97		0.14	0.11	0.20	
Baseline positive behavior score	0.24	0.06	0.00	***	0.32	0.06	0.00	***
Model 6: (adjusted)								
Intercept	3.97	1.19	0.00	**	2.49	0.38	0.00	***
Parent training (N=105)	-0.46	0.34	0.18		0.11	0.12	0.35	
Classroom training (N=108)	0.13	0.35	0.71		0.15	0.11	0.17	
Baseline positive behavior score	0.20	0.06	0.00	**	0.33	0.06	0.00	***
Child characteristics								
Age (months)	0.05	0.02	0.01	**	-0.01	0.01	0.18	
Male	0.42	0.24	0.08	+	0.09	0.08	0.21	
Spanish	-0.04	0.39	0.92		-0.07	0.13	0.58	
Haitian Creole	0.11	0.45	0.80		-0.10	0.14	0.46	
Cape Verdean	0.46	0.58	0.42		0.06	0.17	0.71	
Other	0.78	0.62	0.21		-0.09	0.23	0.69	
White	0.31	0.59	0.60		-0.12	0.20	0.55	
Black	0.35	0.38	0.37		-0.11	0.15	0.44	
Asian	0.57	0.75	0.45		-0.04	0.26	0.86	
Other	0.30	0.52	0.57		-0.13	0.19	0.50	
Parent characteristics								
Age (years)	0.00	0.02	0.79		0.00	0.01	0.63	
Cohabitating	-0.18	0.40	0.66		-0.05	0.14	0.74	
Married	-0.08	0.35	0.83		-0.09	0.14	0.53	
Less than high school	0.25	0.46	0.60		-0.02	0.12	0.84	
Some college	0.42	0.39	0.27		0.05	0.12	0.70	
Associates degree	0.68	0.44	0.12		0.04	0.16	0.82	
Bacelors degree or higher	0.39	0.49	0.43		0.09	0.14	0.51	

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Finally, the classroom training and parent training groups did not differ on the EF or the positive behavior outcomes. Specifically, the classroom training group did not differ from the parent training group on correct answers in Something's the Same (b = 0.10; p = 0.88), percent correct in Pencil Tap (b = 0.01; p = 0.87), successful trials in Head-to-Toes (b = 0.16; p = 0.78), or displays of attentiveness/inhibitory control (b = -0.08; p = 0.37). See top panel of Table 15 ("Model 1: (unadjusted)") for detailed model information. In addition, the classroom training group did not differ from the parent training group on adaptive problem-solving strategies as measured by the Challenging Situations Task (b = -0.40; p = 0.20) or displays of positive engagement (b = -0.05; p = 0.61). See top panel of Table 16 ("Model 1: (unadjusted)") for detailed model information.

Table 15

Added Value of Parent Training Impacts on Executive Function by Treatment Status (N=305)

	Measures of Executive Function																	
	Something's the Same				Pencil Tap				Head-to-Toes				Attentiveness/ Inhibitory Control					
	b	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value			
Model 1: (unadjusted)																		
Intercept	12.41	0.48	0.00	***	0.47	0.04	0.00	***	2.78	0.41	0.00	***	3.33	0.06	0.00	***		
Parent training (N=105)	0.10	0.69	0.88		0.01	0.05	0.87		0.16	0.58	0.78		-0.08	0.09	0.37			
Control group (N=92)	-0.52	0.71	0.47		0.06	0.05	0.31		0.09	0.62	0.88		0.01	0.10	0.95			
Model 5: (adjusted)																		
Intercept	7.39	0.75	0.00	***	0.22	0.03	0.00	***	1.70	0.55	0.00	**	1.53	0.13	0.00	***		
Parent training (N=105)	0.12	0.65	0.85		-0.02	0.04	0.64		-0.10	0.54	0.85		-0.05	0.07	0.42			
Control group (N=92)	-0.37	0.71	0.60		0.06	0.04	0.15		-0.09	0.59	0.88		0.08	0.07	0.29			
Baseline executive function score	0.49	0.06	0.00	***	0.76	0.05	0.00	***	0.50	0.13	0.00	***	0.56	0.04	0.00	***		
Model 6: (adjusted)																		
Intercept	-0.14	2.26	0.95		-0.24	0.15	0.12		-7.32	1.83	0.00	***	1.22	0.25	0.00	***		
Parent training (N=105)	-0.08	0.60	0.89		-0.03	0.04	0.41		-0.60	0.54	0.26		-0.08	0.07	0.24			
Control group (N=92)	-0.81	0.67	0.22		0.01	0.04	0.75		-0.58	0.60	0.34		0.05	0.08	0.51			
Baseline executive function score	0.38	0.06	0.00	***	0.63	0.06	0.00	***	0.35	0.11	0.00	**	0.51	0.04	0.00	***		
Child characteristics																		
Age (months)	0.17	0.04	0.00	***	0.01	0.00	0.00	***	0.19	0.04	0.00	***	0.01	0.00	0.00	**		
Male	-0.30	0.54	0.58		-0.01	0.03	0.80		0.13	0.40	0.75		-0.08	0.06	0.14			
Spanish	-0.72	0.82	0.38		-0.11	0.06	0.04	*	-1.34	0.68	0.05	+	-0.06	0.11	0.61			
Haitian Creole	-0.84	0.97	0.39		0.00	0.06	0.96		0.65	0.86	0.45		0.04	0.12	0.70			
Cape Verdean	0.20	1.33	0.88		-0.02	0.08	0.84		1.22	1.01	0.23		0.08	0.14	0.54			
Other	0.91	1.49	0.54		0.08	0.09	0.36		0.31	1.16	0.79		0.25	0.17	0.14			
White	0.33	1.50	0.83		-0.05	0.08	0.57		0.37	1.10	0.74		-0.02	0.17	0.93			
Black	-0.71	0.92	0.44		-0.04	0.06	0.50		-1.61	0.69	0.02	*	-0.17	0.12	0.18			
Asian	0.71	1.67	0.67		-0.05	0.10	0.58		-1.18	1.37	0.39		-0.16	0.18	0.39			
Other	0.01	1.14	1.00		0.01	0.07	0.85		-1.67	0.88	0.06	+	-0.12	0.14	0.41			
Parent characteristics																		
Age (years)	0.01	0.04	0.84		0.00	0.00	0.54		0.02	0.03	0.51		0.00	0.00	0.77			
Cohabitating	0.51	0.93	0.58		-0.07	0.06	0.31		0.40	0.95	0.67		0.02	0.10	0.88			
Married	-0.82	0.77	0.29		-0.07	0.05	0.13		0.59	0.66	0.37		-0.02	0.10	0.88			
Less than high school	1.33	0.83	0.11		-0.04	0.06	0.53		-0.28	0.75	0.71		0.01	0.10	0.91			
Some college	0.97	0.76	0.21		0.03	0.05	0.57		0.69	0.65	0.30		0.02	0.09	0.81			
Associates degree	0.44	1.20	0.71		0.05	0.07	0.44		0.73	0.87	0.40		0.05	0.11	0.67			
Bacelors degree or higher	-0.23	1.06	0.83		0.09	0.08	0.24		1.57	0.79	0.05	*	-0.06	0.12	0.61			

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 16
Added Value of Parent Training Impacts on Positive Behavior by Treatment Status (N=305)

	Measures of Positive Behavior							
	Challenging Situations Task				Positive Engagement			
	b	SE	*p*-value		*b*	SE	*p*-value	
Model 1: (unadjusted)								
Intercept	8.91	0.22	0.00	***	3.13	0.06	0.00	***
Parent training (N=105)	-0.40	0.31	0.20		-0.05	0.09	0.61	
Control group (N=92)	0.13	0.32	0.70		-0.17	0.10	0.09	+
Model 5: (adjusted)								
Intercept	6.78	0.56	0.00	***	2.15	0.18	0.00	***
Parent training (N=105)	-0.46	0.30	0.12		-0.07	0.10	0.51	
Control group (N=92)	-0.03	0.35	0.92		-0.14	0.11	0.21	
Baseline positive behavior score	0.25	0.06	0.00	***	0.33	0.06	0.00	***
Model 6: (adjusted)								
Intercept	3.88	1.19	0.00	**	2.63	0.37	0.00	***
Parent training (N=105)	-0.60	0.30	0.04	*	-0.05	0.10	0.65	
Control group (N=92)	-0.18	0.37	0.62		-0.15	0.11	0.17	
Baseline positive behavior score	0.20	0.06	0.00	**	0.33	0.06	0.00	***
Child characteristics								
Age (months)	0.05	0.02	0.00	**	-0.01	0.01	0.18	
Male	0.42	0.24	0.08	+	0.09	0.08	0.21	
Spanish	0.01	0.39	0.98		-0.07	0.13	0.60	
Haitian Creole	0.17	0.45	0.71		-0.10	0.14	0.46	
Cape Verdean	0.35	0.57	0.54		0.06	0.17	0.72	
Other	0.74	0.61	0.23		-0.09	0.23	0.70	
White	0.30	0.56	0.59		-0.12	0.20	0.55	
Black	0.34	0.39	0.39		-0.11	0.15	0.44	
Asian	0.59	0.73	0.42		-0.04	0.26	0.87	
Other	0.33	0.52	0.53		-0.13	0.19	0.50	
Parent characteristics								
Age (years)	0.00	0.02	0.79		0.00	0.01	0.63	
Cohabitating	-0.14	0.40	0.72		-0.04	0.14	0.76	
Married	-0.07	0.34	0.84		-0.09	0.14	0.53	
Less than high school	0.24	0.45	0.60		-0.02	0.12	0.85	
Some college	0.47	0.38	0.22		0.05	0.12	0.67	
Associates degree	0.69	0.44	0.12		0.04	0.16	0.82	
Bacelors degree or higher	0.44	0.49	0.36		0.09	0.14	0.51	

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Baseline-adjusted results. Once baseline controls were included in the models, the results changed very little when comparing the classroom training and control conditions and the parent training and classroom training conditions on the EF or positive behavior outcomes, with no significant differences evident between the groups (see middle panels of Table 13, Table 14, Table 15, and Table 16 ("Model 5: (adjusted)") for more detailed model information). However, comparing the parent training group with the control condition, controlling for baseline performance led to some unexpected differences: children in the parent training group demonstrated significantly lower percent correct on the Pencil Tap than children in the control group (b = -0.08; $p < 0.05$) and, while only approaching significance, children in the parent training group had somewhat less attentiveness/inhibitory control than children in the control group (b = -0.13; $p < 0.10$). See middle panel of Table 13 ("Model 5: (adjusted)") for detailed model information.

Covariate- and baseline-adjusted results. Once covariate and baseline controls were included in the models, the results changed very little when comparing the classroom training and control conditions and the parent training and control conditions on the EF or positive behavior outcomes, with no significant differences evident between the groups (see effect size Tables 17-19 and the bottom panels of Table 13, Table 14, Table 15, and Table 16 ("Model 6: (adjusted)") for detailed model information). Comparing the parent training and classroom training conditions, controlling for baseline performance and other covariates led to an unexpected difference (see effect size Table 19 and the bottom panel of Table 16 ("Model 6: (adjusted)") for detailed model information): children in the parent training group had significantly fewer adaptive

problem-solving strategies than children in the classroom training group (b = -0.60; p < 0.05). Additionally, another finding approached significance (see effect size Table 18 and the bottom panel of Table 13 ("Model 6: (adjusted)") for detailed model information): children in the control group had slightly higher attentiveness/ inhibitory control than parent training children (b = -0.13; p < 0.10). Not surprisingly given the overall null comparisons with the control group, no added value of Mind Matters was observed above and beyond the classroom training only. As indicated above, children in the classroom training only group seemed to even perform better on some measures than the Mind Matters group.

Table 17
Classroom Training Impacts

	Control *(N=92)* Mean	Classroom Only *(N=108)* Mean	Difference	Standard Error	Effect Size
Executive function measures					
Somethings the same game (# correct out of 19)	11.89	12.41	0.52	0.64	0.11
Pencil tap (% correct out of 16)	52.56	46.95	-5.61	0.04	-0.15
Head-to-toes (# correct out of 10)	2.87	2.78	-0.09	0.62	-0.02
PSRA: Attentiveness/Inhibitory control (out of 4)	3.34	3.33	-0.01	0.07	-0.02
Social/Behavioral measures					
Challenging situations task - adaptive problem solving (out of 12)	9.03	8.91	-0.13	0.35	-0.06
PSRA: Positive engagement (out of 4)	2.96	3.13	0.17	0.11	0.27

Notes: Standard errors presented are for the full covariate adjusted models. *** indicates p < 0.001; ** indicates p < 0.01; * indicates p < 0.05; + indicates p < 0.10

Table 18
Parent Training Impacts

	Control *(N=92)* Mean	Mind Matters *(N=105)* Mean	Difference	Standard Error	Effect Size
Executive function measures					
Somethings the same game (# correct out of 19)	11.89	12.51	0.62	0.68	0.13
Pencil tap (% correct out of 16)	52.56	47.82	-4.75	0.04	-0.12
Head-to-toes (# correct out of 10)	2.87	2.94	0.07	0.57	0.02
PSRA: Attentiveness/Inhibitory control (out of 4)	3.34	3.25	-0.09 +	0.07	-0.13
Social/Behavioral measures					
Challenging situations task - adaptive problem solving (out of 12)	9.03	8.51	-0.52	0.34	-0.26
PSRA: Positive engagement (out of 4)	2.96	3.08	0.12	0.12	0.18

Notes: Standard errors presented are for the full covariate adjusted models. *** indicates p < 0.001; ** indicates p < 0.01; * indicates p < 0.05; + indicates p < 0.10

Table 19
Impacts of the Addition of Parent Training

	Classroom Only *(N=108)* Mean	Mind Matters *(N=105)* Mean	Difference	Standard Error	Effect Size
Executive function measures					
Somethings the same game (# correct out of 19)	12.41	12.51	0.10	0.60	0.02
Pencil tap (% correct out of 16)	46.95	47.82	0.86	0.04	0.02
Head-to-toes (# correct out of 10)	2.78	2.94	0.16	0.54	0.04
PSRA: Attentiveness/Inhibitory control (out of 4)	3.33	3.25	-0.08	0.07	-0.12
Social/Behavioral measures					
Challenging situations task - adaptive problem solving (out of 12)	8.91	8.51	-0.40 *	0.30	-0.20
PSRA: Positive engagement (out of 4)	3.13	3.08	-0.05	0.10	-0.08

Notes: Standard errors presented are for the full covariate adjusted models. *** indicates $p < 0.001$; ** indicates $p < 0.01$; * indicates $p < 0.05$; + indicates $p < 0.10$

Did dosage matter? Two indicators of dosage were used to examine treatment on the treated: low versus higher fidelity to the classroom training intervention model and low versus higher fidelity to the parent training intervention model. Specifically, low classroom dosage was less than one circle time activity per week over 10 weeks and higher dosage was at least one circle time activity session per week. Comparing the unadjusted means for the classroom dosage groups and, additionally, the control group, there were no significant differences as a function of dosage for the EF outcomes or adaptive problem-solving strategies as measured by the Challenging Situations Task (see top panels of Table 20, Table 21, Table 22, and Table 23 ("Model 1: (unadjusted)") for detailed model information). However, there were findings associated with positive engagement as measured by the PSRA. Specifically, the higher classroom dosage group displayed significantly more positive engagement than the control group ($b = 0.30$; $p < 0.05$), and the difference between the higher classroom dosage and low classroom dosage groups approached significance in the same direction ($b = 0.23$; $p < 0.10$). See top panels of Table 21 and Table 23 ("Model 1: (unadjusted)") for detailed model information. In addition, when classroom dosage was treated as a linear variable (i.e., quantity of dosage or number of activity sessions) and allowed to moderate the effects of treatment (i.e., an

interaction term of treatment condition by dosage), there were, again, no significant differences as a function of dosage for the EF or positive behavior outcomes (see top panels of Table 24 and Table 25 ("Model 1: (unadjusted)") for detailed model information). Finally, collapsing across treatment groups to account for low parent attendance (i.e., the parent training group also received classroom activities), does not change the pattern of linear results – with one exception. As classroom dosage increased (i.e., the more activity sessions children received; $b = 0.01$; $p < 0.10$), children in the parent training group exhibited less attentiveness/inhibitory control than the control group, but this finding only approached significance ($b = -0.27$; $p < 0.10$).

Table 20

Impacts on Executive Function by Classoom Training Dosage - Treatment on the Treated (N=200)

	Measures of Executive Function																	
	Something's the Same				Pencil Tap				Head-to-Toes				Attentiveness/ Inhibitory Control					
	b	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value			
Model 1: (unadjusted)																		
Intercept	11.89	0.53	0.00	***	0.53	0.04	0.00	***	2.87	0.45	0.00	***	3.34	0.07	0.00	***		
Higher dosage (N=49)	0.61	0.87	0.48		-0.01	0.07	0.89		0.52	0.75	0.49		0.07	0.12	0.55			
Low dosage (N=59)	0.44	0.84	0.60		-0.09	0.06	0.14		-0.60	0.71	0.40		-0.07	0.11	0.52			
Model 5: (adjusted)																		
Intercept	6.83	0.84	0.00	***	0.28	0.04	0.00	***	1.58	0.62	0.01	*	1.70	0.15	0.00	***		
Higher dosage (N=49)	0.42	0.78	0.60		-0.03	0.05	0.55		0.58	0.78	0.46		-0.02	0.09	0.83			
Low dosage (N=59)	0.39	0.76	0.61		-0.09	0.05	0.08	+	-0.31	0.69	0.66		-0.12	0.08	0.13			
Baseline executive function score	0.50	0.07	0.00	***	0.74	0.06	0.00	***	0.51	0.14	0.00	**	0.53	0.04	0.00	***		
Model 6: (adjusted)																		
Intercept	0.27	3.11	0.93		-0.18	0.21	0.39		-6.74	2.28	0.00	**	1.56	0.33	0.00	***		
Higher dosage (N=49)	0.67	0.82	0.42		0.03	0.05	0.57		1.20	0.75	0.11		-0.01	0.10	0.93			
Low dosage (N=59)	0.54	0.77	0.48		-0.05	0.05	0.28		0.22	0.69	0.75		-0.11	0.09	0.23			
Baseline executive function score	0.40	0.08	0.00	***	0.61	0.08	0.00	***	0.38	0.13	0.01	**	0.49	0.05	0.00	***		
Child characteristics																		
Age (months)	0.13	0.05	0.01	**	0.01	0.00	0.01	**	0.19	0.04	0.00	***	0.01	0.01	0.08	+		
Male	-0.65	0.65	0.32		-0.01	0.04	0.86		-0.08	0.47	0.87		-0.07	0.07	0.28			
Spanish	-0.68	1.06	0.52		-0.12	0.07	0.11		-1.35	0.81	0.10	+	-0.01	0.12	0.91			
Haitian Creole	-0.40	1.26	0.75		-0.04	0.09	0.62		0.32	1.06	0.77		0.12	0.14	0.41			
Cape Verdean	0.69	1.54	0.66		-0.02	0.10	0.86		0.96	1.30	0.46		0.21	0.16	0.20			
Other	0.59	2.17	0.79		-0.03	0.14	0.86		0.11	1.70	0.95		0.20	0.24	0.39			
White	0.53	1.61	0.75		-0.04	0.11	0.69		0.25	1.25	0.84		-0.04	0.18	0.81			
Black	-1.08	1.08	0.32		-0.06	0.08	0.43		-1.83	0.72	0.01	*	-0.21	0.12	0.09	+		
Asian	0.73	2.34	0.76		-0.01	0.16	0.95		-1.19	1.78	0.51		-0.13	0.24	0.59			
Other	0.41	1.29	0.75		0.02	0.09	0.81		-1.96	1.08	0.07	+	-0.09	0.15	0.54			
Parent characteristics																		
Age (years)	0.03	0.04	0.48		0.00	0.00	0.60		0.00	0.04	1.00		0.00	0.00	0.63			
Cohabitating	0.73	1.21	0.55		-0.08	0.07	0.30		0.43	1.02	0.68		0.01	0.13	0.93			
Married	-0.44	0.99	0.66		-0.09	0.07	0.17		0.35	0.84	0.68		0.01	0.11	0.96			
Less than high school	0.93	0.99	0.35		-0.03	0.08	0.74		-0.67	0.84	0.43		-0.04	0.12	0.74			
Some college	0.72	0.91	0.43		0.06	0.06	0.38		0.41	0.76	0.59		-0.05	0.11	0.64			
Associates degree	0.09	1.30	0.94		0.07	0.08	0.43		0.51	0.96	0.60		0.04	0.12	0.75			
Bacelors degree or higher	0.19	1.42	0.89		0.10	0.10	0.29		1.46	1.00	0.15		-0.12	0.14	0.42			

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Higher classroom dosage indicates at least one circle time activity session per week over 10 weeks, and lower classroom dosage indicates less than one circle time activity session per week. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 21

Impacts on Positive Behavior by Classoom Training Dosage - Treatment on the Treated (N=200)

	Measures of Positive Behavior							
	Challenging Situations Task				Positive Engagement			
	b	SE	*p*-value		*b*	SE	*p*-value	
Model 1: (unadjusted)								
Intercept	9.03	0.23	0.00	***	2.96	0.07	0.00	***
Higher dosage (N=49)	0.10	0.38	0.80		0.30	0.12	0.02	*
Low dosage (N=59)	-0.31	0.37	0.41		0.06	0.11	0.59	
Model 5: (adjusted)								
Intercept	7.31	0.75	0.00	***	2.01	0.22	0.00	***
Higher dosage (N=49)	0.18	0.47	0.69		0.26	0.13	0.05	*
Low dosage (N=59)	-0.14	0.45	0.76		0.05	0.12	0.70	
Baseline positive behavior score	0.18	0.08	0.02	*	0.32	0.07	0.00	***
Model 6: (adjusted)								
Intercept	4.45	1.57	0.01	**	2.41	0.47	0.00	***
Higher dosage (N=49)	0.39	0.47	0.41		0.25	0.14	0.06	+
Low dosage (N=59)	-0.07	0.47	0.88		0.06	0.12	0.66	
Baseline positive behavior score	0.18	0.08	0.03	*	0.34	0.07	0.00	***
Child characteristics								
Age (months)	0.04	0.02	0.07	+	-0.01	0.01	0.19	
Male	0.30	0.30	0.32		0.06	0.09	0.55	
Spanish	-0.06	0.49	0.91		0.02	0.16	0.89	
Haitian Creole	0.57	0.60	0.34		-0.28	0.18	0.13	
Cape Verdean	0.93	0.68	0.18		0.03	0.21	0.87	
Other	1.37	0.90	0.13		-0.14	0.33	0.68	
White	0.45	0.73	0.54		-0.22	0.22	0.33	
Black	0.30	0.45	0.50		-0.05	0.16	0.74	
Asian	0.34	1.03	0.74		0.07	0.38	0.85	
Other	0.50	0.64	0.44		-0.06	0.23	0.80	
Parent characteristics								
Age (years)	0.01	0.02	0.78		0.00	0.01	0.84	
Cohabitating	-0.23	0.52	0.66		-0.02	0.19	0.90	
Married	-0.27	0.51	0.60		-0.05	0.16	0.74	
Less than high school	-0.04	0.54	0.94		-0.05	0.15	0.74	
Some college	0.23	0.49	0.65		0.07	0.14	0.61	
Associates degree	0.24	0.55	0.66		-0.08	0.19	0.69	
Bacelors degree or higher	0.24	0.57	0.68		0.04	0.18	0.81	

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Higher classroom dosage indicates at least one circle time activity session per week over 10 weeks, and lower classroom dosage indicates less than one circle time activity session per week. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 22

Impacts on Executive Function by Classoom Training Dosage (Higher vs Low) - Treatment on the Treated (N=200)

	Measures of Executive Function																	
	Something's the Same				Pencil Tap				Head-to-Toes				Attentiveness/ Inhibitory Control					
	b	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value			
Model 1: (unadjusted)																		
Intercept	12.33	0.65	0.00	***	0.43	0.05	0.00	***	2.27	0.55	0.00	***	3.27	0.08	0.00	***		
Higher dosage (N=49)	0.17	0.96	0.86		0.08	0.07	0.25		1.12	0.80	0.17		0.14	0.12	0.27			
Control group (N=92)	-0.44	0.84	0.60		0.09	0.06	0.14		0.60	0.71	0.40		0.07	0.11	0.52			
Model 5: (adjusted)																		
Intercept	7.22	0.95	0.00	***	0.20	0.04	0.00	***	1.28	0.66	0.05	+	1.58	0.15	0.00	***		
Higher dosage (N=49)	0.03	0.88	0.98		0.06	0.06	0.33		0.88	0.82	0.28		0.10	0.09	0.28			
Control group (N=92)	-0.39	0.76	0.61		0.09	0.05	0.08	+	0.31	0.69	0.66		0.12	0.08	0.13			
Baseline executive function score	0.50	0.07	0.00	***	0.74	0.06	0.00	***	0.51	0.14	0.00	**	0.53	0.04	0.00	***		
Model 6: (adjusted)																		
Intercept	0.82	3.04	0.79		-0.23	0.21	0.26		-6.52	2.26	0.00	**	1.45	0.33	0.00	***		
Higher dosage (N=49)	0.12	0.89	0.89		0.08	0.06	0.15		0.98	0.78	0.21		0.10	0.10	0.35			
Control group (N=92)	-0.54	0.77	0.48		0.05	0.05	0.28		-0.22	0.69	0.75		0.11	0.09	0.23			
Baseline executive function score	0.40	0.08	0.00	***	0.61	0.08	0.00	***	0.38	0.13	0.01	**	0.49	0.05	0.00	***		
Child characteristics																		
Age (months)	0.13	0.05	0.01	**	0.01	0.00	0.01	**	0.19	0.04	0.00	***	0.01	0.01	0.08	+		
Male	-0.65	0.65	0.32		-0.01	0.04	0.86		-0.08	0.47	0.87		-0.07	0.07	0.28			
Spanish	-0.68	1.06	0.52		-0.12	0.07	0.11		-1.35	0.81	0.10	+	-0.01	0.12	0.91			
Haitian Creole	-0.40	1.26	0.75		-0.04	0.09	0.62		0.32	1.06	0.77		0.12	0.14	0.41			
Cape Verdean	0.69	1.54	0.66		-0.02	0.10	0.86		0.96	1.30	0.46		0.21	0.16	0.20			
Other	0.59	2.17	0.79		-0.03	0.14	0.86		0.11	1.70	0.95		0.20	0.24	0.39			
White	0.53	1.61	0.75		-0.04	0.11	0.69		0.25	1.25	0.84		-0.04	0.18	0.81			
Black	-1.08	1.08	0.32		-0.06	0.08	0.43		-1.83	0.72	0.01	*	-0.21	0.12	0.09	+		
Asian	0.73	2.34	0.76		-0.01	0.16	0.95		-1.19	1.78	0.51		-0.13	0.24	0.59			
Other	0.41	1.29	0.75		0.02	0.09	0.81		-1.96	1.08	0.07	+	-0.09	0.15	0.54			
Parent characteristics																		
Age (years)	0.03	0.04	0.48		0.00	0.00	0.60		0.00	0.04	1.00		0.00	0.00	0.63			
Cohabitating	0.73	1.21	0.55		-0.08	0.07	0.30		0.43	1.02	0.68		0.01	0.13	0.93			
Married	-0.44	0.99	0.66		-0.09	0.07	0.17		0.35	0.84	0.68		0.01	0.11	0.96			
Less than high school	0.93	0.99	0.35		-0.03	0.08	0.74		-0.67	0.84	0.43		-0.04	0.12	0.74			
Some college	0.72	0.91	0.43		0.06	0.06	0.38		0.41	0.76	0.59		-0.05	0.11	0.64			
Associates degree	0.09	1.30	0.94		0.07	0.08	0.43		0.51	0.96	0.60		0.04	0.12	0.75			
Bacelors degree or higher	0.19	1.42	0.89		0.10	0.10	0.29		1.46	1.00	0.15		-0.12	0.14	0.42			

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Higher classroom dosage indicates at least one circle time activity session per week over 10 weeks, and lower classroom dosage indicates less than one circle time activity session per week. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 23

Impacts on Positive Behavior by Classoom Training Dosage (Higher vs Low) - Treatment on the Treated (N=200)

	Measures of Positive Behavior							
	Challenging Situations Task				Positive Engagement			
	b	SE	*p*-value		*b*	SE	*p*-value	
Model 1: (unadjusted)								
Intercept	8.72	0.30	0.00	***	3.02	0.09	0.00	***
Higher dosage (N=49)	0.41	0.41	0.32		0.23	0.13	0.07	+
Control group (N=92)	0.31	0.37	0.41		-0.06	0.11	0.59	
Model 5: (adjusted)								
Intercept	7.17	0.72	0.00	***	2.06	0.22	0.00	***
Higher dosage (N=49)	0.32	0.51	0.53		0.21	0.14	0.13	
Control group (N=92)	0.14	0.45	0.76		-0.05	0.12	0.70	
Baseline positive behavior score	0.18	0.08	0.02	*	0.32	0.07	0.00	***
Model 6: (adjusted)								
Intercept	4.38	1.58	0.01	**	2.46	0.46	0.00	***
Higher dosage (N=49)	0.46	0.53	0.38		0.20	0.14	0.16	
Control group (N=92)	0.07	0.47	0.88		-0.06	0.12	0.66	
Baseline positive behavior score	0.18	0.08	0.03	*	0.34	0.07	0.00	***
Child characteristics								
Age (months)	0.04	0.02	0.07	+	-0.01	0.01	0.19	
Male	0.30	0.30	0.32		0.06	0.09	0.55	
Spanish	-0.06	0.49	0.91		0.02	0.16	0.89	
Haitian Creole	0.57	0.60	0.34		-0.28	0.18	0.13	
Cape Verdean	0.93	0.68	0.18		0.03	0.21	0.87	
Other	1.37	0.90	0.13		-0.14	0.33	0.68	
White	0.45	0.73	0.54		-0.22	0.22	0.33	
Black	0.30	0.45	0.50		-0.05	0.16	0.74	
Asian	0.34	1.03	0.74		0.07	0.38	0.85	
Other	0.50	0.64	0.44		-0.06	0.23	0.80	
Parent characteristics								
Age (years)	0.01	0.02	0.78		0.00	0.01	0.84	
Cohabitating	-0.23	0.52	0.66		-0.02	0.19	0.90	
Married	-0.27	0.51	0.60		-0.05	0.16	0.74	
Less than high school	-0.04	0.54	0.94		-0.05	0.15	0.74	
Some college	0.23	0.49	0.65		0.07	0.14	0.61	
Associates degree	0.24	0.55	0.66		-0.08	0.19	0.69	
Bacelors degree or higher	0.24	0.57	0.68		0.04	0.18	0.81	

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Higher classroom dosage indicates at least one circle time activity session per week over 10 weeks, and lower classroom dosage indicates less than one circle time activity session per week. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 24

Impacts on Executive Function by Classroom Training Linear Dosage - Treatment on the Treated (N=200)

	Measures of Executive Function																	
	Something's the Same				Pencil Tap				Head-to-Toes				Attentiveness/ Inhibitory Control					
	b	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value			
Model 1: (unadjusted)																		
Intercept	11.91	0.57	0.00	***	0.53	0.04	0.00	***	2.88	0.45	0.00	***	3.34	0.07	0.00	***		
Parent training	0.26	1.47	0.86		-0.12	0.10	0.24		-0.57	1.09	0.60		-0.33	0.18	0.07	+		
Classroom training	0.57	0.98	0.57		-0.10	0.07	0.16		-0.77	0.79	0.33		-0.09	0.13	0.49			
Linear dosage	0.02	0.09	0.81		0.01	0.01	0.40		0.05	0.07	0.49		0.02	0.01	0.12			
Interaction	-0.03	0.12	0.78		0.00	0.01	0.97		0.03	0.09	0.69		-0.01	0.02	0.61			
Model 5: (adjusted)																		
Intercept	6.97	0.77	0.00	***	0.28	0.03	0.00	***	1.59	0.60	0.01	*	1.62	0.13	0.00	***		
Parent training	0.11	1.44	0.94		-0.12	0.07	0.09	+	0.02	0.99	0.99		-0.28	0.13	0.03	*		
Classroom training	0.46	0.87	0.60		-0.09	0.05	0.10	+	-0.44	0.78	0.57		-0.11	0.09	0.22			
Linear dosage	0.03	0.09	0.75		0.00	0.00	0.47		0.00	0.06	0.98		0.01	0.01	0.17			
Interaction	-0.04	0.11	0.75		0.00	0.01	0.96		0.07	0.08	0.41		-0.01	0.01	0.52			
Baseline executive function score	0.49	0.06	0.00	***	0.76	0.05	0.00	***	0.50	0.13	0.00	**	0.55	0.04	0.00	***		
Model 6: (adjusted)																		
Intercept	-0.97	2.34	0.68		-0.22	0.16	0.16		-7.80	1.83	0.00	***	1.30	0.26	0.00	***		
Parent training	0.55	1.26	0.66		-0.10	0.07	0.15		-0.10	0.95	0.92		-0.28	0.13	0.04	*		
Classroom training	0.92	0.84	0.27		-0.05	0.05	0.36		-0.01	0.77	0.99		-0.08	0.09	0.37			
Linear dosage	0.02	0.08	0.84		0.00	0.00	0.35		0.01	0.06	0.91		0.01	0.01	0.20			
Interaction	-0.03	0.10	0.79		0.00	0.01	0.96		0.07	0.08	0.40		-0.01	0.01	0.53			
Baseline executive function score	0.38	0.06	0.00	***	0.63	0.06	0.00	***	0.35	0.12	0.01	**	0.50	0.04	0.00	***		
Child characteristics																		
Age (months)	0.17	0.04	0.00	***	0.01	0.00	0.00	***	0.19	0.04	0.00	***	0.01	0.00	0.00	**		
Male	-0.31	0.54	0.57		-0.01	0.03	0.74		0.12	0.39	0.76		-0.09	0.06	0.13			
Spanish	-0.74	0.83	0.37		-0.12	0.06	0.04	*	-1.38	0.69	0.05	*	-0.07	0.11	0.55			
Haitian Creole	-0.86	0.98	0.38		0.00	0.06	0.98		0.73	0.85	0.40		0.03	0.12	0.77			
Cape Verdean	0.17	1.35	0.90		0.00	0.08	0.98		1.46	1.01	0.15		0.09	0.14	0.50			
Other	0.90	1.52	0.55		0.07	0.09	0.44		0.20	1.16	0.86		0.23	0.17	0.18			
White	0.31	1.51	0.84		-0.04	0.09	0.62		0.44	1.12	0.70		-0.02	0.18	0.92			
Black	-0.72	0.91	0.43		-0.04	0.06	0.52		-1.63	0.70	0.02	*	-0.16	0.12	0.20			
Asian	0.72	1.67	0.67		-0.05	0.10	0.60		-1.19	1.34	0.38		-0.16	0.19	0.39			
Other	-0.02	1.14	0.99		0.02	0.07	0.84		-1.68	0.89	0.06	+	-0.12	0.14	0.41			
Parent characteristics																		
Age (years)	0.01	0.04	0.87		0.00	0.00	0.55		0.02	0.03	0.49		0.00	0.00	0.73			
Cohabitating	0.54	0.94	0.57		-0.07	0.06	0.29		0.35	0.94	0.71		0.01	0.10	0.90			
Married	-0.81	0.78	0.30		-0.08	0.05	0.12		0.51	0.66	0.45		-0.02	0.10	0.87			
Less than high school	1.36	0.83	0.10		-0.04	0.06	0.53		-0.32	0.74	0.67		0.02	0.10	0.87			
Some college	1.00	0.76	0.19		0.03	0.05	0.57		0.67	0.66	0.31		0.02	0.09	0.81			
Associates degree	0.50	1.18	0.67		0.06	0.07	0.41		0.73	0.89	0.41		0.06	0.11	0.61			
Bacelors degree or higher	-0.21	1.06	0.84		0.09	0.08	0.23		1.57	0.78	0.05	*	-0.05	0.12	0.66			

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Classroom dosage is considered a continuous variable ranging from 0-20 activity sessions. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 25

Impacts on Positive Behavior by Linear Dosage - Treatment on the Treated

	Classroom Training Fidelity (N=200)								Parent Training Fidelity (N=197)							
	Challenging Situations Task				Positive Engagement				Challenging Situations Task				Positive Engagement			
	b	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value	
Model 1: (unadjusted)																
Intercept	9.02	0.24	0.00	***	2.97	0.08	0.00	***	9.01	0.24	0.00	***	2.98	0.08	0.00	***
Parent training	-0.57	0.58	0.33		0.15	0.20	0.47		-0.48	0.34	0.16		0.16	0.12	0.16	
Classroom training	-0.52	0.45	0.26		0.09	0.13	0.50		-0.10	0.36	0.77		0.14	0.11	0.19	
Linear dosage	0.00	0.04	0.92		0.00	0.01	0.92		0.11	0.25	0.67		-0.17	0.08	0.03	*
Interaction	0.04	0.05	0.37		0.01	0.02	0.53		-0.12	0.25	0.64		0.14	0.08	0.08	+
Model 5: (adjusted)																
Intercept	6.87	0.60	0.00	***	2.01	0.18	0.00	***	6.79	0.59	0.00	***	2.05	0.19	0.00	***
Parent training	-0.55	0.61	0.37		0.04	0.20	0.86		-0.40	0.34	0.25		0.12	0.11	0.31	
Classroom training	-0.29	0.49	0.55		0.08	0.14	0.55		0.00	0.35	0.99		0.13	0.11	0.23	
Linear dosage	0.01	0.04	0.86		0.00	0.01	0.81		0.14	0.24	0.56		-0.11	0.08	0.15	
Interaction	0.03	0.05	0.60		0.00	0.02	0.78		-0.17	0.25	0.48		0.08	0.08	0.30	
Baseline positive behavior score	0.24	0.06	0.00	***	0.32	0.06	0.00	***	0.24	0.06	0.00	***	0.31	0.06	0.00	***
Model 6: (adjusted)																
Intercept	3.96	1.19	0.00	**	2.50	0.38	0.00	***	3.87	1.20	0.00	**	2.51	0.38	0.00	***
Parent training	-0.44	0.59	0.46		0.01	0.20	0.94		-0.37	0.36	0.31		0.14	0.12	0.23	
Classroom training	-0.20	0.46	0.65		0.08	0.14	0.55		0.15	0.35	0.67		0.14	0.11	0.21	
Linear dosage	0.00	0.04	0.97		0.01	0.01	0.57		0.16	0.25	0.51		-0.09	0.08	0.25	
Interaction	0.04	0.05	0.40		0.00	0.02	0.92		-0.20	0.25	0.42		0.06	0.08	0.43	
Baseline positive behavior score	0.19	0.06	0.00	**	0.33	0.06	0.00	***	0.21	0.06	0.00	**	0.32	0.06	0.00	***
Child characteristics																
Age (months)	0.05	0.02	0.01	**	-0.01	0.01	0.16		0.05	0.02	0.01	**	-0.01	0.01	0.15	
Male	0.42	0.24	0.08	+	0.09	0.08	0.23		0.43	0.24	0.08	+	0.09	0.08	0.26	
Spanish	-0.05	0.38	0.90		-0.08	0.13	0.56		-0.05	0.38	0.90		-0.09	0.13	0.52	
Haitian Creole	0.15	0.46	0.75		-0.10	0.14	0.46		0.13	0.45	0.78		-0.10	0.14	0.48	
Cape Verdean	0.55	0.58	0.35		0.09	0.18	0.62		0.45	0.58	0.44		0.05	0.17	0.77	
Other	0.75	0.62	0.23		-0.11	0.23	0.63		0.71	0.65	0.27		-0.04	0.23	0.87	
White	0.33	0.58	0.57		-0.12	0.20	0.57		0.33	0.59	0.58		-0.11	0.20	0.57	
Black	0.34	0.38	0.38		-0.11	0.15	0.45		0.35	0.38	0.36		-0.12	0.15	0.42	
Asian	0.55	0.75	0.46		-0.04	0.26	0.87		0.61	0.77	0.43		-0.09	0.26	0.73	
Other	0.31	0.52	0.55		-0.12	0.19	0.52		0.28	0.53	0.59		-0.10	0.19	0.60	
Parent characteristics																
Age (years)	0.01	0.02	0.74		0.00	0.01	0.63		0.01	0.02	0.76		0.00	0.01	0.75	
Cohabitating	-0.20	0.40	0.62		-0.05	0.14	0.72		-0.18	0.40	0.66		-0.04	0.14	0.76	
Married	-0.10	0.35	0.77		-0.09	0.14	0.51		-0.09	0.34	0.80		-0.08	0.14	0.58	
Less than high school	0.23	0.46	0.62		-0.02	0.12	0.84		0.26	0.47	0.58		-0.03	0.12	0.81	
Some college	0.44	0.38	0.25		0.05	0.12	0.69		0.47	0.39	0.23		0.06	0.12	0.63	
Associates degree	0.67	0.44	0.13		0.04	0.16	0.80		0.70	0.44	0.11		0.03	0.16	0.84	
Bacelors degree or higher	0.40	0.49	0.41		0.10	0.14	0.49		0.40	0.49	0.41		0.09	0.14	0.52	

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Classroom dosage is considered a continuous variable ranging from 0-20 activity sessions. Parent dosage is considered a continuous variable ranging from 0-10 training sessions attended. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Comparing the unadjusted means for the parent dosage groups (i.e., low parent training dosage was less than 50 percent attendance (i.e., 4 or less sessions) and higher dosage was at least 50 percent attendance (i.e., 5 or more sessions; N = 20)) and, additionally, the control group, there were no significant differences as a function of dosage for the Pencil Tap, Head-to-Toes, and Challenging Situations Task measures (see top panels of Table 26, Table 27, Table 28, and Table 29 (“Model 1: (unadjusted)”) for

detailed model information). However, there was some evidence that dosage mattered, in both expected and unexpected directions. Specifically, the higher parent dosage group displayed significantly less positive engagement than the low dosage group (b = -0.33; p < 0.05). See top panel of Table 29 ("Model 1: (unadjusted)") for detailed model information. Differences approached significance (in expected directions) for the control group versus the higher parent dosage group for correct responses on Something's the Same (b = 2.11; p < 0.10). In other words, when parents attended 5 or more sessions their children did slightly better on a measure of cognitive flexibility than the control group (see top panel of Table 26 ("Model 1: (unadjusted)") for detailed model information). Additionally, the higher parent dosage group displayed somewhat more attentiveness/inhibitory control than the low dosage group (b = 0.30; p < 0.10); in other words, when parents attended 5 or more sessions, their children displayed somewhat more attentiveness/inhibitory control than children whose parents attended 4 or fewer sessions (see top panel of Table 28 ("Model 1: (unadjusted)") for detailed model information).

In addition, when parent dosage was treated as a linear variable (i.e., quantity of dosage or number of parent sessions attended) and allowed to moderate the effects of treatment (i.e., an interaction term of treatment condition by dosage), a similar pattern of null and significant results emerged (see top panels of Table 25 and Table 30 ("Model 1: (unadjusted)") for detailed model information). Specifically, there was a significant effect in the expected direction for correct responses to Something's the Same (b = 1.28; p < 0.05); in other words, the more sessions parents attended the better their children did on a measure of cognitive flexibility (see top panel of Table 30 ("Model 1: (unadjusted)") for

detailed model information and Figure 3 for a graphical representation). Additionally, for displays of positive engagement, the effect approached significance ($b = 0.14$; $p < 0.10$); in other words, the more sessions parents attended the more positive engagement their children displayed (see top panel of Table 25 ("Model 1: (unadjusted)") for detailed model information and Figure 4 for a graphical representation).

Table 26

Impacts on Executive Function by Parent Training Dosage - Treatment on the Treated (N=197)

	Measures of Executive Function																				
	Something's the Same					Pencil Tap					Head-to-Toes					Attentiveness/ Inhibitory Control				
	b	SE	*p*-value			*b*	SE	*p*-value			*b*	SE	*p*-value			*b*	SE	*p*-value		
Model 1: (unadjusted)																				
Intercept	11.96	0.54	0.00	***		0.53	0.04	0.00	***		2.91	0.45	0.00	***		3.33	0.07	0.00	***	
Higher dosage (N=20)	2.11	1.21	0.08	+		-0.04	0.10	0.69			0.51	1.01	0.61			0.16	0.17	0.35		
Low dosage (N=86)	0.10	0.76	0.90			-0.06	0.06	0.30			-0.11	0.63	0.86			-0.13	0.11	0.21		
Model 5: (adjusted)																				
Intercept	6.86	0.90	0.00	***		0.27	0.03	0.00	***		1.59	0.62	0.01	*		1.56	0.16	0.00	***	
Higher dosage (N=20)	1.13	1.15	0.32			-0.04	0.07	0.52			0.23	0.94	0.80			-0.08	0.13	0.54		
Low dosage (N=86)	0.07	0.77	0.93			-0.09	0.04	0.03	*		-0.10	0.59	0.86			-0.14	0.08	0.09	+	
Baseline positive behavior score	0.51	0.07	0.00	***		0.78	0.06	0.00	***		0.51	0.13	0.00	***		0.57	0.05	0.00	***	
Model 6: (adjusted)																				
Intercept	-1.13	2.72	0.68			-0.32	0.18	0.08	+		-9.05	2.01	0.00	***		1.27	0.32	0.00	***	
Higher dosage (N=20)	1.84	1.20	0.13			-0.07	0.07	0.31			-0.05	0.94	0.96			-0.08	0.14	0.54		
Low dosage (N=86)	0.52	0.76	0.49			-0.06	0.04	0.18			-0.07	0.61	0.91			-0.15	0.08	0.08	+	
Baseline executive function score	0.39	0.08	0.00	***		0.62	0.07	0.00	***		0.35	0.12	0.01	**		0.51	0.05	0.00	***	
Child characteristics																				
Age (months)	0.18	0.04	0.00	***		0.01	0.00	0.00	***		0.18	0.04	0.00	***		0.01	0.01	0.02	*	
Male	0.16	0.68	0.81			0.00	0.04	0.97			0.39	0.47	0.41			-0.13	0.07	0.07	+	
Spanish	-0.46	1.01	0.65			-0.09	0.06	0.16			-0.95	0.75	0.21			-0.06	0.14	0.66		
Haitian Creole	-1.07	1.29	0.41			0.08	0.08	0.35			1.08	0.97	0.27			0.09	0.15	0.56		
Cape Verdean	0.28	1.68	0.87			0.05	0.10	0.64			1.97	1.24	0.11			0.08	0.19	0.66		
Other	0.41	1.55	0.79			0.16	0.10	0.09	+		0.36	1.21	0.77			0.28	0.19	0.14		
White	-0.06	1.89	0.97			-0.02	0.09	0.83			0.58	1.26	0.65			-0.06	0.24	0.79		
Black	-0.55	1.13	0.63			-0.02	0.07	0.79			-1.28	0.85	0.14			-0.16	0.16	0.30		
Asian	1.16	2.00	0.56			-0.04	0.12	0.73			-1.10	1.53	0.48			-0.24	0.24	0.33		
Other	-0.43	1.53	0.78			0.02	0.09	0.86			-1.61	1.06	0.13			-0.14	0.21	0.49		
Parent characteristics																				
Age (years)	-0.01	0.05	0.86			0.00	0.00	0.72			0.05	0.04	0.23			0.00	0.01	0.89		
Cohabitating	0.18	1.12	0.87			-0.06	0.07	0.37			0.49	1.02	0.64			0.04	0.14	0.76		
Married	-1.26	1.05	0.24			-0.06	0.07	0.40			0.52	0.83	0.53			-0.03	0.13	0.85		
Less than high school	1.73	1.06	0.11			-0.04	0.07	0.63			-0.22	0.84	0.80			0.02	0.12	0.90		
Some college	1.05	1.06	0.33			0.04	0.07	0.61			0.84	0.86	0.33			0.02	0.12	0.90		
Associates degree	1.01	1.35	0.46			0.06	0.09	0.47			0.66	1.11	0.55			0.03	0.15	0.83		
Bacelors degree or higher	-0.73	1.17	0.54			0.12	0.09	0.18			1.79	0.92	0.06	+		-0.01	0.14	0.97		

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Higher parent dosage indicates at least 50% attendance at the 10 parent sessions (i.e., 5 or more), and lower parent dosage indicates less than 50% attendance (i.e., 4 or less) at the parent sessions. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 27

Impacts on Positive Behavior by Parent Training Dosage - Treatment on the Treated (N=197)

	Measures of Positive Behavior							
	Challenging Situations Task				Positive Engagement			
	b	SE	*p*-value		*b*	SE	*p*-value	
Model 1: (unadjusted)								
Intercept	9.02	0.24	0.00	***	2.98	0.08	0.00	***
Higher dosage (N=20)	-0.41	0.52	0.43		-0.17	0.17	0.31	
Low dosage (N=86)	-0.52	0.34	0.13		0.16	0.11	0.14	
Model 5: (adjusted)								
Intercept	6.86	0.70	0.00	***	2.01	0.22	0.00	***
Higher dosage (N=20)	-0.47	0.52	0.37		-0.20	0.17	0.23	
Low dosage (N=86)	-0.44	0.34	0.20		0.11	0.11	0.32	
Baseline positive behavior score	0.24	0.07	0.00	**	0.33	0.07	0.00	***
Model 6: (adjusted)								
Intercept	4.57	1.33	0.00	**	2.62	0.42	0.00	***
Higher dosage (N=20)	-0.44	0.56	0.43		-0.18	0.18	0.34	
Low dosage (N=86)	-0.37	0.36	0.31		0.12	0.12	0.32	
Baseline positive behavior score	0.17	0.08	0.05	*	0.35	0.07	0.00	***
Child characteristics								
Age (months)	0.04	0.02	0.03	*	-0.01	0.01	0.07	+
Male	0.53	0.30	0.08	+	0.09	0.09	0.34	
Spanish	-0.22	0.47	0.64		-0.17	0.16	0.29	
Haitian Creole	-0.32	0.59	0.59		0.14	0.18	0.45	
Cape Verdean	0.69	0.78	0.37		0.19	0.24	0.43	
Other	0.60	0.74	0.42		-0.05	0.24	0.83	
White	0.13	0.81	0.87		-0.05	0.25	0.84	
Black	0.37	0.48	0.44		-0.25	0.19	0.20	
Asian	0.51	0.95	0.59		-0.16	0.30	0.59	
Other	-0.06	0.67	0.92		-0.14	0.24	0.56	
Parent characteristics								
Age (years)	0.00	0.02	0.94		0.00	0.01	0.93	
Cohabitating	-0.15	0.50	0.76		-0.07	0.18	0.72	
Married	0.09	0.43	0.84		-0.11	0.18	0.53	
Less than high school	0.40	0.50	0.42		-0.01	0.15	0.94	
Some college	0.47	0.51	0.36		0.03	0.16	0.87	
Associates degree	0.79	0.59	0.18		0.06	0.20	0.75	
Bacelors degree or higher	0.52	0.62	0.41		0.22	0.18	0.21	

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Higher parent dosage indicates at least 50% attendance at the 10 parent sessions (i.e., 5 or more), and lower parent dosage indicates less than 50% attendance (i.e., 4 or less) at the parent sessions. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 28

Impacts on Executive Function by Parent Training Dosage (Higher vs Low) - Treatment on the Treated (N=197)

	Measures of Executive Function																	
	Something's the Same				Pencil Tap				Head-to-Toes				Attentiveness/ Inhibitory Control					
	b	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value			
Model 1: (unadjusted)																		
Intercept	12.06	0.54	0.00	***	0.47	0.04	0.00	***	2.80	0.45	0.00	***	3.20	0.08	0.00	***		
Higher dosage (N=20)	2.01	1.22	0.10		0.02	0.10	0.82		0.62	1.01	0.54		0.30	0.17	0.09	+		
Control group (N=92)	-0.10	0.76	0.90		0.06	0.06	0.30		0.11	0.63	0.86		0.13	0.11	0.21			
Model 5: (adjusted)																		
Intercept	6.94	0.90	0.00	***	0.18	0.04	0.00	***	1.49	0.52	0.01	**	1.43	0.16	0.00	***		
Higher dosage (N=20)	1.06	1.09	0.33		0.05	0.07	0.46		0.34	0.89	0.71		0.06	0.13	0.65			
Control group (N=92)	-0.07	0.77	0.93		0.09	0.04	0.03	*	0.10	0.59	0.86		0.14	0.08	0.09	+		
Baseline positive behavior score	0.51	0.07	0.00	***	0.78	0.06	0.00	***	0.51	0.13	0.00	***	0.57	0.05	0.00	***		
Model 6: (adjusted)																		
Intercept	-0.61	2.74	0.82		-0.38	0.18	0.04	*	-9.12	1.93	0.00	***	1.12	0.31	0.00	***		
Higher dosage (N=20)	1.32	1.14	0.25		-0.01	0.07	0.84		0.02	0.84	0.98		0.06	0.14	0.65			
Control group (N=92)	-0.52	0.76	0.49		0.06	0.04	0.18		0.07	0.61	0.91		0.15	0.08	0.08	+		
Baseline executive function score	0.39	0.08	0.00	***	0.62	0.07	0.00	***	0.35	0.12	0.01	**	0.51	0.05	0.00	***		
Child characteristics																		
Age (months)	0.18	0.04	0.00	***	0.01	0.00	0.00	***	0.18	0.04	0.00	***	0.01	0.01	0.02	*		
Male	0.16	0.68	0.81		0.00	0.04	0.97		0.39	0.47	0.41		-0.13	0.07	0.07	+		
Spanish	-0.46	1.01	0.65		-0.09	0.06	0.16		-0.95	0.75	0.21		-0.06	0.14	0.66			
Haitian Creole	-1.07	1.29	0.41		0.08	0.08	0.35		1.08	0.97	0.27		0.09	0.15	0.56			
Cape Verdean	0.28	1.68	0.87		0.05	0.10	0.64		1.97	1.24	0.11		0.08	0.19	0.66			
Other	0.41	1.55	0.79		0.16	0.10	0.09	+	0.36	1.21	0.77		0.28	0.19	0.14			
White	-0.06	1.89	0.97		-0.02	0.09	0.83		0.58	1.26	0.65		-0.06	0.24	0.79			
Black	-0.55	1.13	0.63		-0.02	0.07	0.79		-1.28	0.85	0.14		-0.16	0.16	0.30			
Asian	1.16	2.00	0.56		-0.04	0.12	0.73		-1.10	1.53	0.48		-0.24	0.24	0.33			
Other	-0.43	1.53	0.78		0.02	0.09	0.86		-1.61	1.06	0.13		-0.14	0.21	0.49			
Parent characteristics																		
Age (years)	-0.01	0.05	0.86		0.00	0.00	0.72		0.05	0.04	0.23		0.00	0.01	0.89			
Cohabitating	0.18	1.12	0.87		-0.06	0.07	0.37		0.49	1.02	0.64		0.04	0.14	0.76			
Married	-1.26	1.05	0.24		-0.06	0.07	0.40		0.52	0.83	0.53		-0.03	0.13	0.85			
Less than high school	1.73	1.06	0.11		-0.04	0.07	0.63		-0.22	0.84	0.80		0.02	0.12	0.90			
Some college	1.05	1.06	0.33		0.04	0.07	0.61		0.84	0.86	0.33		0.02	0.12	0.90			
Associates degree	1.01	1.35	0.46		0.06	0.09	0.47		0.66	1.11	0.55		0.03	0.15	0.83			
Bacelors degree or higher	-0.73	1.17	0.54		0.12	0.09	0.18		1.79	0.92	0.06	+	-0.01	0.14	0.97			

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Higher parent dosage indicates at least 50% attendance at the 10 parent sessions (i.e., 5 or more), and lower parent dosage indicates less than 50% attendance (i.e., 4 or less) at the parent sessions. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 29

Impacts on Positive Behavior by Parent Training Dosage (Higher vs Low) - Treatment on the Treated (N=197)

	Measures of Positive Behavior							
	Challenging Situations Task				Positive Engagement			
	b	SE	*p*-value		*b*	SE	*p*-value	
Model 1: (unadjusted)								
Intercept	8.50	0.23	0.00	***	3.13	0.07	0.00	***
Higher dosage (N=20)	0.10	0.52	0.84		-0.33	0.17	0.05	*
Control group (N=92)	0.52	0.34	0.13		-0.16	0.11	0.14	
Model 5: (adjusted)								
Intercept	6.42	0.68	0.00	***	2.13	0.23	0.00	***
Higher dosage (N=20)	-0.03	0.51	0.95		-0.32	0.16	0.05	*
Control group (N=92)	0.44	0.34	0.20		-0.11	0.11	0.32	
Baseline positive behavior score	0.24	0.07	0.00	**	0.33	0.07	0.00	***
Model 6: (adjusted)								
Intercept	4.20	1.32	0.00	**	2.74	0.43	0.00	***
Higher dosage (N=20)	-0.07	0.54	0.90		-0.30	0.17	0.08	+
Control group (N=92)	0.37	0.36	0.31		-0.12	0.12	0.32	
Baseline positive behavior score	0.17	0.08	0.05	*	0.35	0.07	0.00	***
Child characteristics								
Age (months)	0.04	0.02	0.03	*	-0.01	0.01	0.07	+
Male	0.53	0.30	0.08	+	0.09	0.09	0.34	
Spanish	-0.22	0.47	0.64		-0.17	0.16	0.29	
Haitian Creole	-0.32	0.59	0.59		0.14	0.18	0.45	
Cape Verdean	0.69	0.78	0.37		0.19	0.24	0.43	
Other	0.60	0.74	0.42		-0.05	0.24	0.83	
White	0.13	0.81	0.87		-0.05	0.25	0.84	
Black	0.37	0.48	0.44		-0.25	0.19	0.20	
Asian	0.51	0.95	0.59		-0.16	0.30	0.59	
Other	-0.06	0.67	0.92		-0.14	0.24	0.56	
Parent characteristics								
Age (years)	0.00	0.02	0.94		0.00	0.01	0.93	
Cohabitating	-0.15	0.50	0.76		-0.07	0.18	0.72	
Married	0.09	0.43	0.84		-0.11	0.18	0.53	
Less than high school	0.40	0.50	0.42		-0.01	0.15	0.94	
Some college	0.47	0.51	0.36		0.03	0.16	0.87	
Associates degree	0.79	0.59	0.18		0.06	0.20	0.75	
Bacelors degree or higher	0.52	0.62	0.41		0.22	0.18	0.21	

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Higher parent dosage indicates at least 50% attendance at the 10 parent sessions (i.e., 5 or more), and lower parent dosage indicates less than 50% attendance (i.e., 4 or less) at the parent sessions. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

Table 30

Impacts on Executive Function by Parent Training Linear Dosage - Treatment on the Treated (N=197)

	Measures of Executive Function																	
	Something's the Same				Pencil Tap				Head-to-Toes				Attentiveness/ Inhibitory Control					
	b	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value		*b*	SE	*p*-value			
Model 1: (unadjusted)																		
Intercept	11.99	0.53	0.00	***	0.53	0.04	0.00	***	2.92	0.46	0.00	***	3.34	0.07	0.00	***		
Parent training	0.08	0.77	0.92		-0.06	0.06	0.29		-0.08	0.65	0.91		-0.14	0.11	0.21			
Classroom training	0.41	0.71	0.56		-0.06	0.05	0.25		-0.14	0.67	0.83		-0.01	0.11	0.92			
Linear dosage	-1.04	0.60	0.08	+	-0.07	0.05	0.11		-0.40	0.49	0.42		0.04	0.08	0.59			
Interaction	1.28	0.61	0.04	*	0.08	0.05	0.10		0.45	0.51	0.37		-0.02	0.08	0.84			
Model 5: (adjusted)																		
Intercept	7.11	0.75	0.00	***	0.28	0.03	0.00	***	1.61	0.60	0.01	*	1.61	0.13	0.00	***		
Parent training	0.20	0.71	0.78		-0.09	0.04	0.04	*	-0.08	0.59	0.89		-0.14	0.08	0.07	+		
Classroom training	0.32	0.64	0.62		-0.06	0.04	0.12		0.09	0.63	0.88		-0.08	0.07	0.30			
Linear dosage	-1.04	0.53	0.05	*	-0.04	0.03	0.25		-0.23	0.42	0.59		0.02	0.06	0.72			
Interaction	1.18	0.54	0.03	*	0.04	0.03	0.22		0.26	0.44	0.55		-0.01	0.06	0.81			
Baseline executive function score	0.49	0.06	0.00	***	0.76	0.05	0.00	***	0.50	0.13	0.00	***	0.56	0.04	0.00	***		
Model 6: (adjusted)																		
Intercept	-0.65	2.32	0.78		-0.21	0.16	0.17		-7.79	1.84	0.00	***	1.28	0.26	0.00	***		
Parent training	0.38	0.72	0.59		-0.05	0.04	0.23		0.00	0.60	1.00		-0.15	0.08	0.07	+		
Classroom training	0.74	0.64	0.25		-0.02	0.04	0.65		0.63	0.63	0.32		-0.05	0.08	0.50			
Linear dosage	-0.90	0.53	0.09	+	-0.05	0.03	0.17		0.02	0.39	0.96		0.02	0.06	0.79			
Interaction	1.05	0.54	0.05	+	0.04	0.03	0.19		-0.02	0.39	0.97		-0.01	0.06	0.91			
Baseline executive function score	0.37	0.06	0.00	***	0.63	0.06	0.00	***	0.36	0.12	0.00	**	0.50	0.04	0.00	***		
Child characteristics																		
Age (months)	0.17	0.04	0.00	***	0.01	0.00	0.00	***	0.19	0.04	0.00	***	0.01	0.00	0.00	**		
Male	-0.35	0.54	0.52		-0.01	0.03	0.72		0.14	0.40	0.73		-0.08	0.06	0.15			
Spanish	-0.68	0.82	0.41		-0.11	0.06	0.04	*	-1.39	0.69	0.05	*	-0.05	0.11	0.63			
Haitian Creole	-0.88	0.97	0.36		0.00	0.06	0.96		0.71	0.85	0.41		0.04	0.12	0.70			
Cape Verdean	0.28	1.33	0.84		-0.02	0.08	0.85		1.25	1.02	0.22		0.09	0.14	0.51			
Other	1.30	1.54	0.40		0.11	0.09	0.25		0.25	1.18	0.83		0.24	0.17	0.17			
White	0.28	1.49	0.85		-0.05	0.08	0.57		0.39	1.11	0.73		-0.02	0.17	0.91			
Black	-0.72	0.91	0.43		-0.04	0.06	0.48		-1.63	0.70	0.02	*	-0.16	0.12	0.19			
Asian	0.49	1.67	0.77		-0.07	0.10	0.48		-1.18	1.37	0.39		-0.15	0.19	0.42			
Other	0.11	1.15	0.92		0.02	0.07	0.77		-1.71	0.90	0.06	+	-0.12	0.14	0.40			
Parent characteristics																		
Age (years)	0.00	0.04	0.91		0.00	0.00	0.51		0.02	0.03	0.52		0.00	0.00	0.72			
Cohabitating	0.54	0.93	0.56		-0.06	0.06	0.32		0.38	0.95	0.69		0.01	0.10	0.91			
Married	-0.76	0.77	0.33		-0.07	0.05	0.15		0.54	0.66	0.41		-0.02	0.10	0.87			
Less than high school	1.25	0.82	0.13		-0.04	0.06	0.50		-0.32	0.75	0.67		0.01	0.10	0.88			
Some college	0.81	0.76	0.29		0.03	0.05	0.62		0.65	0.67	0.34		0.02	0.09	0.86			
Associates degree	0.39	1.17	0.74		0.05	0.07	0.48		0.73	0.88	0.41		0.05	0.11	0.67			
Bacelors degree or higher	-0.30	1.06	0.78		0.09	0.08	0.26		1.55	0.79	0.05	+	-0.06	0.12	0.63			

Notes: Significance levels indicated at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Parent dosage is considered a continuous variable ranging from 0-10 training sessions attended. Omitted variables include: Female, English, Hispanic, Single, and High School/GED. Models not shown: 2) Unadjusted results with baseline score; 3) Unadjusted results with all covariates and baseline score; 4) Adjusted results with no covariates.

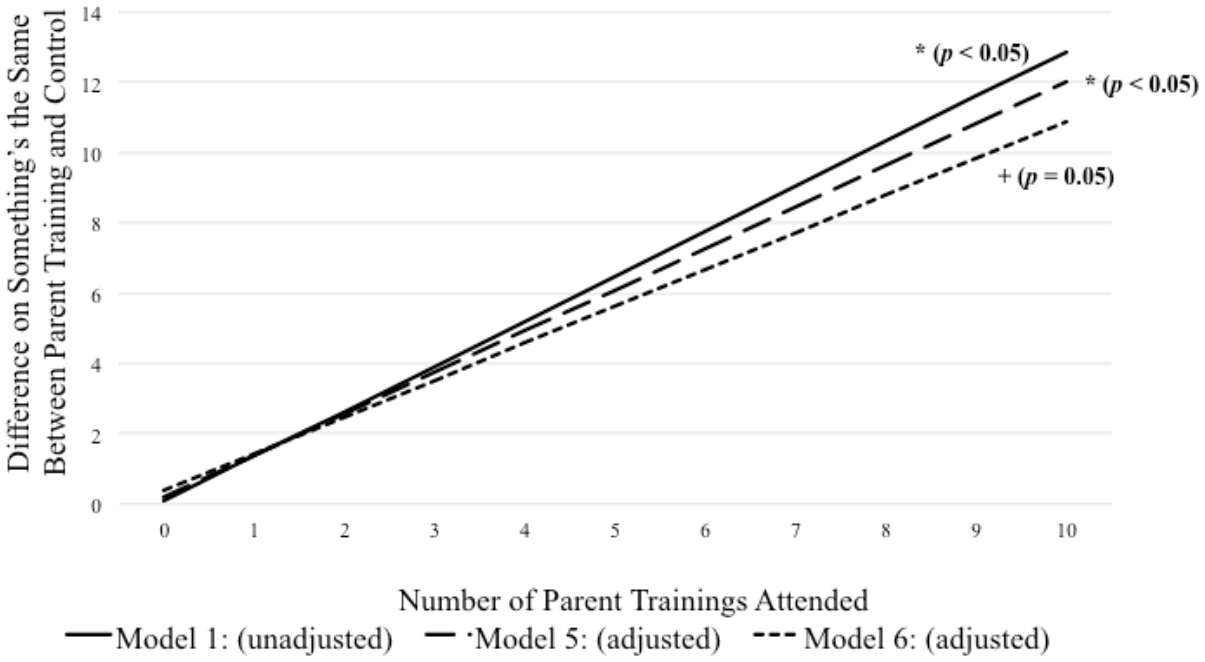

Figure 3: Linear dosage effects for something's the same by parent attendance

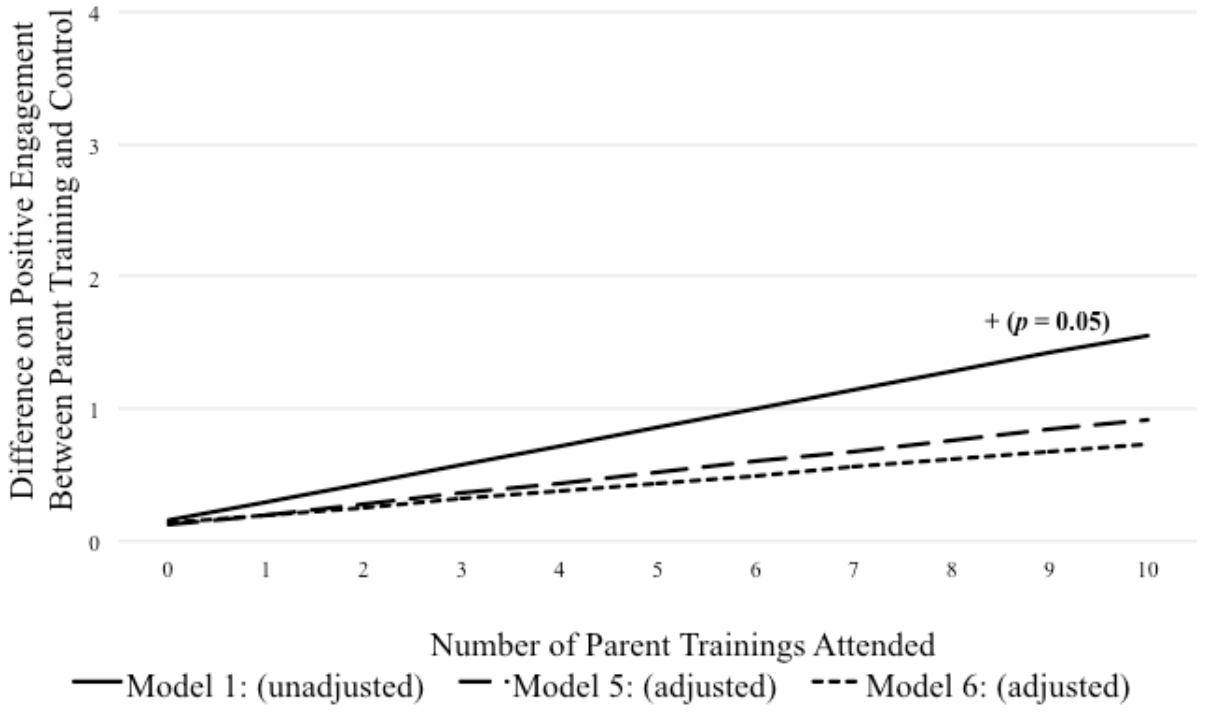

Figure 4: Linear dosage effects for positive engagement by parent attendance

Adjusted dosage – treatment on the treated. Once controls were included in the classroom dosage models, the results changed very little from the unadjusted findings for

all outcomes, with a few exceptions (see effect size Table 31 and middle and bottom panels of Table 20, Table 21, Table 22, Table 23, Table 24, and Table 25 ("Model 5: (adjusted)" and "Model 6: (adjusted)," respectively) for more detailed model information). Specifically, the significant finding on positive engagement for the higher dosage classroom training as compared to the control group was reduced to approaching significance once the full battery of covariates was included in the model ($b = 0.25$; $p < 0.10$ - see middle and bottom panels of Table 21 ("Model 5: (adjusted)" and "Model 6: (adjusted)") for detailed model information). Additionally, a difference between the low dosage classroom group and the control group approached significance for percent correct on the Pencil Tap such that children with lower dosage of the classroom training did somewhat worse than the control group ($b = -0.09$; $p < 0.10$) when baseline Pencil Tap score was the only covariate in the model (see middle panel of Table 29 ("Model 5: (adjusted)") for detailed model information).

In addition, when classroom dosage was treated as a linear variable (i.e., quantity of dosage or number of activity sessions) and allowed to moderate the effects of treatment (i.e., an interaction term of treatment condition by dosage), there were, again, no significant differences as a function of dosage for the EF or positive behavior outcomes (see middle and bottom panels of Table 24 and Table 25 ("Model 5: (adjusted)" and "Model 6: (adjusted)") for detailed model information). Finally, collapsing across treatment groups to account for low parent attendance (i.e., because the Mind Matters parent group also received the classroom activities), does not change the pattern of results with respect to number of sessions children received. In other words, there were no effects of the classroom intervention (i.e., when examined as a linear variable – number

of sessions received) once covariates were included in the model.

Once controls were included in the parent dosage models, results were somewhat different from the unadjusted findings (see effect size Table 32 and middle and bottom panels of Table 25, Table 26, Table 27, Table 28, Table 29, and Table 30 ("Model 5: (adjusted)" and "Model 6: (adjusted)," respectively) for more detailed model information) in both expected and unexpected directions. Specifically, once controlling for baseline performance on the Pencil Tap, a significant finding emerged such that children in the low parent plus dosage group performed slightly worse than children in the control group (b = -0.09; $p < 0.05$ – see Table 26 ("Model 5: (adjusted)") for detailed model information). This result disappeared again once all covariates were included in the model (b = -0.06; $p = 0.18$ – see Table 26 ("Model 6: (adjusted)") for detailed model information). Similarly, once covariates were included in the models, group differences for displays of attentiveness/inhibitory control between the higher parent dosage group and lower parent dosage group disappeared but differences approaching significance between the lower parent dosage group and the control group emerged such that when baseline controls for attentiveness/inhibitory control and the full battery of control variables were entered in the model children displayed less attentiveness/inhibitory control than the control group if their parents attended 4 or fewer trainings (see Table 26 and Table 28 ("Model 5: (adjusted)" and "Model 6: (adjusted)") for detailed model information).

Additionally, the significant finding that the higher parent dosage group displayed significantly less positive engagement than the low dosage group remained when models were adjusted for baseline displays of positive engagement (b = -0.32; $p < 0.05$) but was

reduced to approaching significance when the full battery of controls was included. See middle and bottom panels of Table 29 ("Model 5: (adjusted)" and "Model 6: (adjusted)," respectively) for detailed model information. Moreover, the approaching significant finding between the higher dosage parent group and the control group for Something's the Same disappeared with the addition of covariates (see middle and bottom panels of Table 26 ("Model 5: (adjusted)" and "Model 6: (adjusted)," respectively) for detailed model information). Finally, there were no significant differences as a function of dosage for the Head-to-Toes and Challenging Situations Task measures between the parent dosage groups and, additionally, the control group (see middle and bottom panels of Table 26, Table 27, Table 28, and Table 29 ("Model 5: (adjusted)" and "Model 6: (adjusted)," respectively) for detailed model information).

In addition, when parent dosage was treated as a linear variable and allowed to moderate the effects of treatment, the pattern was somewhat different than the unadjusted findings (see middle and bottom panels of Table 25 and Table 30 ("Model 5: (adjusted)" and "Model 6: (adjusted)," respectively) for detailed model information). Specifically, there was a significant effect in the expected direction for correct responses to Something's the Same ($b = 1.18$; $p < 0.05$) when controlling for baseline score on Something's the Same; in other words, the more sessions parents attended the better their children did on a measure of cognitive flexibility (see middle and bottom panels of Table 30 ("Model 5: (adjusted)" and "Model 6: (adjusted)," respectively) for detailed model information and Figure 3 for a graphical representation). However, this finding was reduced to approaching significance when all covariates were included in the model ($b = 1.05$; $p < 0.10$ – again see middle and bottom panels of Table 30 ("Model 5: (adjusted)"

and "Model 6: (adjusted)," respectively) for detailed model information and Figure 3 for a graphical representation). Finally, the previous unadjusted finding for displays of positive engagement that approached significance disappeared once covariates were included in the models (see middle and bottom panels of Table 25 ("Model 5: (adjusted)" and "Model 6: (adjusted)," respectively) for detailed model information).

Table 31
Classroom Training Dosage

		Classroom Only				
	Control *(N=92)* Mean	Low Dosage *(N=59)* Mean	Higher Dosage *(N=49)* Mean	Difference	Standard Error	Effect Size
Executive function measures						
Somethings the same game (# correct out of 19)	11.89	12.33	12.50	0.17	0.89	0.04
Pencil tap (% correct out of 16)	52.56	43.10	51.59	8.49	0.06	0.25
Head-to-toes (# correct out of 10)	2.87	2.27	3.39	1.12	0.78	0.29
PSRA: Attentiveness/Inhibitory control (out of 4)	3.34	3.27	3.41	0.14	0.10	0.24
Social/Behavioral measures						
Challenging situations task - adaptive problem solving (out of 12)	9.03	8.72	9.13	0.41	0.53	0.21
PSRA: Positive engagement (out of 4)	2.96 [d]	3.02	3.26 [d]	0.23	0.14	0.40

Notes: Standard errors and effect sizes presented are for the full covariate adjusted models for difference between higher and low dosage. *** indicates $p < 0.001$; ** indicates $p < 0.01$; * indicates $p < 0.05$; + indicates $p < 0.10$. Superscript letters indicate statistically significant differences between the dosage variables and the control group such that a indicates $p < 0.001$; b indicates $p < 0.01$; c indicates $p < 0.05$; d indicates $p < 0.10$

Table 32
Parent Training Dosage

		Mind Matters				
	Control *(N=92)* Mean	Low Dosage *(N=86)* Mean	Higher Dosage *(N=20)* Mean	Difference	Standard Error	Effect Size
Executive function measures						
Somethings the same game (# correct out of 19)	11.89	12.06	14.07	2.01	1.14	0.41
Pencil tap (% correct out of 16)	52.56	46.94	49.18	2.24	0.07	0.06
Head-to-toes (# correct out of 10)	2.87	2.80	3.42	0.62	0.84	0.16
PSRA: Attentiveness/Inhibitory control (out of 4)	3.34 [d]	3.20 [d]	3.50	0.30	0.14	0.43
Social/Behavioral measures						
Challenging situations task - adaptive problem solving (out of 12)	9.03	8.50	8.61	0.10	0.54	0.05
PSRA: Positive engagement (out of 4)	2.96	3.13	2.80	-0.33 +	0.17	-0.52

Notes: Standard errors and effect sizes presented are for the full covariate adjusted models for difference between higher and low dosage. *** indicates $p < 0.001$; ** indicates $p < 0.01$; * indicates $p < 0.05$; + indicates $p < 0.10$. Superscript letters indicate statistically significant differences between the dosage variables and the control group such that a indicates $p < 0.001$; b indicates $p < 0.01$; c indicates $p < 0.05$; d indicates $p < 0.10$

Mediation

Despite the null direct effects, possible indirect effects of the treatment on social and behavioral skills as measured by the Challenging Situations Task and the Positive Engagement subscale of the PSRA were examined, but unsurprisingly, none of these

reached statistical significance. Specifically, exploratory analyses for mediation were conducted in two ways using the Barron and Kenny (1986) method within the multilevel model. First, a composite score for EF measures was created by taking the mean of z-scores across all 4 measures (i.e., Something's the Same, Pencil Tap, Head-to-Toes, and Attentiveness/Inhibitory Control). Second, each individual EF measure was also examined as a possible mediator of the relation between intervention group status and adaptive problem-solving strategies or positive engagement.

Using the composite score of all EF measures, no mediation was detected – intervention group did not predict EF skill (b = -0.02; p = 0.79). So the first condition of mediation was not met, and therefore moving forward with subsequent analyses is not advised. Regardless, intervention group approaches significance in predicting adaptive problem-solving skills (i.e., children in the parent training group have lower skills than the control group; b = -0.26; $p < 0.10$) and approaches significance in predicting positive engagement (i.e., children in the classroom group have higher positive engagement than the control group b = 0.17; $p < 0.10$). However, once EF skill was included, EF skill did predict performance on the Challenging Situations Task (and the approaching significant finding for the parent group versus the control group was reduced to non-significance), but not positive engagement. Finally, using the individual EF measures separately, the same pattern of null mediation findings emerged.

CHAPTER 5: DISCUSSION

Using a bioecological framework, the critical importance of executive function (EF) for children's emotional and behavioral regulation, with an emphasis placed on the chaos and stress that poverty can exert on EF and the potential buffering effect that high quality early childhood education (ECE) can exert, was investigated using a two-generation approach addressing these issues across multiple systems. Prior research has theorized EF to be a foundational cognitive system that controls and manages many other cognitive processes related to self-regulation and achievement through three core system elements: working memory, cognitive flexibility, and inhibitory control (Blair & Diamond, 2008; CDCHU, 2011; Hofmann et al., 2012). Infants and young children in poverty are more likely to be exposed to multiple ecological stressors such as residential instability, higher levels of neighborhood and family violence, greater psychological distress among adult caregivers, and a range of other factors that appear to place children's EF, effortful control, and processing of emotional information at risk which compounds over time (Blair et al., 2005; Brooks-Gunn & Duncan, 1997; CDCHU, 2011; NICHD Early Child Care Research Network, 2001, 2002; 2005; McLoyd, 1998; NSCDC, 2005; 2010; Pollack, 2003; Ackerman et al., 1999).

Yet, for these children, the risk may be alleviated through high quality programs (including Head Start) and interventions that target these skills in preschool (Aikens et al., 2013; Bierman et al., 2008; Diamond et al., 2007; Domitrovich et al., 2007; Garces et al., 2002; Izard et al., 2004; USHHS, 2005; Webster-Stratton & Reid, 2004; Zill et al., 2003). However, the findings from classroom-only interventions (e.g., Incredible Years, Tools of the Mind, Head Start CARES) are mixed, although generally positive (Bierman

et al., 2008; Clements et al., 2012; Domitrovich et al., 2007; Diamond et al., 2007; Farran et al., 2013; Izard et al., 2004; Lonigan & Phillips, 2012; Morris et al., 2014; Tominey & McClelland, 2011; Webster-Stratton & Reid, 2004; Webster-Stratton et al., 2001; Wilson & Farran, 2012), leaving policy makers to grapple with how to improve the effectiveness of Head Start and preschool programs more generally in socioemotional and behavioral domains. The current study bridged this gap by evaluating the effectiveness of an intervention aimed at improving EF and emotional and behavioral skills, thereby improving the quality of Head Start.

High quality parenting has been investigated as an additional method for buffering the risks associated with poverty and shown to be among the most critical influences on child emotional and behavioral regulation in infancy and early childhood (Bradley & Corwyn, 2004; Calkins & Johnson, 1998; Calkins et al., 1998; Derryberry & Rothbart, 1997; Kopp, 1982). Additionally, interventions that take two-generation approaches have the potential to improve the well-being and psychological functioning of parents, creating an additional buffer from risk in deprived homes (Babcock, 2012; Sheridan & Floyd, 2013). Moreover, prior research suggests developmental coherence and consistency across home and classroom environments can have greater positive impacts on children, than positive climates in either one alone (Grindal et al., 2016; Neville et al., 2013; Reynolds & Temple, 1998; Reynolds, Temple, Robertson, & Mann, 2001; Webster-Sratton et al., 2001; 2004). Despite the success of these models, interventions that combine parent and classroom training in promoting children's emotional and behavioral regulation and EF abilities have not been widely available nor have the effectiveness of such interventions been widely evaluated. Therefore, given the

importance of both classroom and home influences on children's development of emotional and behavioral regulation skills, it was hypothesized that an intervention that combines the efforts of classroom and parents would show effects above and beyond that of a strictly classroom-based intervention. It was through changes in EF that the intervention was intended to influence children's emotional and behavioral regulation (Ladd et al., 2000; McClelland et al., 2006).

While there was tremendous positive feedback from Head Start parents and staff relating to both interventions, this did not translate into gains for children in the domains of EF, social problem-solving skills, or emotional and behavioral regulation. Overall, results of the current study were null, in part, due to lack of power and small effect sizes. Only one significant difference among the intent to treat model was found – when controlling for a fully battery of covariates and baseline score, children in the parent training group displayed fewer adaptive problem-solving strategies than children in the classroom training group – in the opposite direction of expected results (i.e., that children in the parent training group would show gains above and beyond the classroom training only group on all measures).

However, children receiving optimal dosage of the intervention model was an issue. Children in the classroom training did not receive the full dosage, which sensitivity tests for treatment-on-the-treated indicated may matter. Controlling for baseline positive engagement score, children who received a higher dosage of classroom training displayed better positive engagement at follow-up than control children. While this finding is in the expected direction of effects, it did not hold up after the inclusion of additional covariates. These results (or lack thereof) point to the difficulty of budging EF. It may

require a very high fidelity and dosage to improve EF skills in this group; inconsistent and infrequent trainings are likely inadequate. While prior research on the activities used in the classroom training did find effects of these games in behavioral regulation for children with low-levels of EF skills, a random assignment evaluation of the games failed to produce similar effects on behavior (only for literacy) for the full sample (Tominey & McClelland, 2011). It is possible that these types of activities may not be intensive enough, especially when not performed consistently, to have an impact on children's regulation unless they display very low levels at the outset. Additionally, other studies testing interventions targeting EF skills have also failed to show expected improvements in EF (see Alloway & Alloway, 2009; Borella et al., 2011; Holmes et al., 2009; Horowitz-Kraus & Breznitz, 2009; Morris et al., 2013; 2014; Thorell, Lindqvist, Nutley, Bohlin, & Klingberg, 2008; St. Clair-Thompson et al., 2010; Van der Molen et al., 2010) Finally, prior research indicates that lack of fidelity to intervention dosage, more generally, can affect impact results (Morris et al., 2014).

Similarly, children and parents in the parent training condition did not receive the full dosage. Treatment on the treated models controlling for baseline displays of attentiveness/ inhibitory control indicated that children who received a lower dosage of parent training scored lower than the control group on this measure, and controlling for baseline positive engagement score, children who received a higher dosage of parent training displayed better positive engagement at follow-up than children receiving a lower dosage. While this finding is in the expected direction of effects, there were too few parents in the higher dosage group (N=20) to make any firm conclusions, and these dosage findings did not hold up after the inclusion of additional covariates. Again, prior

research indicates that lack of intervention dosage can affect impact results (Coie et al., 1993; Menting, de Castro, & Matthys, 2013; Morris et al., 2014; Reyno & McGrath, 2005).

While the dosages for classroom activities and parent attendance are low, they are not out of the ordinary for these types of interventions with this population (Chacko et al., 2016). Investigations of the IY curriculum indicate attendance of about 60 percent for participating parents in prevention programs (Baker et al., 2011; Gross et al., 2003; Webster-Stratton et al., 2001), with much higher rates for treatment programs (Menting et al., 2013). Additionally, prior investigations into successful program components for parenting interventions note the lack of reported intervention dosage information in published studies indicating that this type of information is difficult to systematically investigate (Chacko et al., 2016; Kaminski, Valle, Filene, & Boyle, 2008). Moreover, research has shown that it is not only the quantity of participation but the quality – when parents are more actively engaged in the treatment children display better outcomes (Clarke et al., 2015; Nix, Bierman, McMahon, & the Conduct Problems Prevention Research Group (CPPRG), 2009).

Ultimately, parental participation in the parent plus training group was very low (20 out of a possible 100 parents), and there were differences among groups in regards to dosage – parents who participated in the parent plus training tended to be older, more educated, and married. These differences speak to selection effects that might exacerbate existing barriers to participation – the parents that did participate may have felt they needed to because of their prior experience, education, or availability of social support. Prior literature on barriers to parent engagement indicates that participation rates are

typically low for prevention programs with this population (Chacko et al., 2016; Dumka, Garza, Roosa, & Stoerzinger, 1997; Fox & Gottfredson, 2003; Garvey, Julion, Fogg, Kratovil, & Gross; 2006; Gross & Fogg, 2004; Haggarty et al., 2002; Heinrichs, 2006; Perrino, Coatsworth, Briones, Pantin, & Szapocznik, 2001; Prinz et al., 2001; Spoth & Redmond, 1994; 2000; Spoth, Redmond, Hockaday, & Chung, 1996; Stein, Bauman, & Ireys, 1991). Barriers such as lack of child care, lack of transportation, and non standard work schedules can limit parents' ability to participate in programs for their children (Barrera et al., 2002; Baydar, Reid, & Webster-Stratton, 2003; CPPRG, 1999; Irvine, Biglan, Smolkowski, Metzler, & Ary, 1999; Miller-Heyl, MacPhee, & Fritz, 1998; Reid, Eddy, Fetrow, & Stoolmiller, 1999). Additionally, when parents do not feel welcome or comfortable in their child's school, they are less likely to participate in programs associated with it (Baker, Denessen, & Brus-Laven, 2007; Blank, Berg, & Melaville, 2006; Boethel et al., 2003; Caspe & Lopez, 2006; Child Trends, 2010; Ferguson, Ramos, Rudo, Wood, 2008; Henderson, Mapp, Johnson, & Davies, 2007; Hong & Longo, 2013; Hoover-Dempsey & Sandler, 1997; Jordan et al., 2001; Lawrence-Lightfoot, 2003; Mapp & Hong, 2010; NASEM, 2016; Smith, Kuzin, De Pedro, & Wohlstetter, 2009; Stewart, 2008; Warren, Hong, Rubin & Uy, 2009). From a practice standpoint, alleviating these barriers could increase parent participation rates in programs similar to those tested here.

Contributions to the Literature

Even with a lack of significant findings, this dissertation makes a contribution to the literature. First, in the early childhood field, there is a general lack of support for parents and providers of early care and education to deal with children's behavioral issues (NSCDC, 2004). The current study was designed to help remedy this. Specifically,

the present study targeted two issues that are central to the Head Start mission. First, the present study was aligned with the National Head Start Association's (NHSA) recently started *Two Generations Together* initiative with the express goal to pair child-targeted school readiness approaches with intensive and intentional supports for adults (NHSA, 2014). Second, the project was aligned with the more general focus in Head Start on family engagement and family well-being, as a route to child well-being and an important outcome in its own right. The interventions evaluated had the potential to positively impact the classroom and home environments such that there would be less conflict and more positive interactions.

More generally, the present study was designed to inform research and practice debates about the kinds of intervention models that best increase children's emotional and behavioral regulation. Specifically, this dissertation sought to address critical gaps in the field and our current understanding of Head Start children by rigorously evaluating a two-generation model for improving emotional and behavioral regulation through training in EF. Beyond the general applied science question of whether children benefit more from combining classroom and parent models than from classroom-based approaches alone, the present study intended to help identify new models (or core model components) for teachers and parents efforts aimed at school readiness skills. Consistent with Head Start aims, the study was designed to involve parents in their children's development in a manner that is directly connected to activities that would take place in the classroom, thereby promoting opportunities for greater parental engagement in the classroom and richer collaborations between parents and classroom teachers in their children's Head Start experiences. Ultimately, this study highlighted the existing barriers

that these parents face to participation in programs offered by Head Start.

In fact, the greatest contribution of this dissertation to the literature may be the identification of certain factors that influence parent and teacher participation in intervention efforts. With regards to professional development, it is important to understand factors that influence whether or not teachers will follow prescribed curricula or have the capacity (either conceptually or time management-wise) to implement new programs. Prior research indicates that without proper supports and "buy-in" or commitment from teachers new programs or curricula do not reach their intended effects (LaChausse, Clark, & Chapple, 2014; Morris et al., 2014; O'Dwyer & Atli, 2015; Sandholtz & Scribner, 2006; Yoshikawa et al., 2015). Additionally, when teachers or centers do not have the capacity to understand and teach the concepts provided in an intervention or enough time in the schedule to implement changes, interventions may not be as successful (Domitrovich et al., 2015; Dymnicki, Wandersman, Osher, Grigorescu, & Huang, 2014; Malloy et al., 2015; Peterson, 2012; Roberts et al., 2015; Wanless & Domitrovich, 2015; Williford, Wolcott, Whittaker, & Locasale-Crouch, 2015). This dissertation adds to this literature by demonstrating that without this critical participation, as indicated by low rates of activities conducted in the classroom, ability to detect effects may be hampered.

With regards to parent participation and engagement, it is important to understand the factors that influence whether or not parents will participate in programs designed to improve their own or their children's skills and engagement in their child's learning. Prior literature on barriers to parent engagement indicates that participation rates are typically low for prevention programs with this population and barriers include lack of

child care, lack of transportation, lack of community engagement within the school, and non-standard work schedules (Baker et al., 2007; Barrera et al., 2002; Baydar, Reid, & Webster-Stratton, 2003; Blank et al., 2006; Boethel et al., 2003; Caspe & Lopez, 2006; Child Trends, 2010; Ferguson et al., 2008; Fox & Gottfredson, 2003; Garvey et al.; 2006; Gross & Fogg, 2004; Haggarty et al., 2002; Heinrichs, 2006; Henderson et al., 2007; Hong & Longo, 2013; Mapp & Hong, 2010; Perrino et al., 2001; Prinz et al., 2001; Spoth & Redmond, 1994; 2000). Anecdotally, lack of community engagement and positive school climate were two factors mentioned by parents as reasons why they did not participate in the present study. This dissertation adds to this body of literature by demonstrating that even if parents believe in the importance of knowledge and understanding new ways to improve their children's development (as evidenced by the high initial recruitment rates), factors such as community engagement and structural barriers may prevent them from doing so.

Limitations and Future Directions

The lack of significant impacts could be interpreted as an indication that the two interventions tested in this dissertation are not strong enough to produce positive changes for children and therefore should be scrapped in favor of other interventions. However, caution should be used when interpreting these null results due several limitations of the current study. First, while this dissertation employed the "gold standard" research design, an RCT, due to low teacher and parent survey response rates, the ability of the current study to identify mechanisms through which the interventions may or may not have had an impact on behavior was limited. Second, there was a potential lack of power to detect effects due to the low dosage rates of both the intervention groups (i.e., lack of classroom

training implementation fidelity and lack of parent participation). Third, there is debate in the field over the reliability of current measures of EF and if they actually or accurately capture children's abilities in this domain. While the measures selected and used in the current study have all been used in prior research, they may not have captured children's EF skills. Fourth, the financial and manpower resources needed to conduct an RCT of this scale in the field were not available. This could have influenced any number of important factors from fidelity to data collection. Finally, random assignment may not have been completely successful due to statistically significant differences between the groups on child age and gender. This baseline non-equivalence could have had an effect on the impact results.

Future directions of this research will follow two tracks. First, the teacher and parent report data will be analyzed. These additional data beyond the direct child assessments may demonstrate other areas in which the intervention might have been beneficial to families and children. For example, prior research on the Mind Matters curriculum has indicated that after participation parents rated less conflict in the home (Sheridan & Floyd, 2011). This dissertation also collected information on this construct (i.e., the Conflict Tactics Scale) and will try to replicate the non-experimental findings.

Second, to further ascertain the specific factors influencing teacher and parent participation, a qualitative follow-up study is planned for a random sample of staff and parents from all three groups. Recruitment for qualitative interviews will begin in February 2017. Questions about community connectedness and engagement as well as about study participation and barriers will be asked during the semi-structured interviews. Analysis of qualitative data will take place during the spring and summer of 2017.

Implications for Policy and Practice

The information from this study will be shared with the Action for Boston Community Development Head Start Program, which may help Head Start teachers and parents to best support children's individual competencies and needs and improve children's social and emotional development. Because of the range and scope of information collected on the Head Start families, these data can be used to inform staff and parents about the current state of their students leading to discussions about and solutions for issues relevant to this population.

Moreover, review of the proposed changes to the Head Start performance standards indicate a number of areas in which this dissertation can inform policy and practice. First, this dissertation focuses on two of the four central elements for delivering high quality education and services: teaching practices and the learning environment and parent involvement. By identifying the factors that restrict these elements it may help practitioners as they are attempting to implement the new standards and understand how important a sense of community is to parent involvement. Second, a new section of the standards focus on family and community partnerships, which require programs to integrate parent and family engagement strategies into all systems and program components and include new requirements that emphasize using research and best practice to inform these efforts. However, there is little to no discussion about the importance of using evidence-based research and rigorously tested interventions when selecting these partnerships and programs. This dissertation speaks to the need to pay attention to research and proven interventions. Additionally, the difficulty of this study with parent participation and identification of factors that influence family engagement

can help programs select community partnerships that alleviate the barriers experienced by families.

Conclusion

Overall, this dissertation extends the literature on program implementation and interventions targeting children's EF and social problem solving skills and emotional and behavioral regulation in early childhood in important ways. Key take away points from this research are that fidelity to implementation models and barriers to parent engagement are important factors to consider when doing field research, particularly within the Head Start context. A better understanding of the measures that evaluate children's skills in key developmental domains and the mechanisms that influence children's development of emotional and behavioral regulation across home and school contexts would advance the research in this field. Ultimately, further investigation is needed of a wide range of varied intervention models to improve preschool program quality for children experiencing the greatest need.

CHAPTER 6: REFERENCES

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Appendix A

Supplemental Tables

Appendix Table A.1
Full Compliment of Measures Collected for Current Study

Construct	Measure	Assessment Type	Range of Effect Sizes	Time Point Assessed	
				Pre-Intervention	Post-Intervention
Emotional Reg.	Challenging Situations Task (CST; Denham, Bouril, & Belouad, 1994)	Direct Child	-0.21-0.35	X	X
Emotional Reg.	Adapted Leiter-R Assessor Report (Smith-Donald, Raver, Hayes & Richardson, 2007)	Observer Report		X	X
Emotional Reg.	Social Competence Scale (Conduct Problems Prevention Research Group, 1995)	Teacher or Parent Report	-0.38-0.58	X	X
Behavioral Reg.	Challenging Situations Task (CST; Denham, Bouril, & Belouad, 1994)	Direct Child	-0.21-0.35	X	X
Behavioral Reg.	Behavior Problems Index (BPI; Zill & Peterson, 1986)	Teacher or Parent Report	-0.44-0.52	X	X
Behavioral Reg.	Positive Behavior Scale (Quint, Bos, & Polit, 1997)	Teacher or Parent Report	0.00-0.59	X	X
Behavioral Reg.	Adapted Leiter-R Assessor Report (Smith-Donald, Raver, Hayes & Richardson, 2007)	Observer Report		X	X
Behavioral Reg.	Social Competence Scale (Conduct Problems Prevention Research Group, 1995; 1999)	Teacher or Parent Report	-0.38-0.58	X	X
Executive Function	Head-to-Toes (Cameron et al., 2008)	Direct Child	0.37	X	X
Executive Function	Pencil Tap Task (Diamond & Taylor, 1996)	Direct Child	-0.28-0.05	X	X
Executive Function	Something's the Same Game (Willoughby et al., 2010)	Direct Child	-0.01	X	X
Executive Function	BRIEF-P Questionnaire (for preschool children) (Gioia et al., 2002)	Teacher or Parent Report	0.01-0.43	X	X
Behavioral Reg.	Adapted Leiter-R Assessor Report (Smith-Donald, Raver, Hayes & Richardson, 2007)	Observer Report		X	X
Executive Function	Executive Functions Questionnaire (for adults) (EFQ; Wenner, Jacobs, & Nagaran, 2007)	Parent Report	0.19	X	X
Parent Child Interaction	Conflict Tactics Scale (CTS; Straus et al., 1998)	Parent Report	-0.34-0.14	X	X
Parent Functioning	K-6 Kessler Psychological Distress Scale (K-6; Kessler, Andrews & Colpe, 2002)	Parent Report	-0.17-0.15	X	X
Parent Functioning	Parenting Stress Index (PSI; Abidin, 1983)	Parent Report	0.76-2.02	X	X
Family Characteristics	Survey: demographic information, including racial and ethnic background, family structure, household composition, marital status, maternal levels of educational attainment, and maternal employment	Parent Report	n/a	X	
Parent Learning	Survey developed by Sheridan to assess knowledge gained over 10 week Mind Matters Training	Parent Report	n/a		X

Appendix Table A.2

Items and Factor Loadings for the PSRA Assessor Reported Subscales

	Factor Loading	
Item in Total Scale	Attentiveness/ Inhibitory Control	Positive Engagement
Pays attention	0.89	
Careful	0.83	
Sustains concentration	0.81	
Daydreams	0.76	
Distracted by sights	0.78	
Destructive with materials	0.79	
Thinks and plans	0.83	
Refrains from touching	0.81	
Does not interrupt	0.76	
Difficulty waiting	0.82	
Remains in seat	0.72	
Alert and interactive	0.67	
Cooperates and complies	0.84	
Defiant	0.77	
Passively noncompliant	0.84	
Regulates arousal in self	0.77	
Shows intense irritability	0.70	
Shows frequent irritability	0.65	
Aggressiveness aggregate 0-3	0.64	
Actively engages interviewer		0.77
Shows pleasure in accomplishment		0.69
Confident		0.67
Shows intense positivity		0.79
Shows frequent positivity		0.77
Shows intense apprehension		
Shows frequent apprehension		
Cronbach coefficient alpha for scale	0.94	0.86

Notes: A three-factor structure was used to identify subscales. Only factor loadings greater than or equal to |.30| are shown, based on factor analysis. Factor loadings indicate items that were used to create the respective scales. Items were included on the factors on which they most highly loaded. A third subscale was not used in this study.

Appendix Table A.3
Correlations Table

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1 Child age (months)	1																				
2 Child gender	-0.03	1																			
3 Parent age (years)	0.00	0.05	1																		
4 Marital status	-0.03	-0.07	0.26 **	1																	
5 Education level	0.09	0.04	0.08	-0.06	1																
6 Primary language	-0.08	-0.04	0.12 *	0.42 ***	-0.21 *	1															
7 Child race/ethnicity	-0.07	-0.02	-0.02	0.11	-0.02	0.33 ***	1														
8 SS baseline	0.35 ***	-0.02	-0.03	0.04	0.07	-0.06	-0.02	1													
9 PT baseline	0.53 ***	0.02	-0.04	-0.02	0.00	-0.03	-0.02	0.37 ***	1												
10 HT baseline	0.41 ***	0.06	-0.03	-0.02	0.05	0.00	0.05	0.18 **	0.38 ***	1											
11 CST_aps baseline	0.29 ***	-0.07	-0.05	0.07	0.05	-0.09	0.18 *	0.30 ***	0.27 ***	0.19 **	1										
12 IC baseline	0.33 ***	0.03	-0.05	0.05	0.00	0.10 +	0.12	0.44 ***	0.47 ***	0.16 **	0.19 ***	1									
13 PE baseline	0.25 ***	-0.01	-0.05	-0.11	0.03	-0.08	-0.05	0.15 **	0.19 **	0.16 **	0.14 *	0.14 *	1								
14 LA baseline	0.06	0.11 +	-0.10	0.00	-0.10	0.16 **	0.15 +	0.15 **	0.24 ***	-0.03	0.14 *	0.59 ***	0.11 +	1							
15 LW baseline	0.17 **	-0.02	-0.02	0.03	-0.02	0.04	-0.05	0.22 ***	0.06	0.03	0.09	0.26 ***	0.25 ***	0.13 *	1						
16 SS follow-up	0.40 ***	0.03	-0.01	-0.02	0.01	0.00	0.04	0.44 ***	0.42 ***	0.33 ***	0.21 ***	0.39 ***	0.18 **	0.12 +	0.11 +	1					
17 PT follow-up	0.52 ***	0.03	0.03	-0.11	0.18 *	-0.04	0.01	0.46 ***	0.68 ***	0.39 ***	0.22 ***	0.44 ***	0.28 ***	0.14 *	0.18 **	0.46 ***	1				
18 HT follow-up	0.49 ***	0.00	0.03	0.10	0.16 +	0.01	-0.06	0.34 ***	0.48 ***	0.57 ***	0.23 ***	0.29 ***	0.22 ***	0.06	0.12 +	0.38 ***	0.54 ***	1			
19 CST_aps follow-up	0.24 ***	-0.12 +	0.02	0.00	0.13	0.07	0.06	0.09	0.21 **	0.20 **	0.26 ***	0.12 +	0.10	-0.04	0.00	0.22 ***	0.21 ***	0.19 **	1		
20 IC follow-up	0.35 ***	0.07	-0.03	0.04	0.09	0.10 +	0.04	0.33 ***	0.42 ***	0.21 **	0.17 **	0.67 ***	0.20 **	0.39 ***	0.23 ***	0.47 ***	0.49 ***	0.28 ***	0.23 ***	1	
21 PE follow-up	0.00	-0.07	-0.07	-0.13	0.12	-0.07	-0.01	0.02	-0.05	0.05	0.04	-0.20 **	0.33 ***	-0.18 **	0.01	0.06	0.02	0.07	0.05	-0.03	1

Notes: Significance indicated for pair-wise correlations *** p-value < 0.001, ** p-value < 0.01, * p-value < 0.05, + p-value < 0.10. Abbreviations are as follows: SS=Something's the Same, PT=Pencil Tap, HT=Head-to-Toes, CST_aps=Challenging Situations Task - adaptive problem solving, IC=Attentiveness/Inhibitory Control, PE=Positive Engagement, LA=Low Anger/Aggression, LW=Low Worry/Anxiety