A Randomized-Controlled Trial of Mindfulness and Executive Function Trainings to Promote Self-Regulation in Internationally Adopted Children

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Abstract

While children adopted internationally show remarkable recovery once placed in families, as a group these children continue to show delays in certain aspects of development years after adoption. In particular, the area that seems to show the most lasting, and sometimes profound deficits is children's self-regulation. The current study uses a randomized, controlled trial to evaluate the effects of mindfulness-based and executive function trainings on internationally adopted (IA) children's self-regulation, including inhibitory control, attention, and emotion regulation. Seventy-two IA children ages 6-10 were randomized into Mindfulness training (MT), Executive Function training (EF), or no intervention (NI) groups. The MT and EF groups attended 12 one-hour group sessions. Children in both intervention groups showed fewer hyperactivity and attention problems and showed better emotion regulation in the classroom, as rated by teachers blind to group status. The EF training was more successful in improving inhibitory control, while the MT group may have improved in delay of gratification. Both interventions improved selective attention in children with poor baseline regulatory functioning. Parent-reported behavior did not significantly change in any domain. Contrary to expectations, the mindfulness intervention did not improve perspective taking skills or prosocial behavior. Implications and future directions are discussed.

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A Randomized-Controlled Trial of Mindfulness and Executive Function Trainings to Promote Self-Regulation in Internationally Adopted Children

Early life stress in the form of institutional deprivation or neglect has profound and lasting impacts on child development (see O'Connor, 2006; Cicchetti & Valentino, 2006). Globally, UNICEF estimates that there are currently more than sixteen million orphaned children (The United Nations Children's Fund, 2004), many of whom spend a significant portion of their early lives in institutions. Beginning in the 1990s, Western families began to adopt increasing numbers of children from institutions overseas in a natural experiment of the potential for families to reverse any negative impacts of early deprived care (Gunnar, Bruce, & Grotevant, 2000). While most internationally adopted (IA) children do well, as a group they are at risk for a plethora of negative psychological outcomes, including social and emotional deficits, cognitive delays, behavior problems, and psychopathology (e.g. Gunnar & van Dulmen, 2007).

Researchers have been exploring institutional deprivation since the time of Spitz (1946) and Goldfarb (1944; for review see MacLean, 2003). Early studies showed overwhelming deleterious effects for children living in institutions. Rutter (1972) adeptly pointed out that many of these outcomes could be due to general privation (i.e. lack of proper nutrition, stimulation, medical care) as opposed to caregiver deprivation/emotional neglect. Emotional neglect refers to the lack of a *consistent* and responsive caregiver who provides for the social and emotional needs of the infant or child. Many children raised in institutions or foster care experience physical neglect and/or abuse in addition to emotional neglect, so it is often difficult to disentangle the effects. Tizard and colleagues

(Tizard & Rees, 1975; Tizard & Hodges, 1978) were able to examine the differential effects of early emotional neglect by studying children in "model" institutions that provided adequate nutrition, medical care, and stimulation, but which had high caregiver turnover. They found that cognitive and language development proceeded normally in these children, with no lasting deficits in IQ. However, other areas of development showed disturbances despite these "ideal" circumstances. Children's self-regulation, including inhibitory control, attention, and emotion regulation, was negatively impacted by the lack of a consistent caregiver early in life, and these deficits persisted long after the children were removed from the institution (Tizard & Hodges, 1978). Children adopted from foster care overseas and children in domestic foster care also show lasting deficits in areas of self-regulation (e.g. van der Kolk & Fisler, 1994; Kim & Cicchetti, 2010; Wiik et al., 2011) supporting the idea that it is inconsistent caregiving, rather than general privation that leads to these deficits. While also seen in children experiencing ongoing adversity (such as children in domestic foster care), it seems that emotional neglect during the first year of life, even if followed by quality caregiving, is sufficient to affect regulatory functioning, suggesting a sensitive period for the development of the systems underlying regulation.

These self-regulation deficits likely contribute to other lasting effects, such as behavior problems, psychopathology and peer difficulties (see review, Gunnar, 2001). This negative impact on children's capacity for self-regulation is a key mechanism by which early emotional neglect exerts the most profound and lasting effects. Therefore,

interventions should target self-regulation in these populations in order to have the most positive effect on global outcomes.

The current study investigated the impacts of two interventions designed to promote self-regulation in a group of school-aged IA children. This paper begins with a brief overview of the normative development of self-regulation, followed by a review of the effects of early emotional neglect on self-regulation and the preliminary evidence of the mediating role of self-regulation on other negative outcomes. Next, I review the existing literature on interventions designed to promote self-regulation, including the promising evidence for executive function training and mindfulness-based interventions. Finally, I will describe the specific aims, method, and results of the current study and discuss conclusions and future directions for the field.

Self-regulation and Development

Definitions. There is no universally accepted definition of self-regulation; in fact the concept has many different definitions, often depending on the theoretical perspective under which it is studied (Berger, 2011). Self-regulation can refer to a dimension of temperament (e.g. Eisenberg, Hofer, & Vaughan, 2007), to a set of cognitive processes involved in higher order control (i.e. executive functions; e.g. Baumeister & Vohs, 2003), or to the physiological regulation of the stress response (e.g. Blair, 2010). For the current purposes, *self-regulation* refers to the developing capacity for self-control of thought, behavior, and emotion. While self-regulation involves regulation at both physiological and behavioral levels including regulation of the stress response, the current investigation will focus on self-regulation at the level of observable behavior, such as attention,

inhibitory control, and emotion regulation. Even at the behavioral level of analysis, self-regulation includes both automatic and conscious, effortful processes.

Successful self-regulation is supported by both top-down and bottom-up influences, in a bidirectional system (Blair & Ursache, 2011). Top-down processes involve neurocognitive aspects such as attention and working memory (or collectively, executive functions) while bottom-up influences refer to emotion and arousal states (such as chronic stress), which may interfere with an individual's ability to utilize cognitive regulatory abilities (e.g. Zelazo & Lyons, 2012). A balance of both aspects is necessary for successful self-regulation (Blair & Urasche, 2011).

The sub-processes involved in self-regulation at a behavioral level are as follows. *Selective attention* is the ability to focus on targeted stimuli in the environment while ignoring extraneous stimuli. This is useful in a day-to-day context, for example in a school setting where a child needs to focus his or her attention on the teacher and ignore the talking at the back of the room, the children in the hallway, and the traffic outside the window. It is also a useful strategy involved in the other aspects of self-regulation, such as diverting ones attention from emotion eliciting stimuli in order to regulate emotions. *Inhibitory control* refers to the ability to inhibit an automatic or prepotent response, while *activational control* refers to the ability to effortfully activate behavior as needed, especially in the context of competing motivations. Both are needed to successfully navigate everyday life, such as when a child inhibits his impulse to hit a peer who took his toy, or when a child forces herself to complete homework. *Delay of Gratification* involves forgoing an immediate reward for the promise of a greater future reward. It is a

complex skill that involves various other aspects of self-regulation such as inhibitory control and attention. *Emotion regulation* is the self-control of the intensity and temporal characteristics of an emotional response to modulate one's emotional arousal for optimal engagement with the environment (Cicchetti, Ganiban, & Barnett, 1991; Thompson, 1994). Failure of emotion regulation is implicated in numerous forms of psychopathology (Zeman, Cassano, Perry-Parrish, & Stegall, 2006).

While cognitive and emotional processes are often considered separately in developmental research, they are inextricably tied in the case of self-regulation (Bell & Wolfe, 2004). For example, individual differences in young children's inhibitory control skills are associated with their ability to regulate their emotions (Carlson & Wang, 2007). As previously mentioned, attention is also involved in emotion regulation strategies. In addition, adequate emotion regulation is necessary for the proper control of cognition and behavior.

Normative Development of Self-Regulation. In the first months of a child's life, he or she is incapable of regulating his or her own arousal or emotional states in the absence of a caregiver. While the infant can signal distress, it is up to the caregiver to sensitively respond to this signal in order for the infant to be well-regulated (Sroufe, 2000). As children mature, they are capable of actively participating, such as reaching their arms to the caregiver to be picked up, but they still need the caregiver to act accordingly. It is not until much later that children are responsible for independently regulating their own emotions and behavior. Therefore, the normative development of

self-regulation can be conceptualized as a shift from external, to dyadic, to internal regulation.

As such, the foundation of self-regulation originates within early caregiver-child relationships. More conscious and effortful forms of self-regulation build upon unconscious and automatic processes, such as physiological regulation (Calkins & Hill, 2007). Research in animal models indicates that caregiving received in the first months of life shapes the child's biological systems involved in regulation of the stress response, with implications for the structure and function of brain areas important for the self-regulation of cognition and behavior (Meaney, 2001). In a study of rat pups and their mothers, Hofer (1994, 2006) demonstrated that a mother's functions in providing nutrients, warmth, and sensorimotor stimulation independently explained different aspects of the pup's distress at separation. This suggests that the presence of a caregiver is biologically necessary for infant regulation, and that formation of this relationship likely involves the regulatory interactions between the mother and her offspring. Likewise, tactile stimulation in humans, for example "kangaroo care," has been shown to increase premature infant's abilities to regulate sleep patterns, temperature and arousal (Feldman, Weller, Sirota, & Eidelman, 2002; Ferber & Makhoul, 2004). In addition, holding and rocking are frequently used techniques for reducing infant distress in typically-developing populations (Jahromi, Putnam, & Stifter, 2004). At this stage, the infant can employ instinctual mechanisms for modulating arousal, such as turning away from the source of stimulation (Kopp, 1982). They also learn the association between caregivers and distress termination, in that infants begin quieting in apparent anticipation

of a caregiver when they can hear the approaching footsteps (Gekoski, Rovee-Collier, & Carulli-Rabinowitz, 1983).

As infants mature and become more involved in the regulatory process, dyadic regulation emerges in the form of an attachment relationship. Schore (2000, p. 23) states "Attachment theory… is fundamentally a regulatory theory. Attachment can thus be conceptualized as the interactive regulation of synchrony between psychobiologically attuned organisms." The caregiver responds to bids by the infant in a way that gradually increases the child's tolerance for arousal and distress, while simultaneously keeping the infant within acceptable bounds for organized behavior (Sroufe, 2000; Gianino & Tronick, 1988). This modulated yet flexible emotional responding is essential for development of brain systems underlying self-regulation (e.g. Schore, 1994). In addition, caregivers model strategies for self-regulation that are internalized in the child, for example utilizing attentional distraction as a means of regulating arousal (Harman, Rothbart, Posner, 1997; Spinrad, Stifter, McCall, & Turner, 2004). Parents help in other ways too, such as using mental state and emotional language and providing support and structure in response to child distress, which enable the child to more successfully understand and regulate their own emotions, and are related to executive functioning (Cole, Dennis, Smith-Simon, & Cohen, 2009; Bernier, Carlson, & Whipple, 2010). Together, these ensure that the child is physiologically and behaviorally prepared for environmental challenge (Sroufe, 2000). Longitudinal studies have confirmed the relationship between early caregiving and later self-regulation. Children who received responsive, sensitive care as infants were rated by teachers as better able to regulate their

emotions and behavior in preschool (Sroufe, 1983). Parental sensitivity and mental state language in infancy is also related to child executive functioning several years later (Bernier et al., 2010). In particular support of the concept of attachment as a regulatory system, attachment security measured at 15 and 24 months of age predicted executive functioning at 3-years-old, over and above child verbal ability and prior executive functioning, family socioeconomic status (SES), and observed parenting behavior (Bernier, Carlson, Deschenes, & Matte-Gagne, 2012).

While the first year of life is essential for creating a foundation for self-regulation, the preschool to early school years mark an important developmental period for the internalization of self-regulation. Parents continue aiding the child throughout this stage, for example by structuring children's experiences proactively to make situational demands predictable and manageable. However, the child is increasingly responsible for their own regulation, as they develop autonomy and begin spending a majority of their time away from their primary caregiver. As key brain areas are maturing, building on the structures and connectivity established during the first few years, children in this age range are capable of directing attention, inhibiting prepotent responses, complying with adult requests, and modulating their own emotional reactions (for review, see Zelazo & Muller, 2002). Wide individual differences are evident at this age, many associated with typical variations in parenting (e.g. Calkins & Johnson, 1998). Self-regulation continues developing at a decelerating rate throughout childhood and adolescence (e.g. Williams, Ponesse, Schachar, Logan, & Tannock, 1999).

Importance of Self-Regulation. The ability to successfully regulate cognition, emotions, and behavior is essential for positive development. Self-regulation has been cited as one of the most important individual differences in predicting school readiness (e.g. Ursache, Blair, & Raver, 2012). Self-regulation in preschool is strongly predictive of children's academic school readiness, including math and literacy skills, over and above measures of general cognitive ability (Blair & Razza, 2007). Deficits in self-regulation (particularly executive functioning skills) are related to grade retention and decreased academic achievement (Beiderman et al., 2004). Parent ratings of emotion regulation also predict math and reading ability in kindergarten (Graziano, Reavis, Keane, & Calkins, 2007), and children more competent in emotion regulation are perceived by teachers as being more academically and socially competent than children who struggle with emotion regulation (Denham, 2006). It follows that self-regulation has been cited as a target for interventions to prevent school failure (Blair & Diamond, 2008).

One of the most impressive predictors of long-term outcomes is delay of gratification, or an individual's ability to postpone immediate gratification in favor of long-term outcomes, an aspect of behavioral regulation (Mischel, Shoda, & Rodriguez, 1989). Delay of gratification is often measured in preschool using the marshmallow task, where a child is asked to wait several minutes without eating one marshmallow in order to receive a second marshmallow. Remarkably, children who were better able to delay gratification in preschool were rated by parents years later as more socially and academically competent, more capable of dealing with stress, and better at planning in adolescence (Mischel, Shoda, & Peake, 1988). Children who delayed also had higher

SAT scores (Shoda, Mischel, & Peake, 1990) and showed better physical health, higher socioeconomic status, less substance dependence, and less criminality in adulthood (Moffit et al., 2011). In another example of the interconnectedness of the self-regulation network, attentional processes are intricately involved in successful delay of gratification (Mischel, Ebbesen, & Raskoff Zeiss, 1972).

Interestingly, even though several interventions have proved successful in improving other areas of self-regulation, no intervention to date has successfully improved children's delay of gratification abilities (Diamond, 2012). This may suggest that delay of gratification is supported primarily by temperamental individual differences that are less malleable to intervention. Contrary to this hypothesis, however, children exposed to early adversity exhibit a decreased competence to delay gratification (Hostinar et al., 2012), indicating that the environment does indeed impact this ability. It is possible that early environments shape this competency, but that plasticity decreases past a certain sensitive period. Alternatively it is possible that previous interventions that have tested delay of gratification as an outcome did not practice the skills necessary for this ability. See below for further discussion.

Self-regulation is also implicated in a number of socio-emotional outcomes. For example, executive functioning (including working memory, inhibitory control, and set shifting) is related to children's theory of mind understanding, or the ability to understand other's thoughts, emotions, and beliefs (Carlson & Moses, 2001). Theory of mind is an essential skill for positive social development and peer interactions (e.g. Slaughter, Dennish, & Pritchard, 2002). Self-regulation in preschool, including attentional and

behavioral control, also predicts emotion knowledge several years later (Schultz, Izard, Ackerman, & Youngstrom, 2001), an important marker of socioemotional development.

Conversely, deficits in or failure of self-regulation have been implicated in "nearly every major personal and social problem" (Vohs & Baumeister, 2004, p. 3). For example addictive problems (alcoholism, drug addition, gambling), obesity, school dropout, and violence can all be attributed to some type of failure of self-regulation (for review see Berger, 2011). Self-regulation and emotion regulation, in particular, have also been implicated in multiple forms of psychopathology (e.g. Mullin & Hinshaw, 2007). Attention Deficit and Hyperactivity Disorder (ADHD) has been characterized as primarily a deficit in executive function and behavioral self-regulation (e.g. Nigg, 2006). Failure to properly regulate feelings of sadness and worry has been implicated as a cause of internalizing problems, whereas failure to properly regulate feelings of anger and frustration has been implicated in externalizing problems (e.g. Cole, Michel, & Teti, 1994; Zeman, Cassano, Perry-Perrish, & Stegall, 2006). Clearly adequate self-regulation is of critical importance for healthy development.

Impact of Early Emotional Neglect on Self-Regulation

Because of the crucial importance of early child-caregiver relationships, it follows that early emotional neglect has profound and lasting impacts on children's self-regulation. It is important to note, however, that the range of outcomes is as striking as the increase in risk of poorer outcomes. Even under conditions of horrifically neglectful early care, a remarkable percentage of children appear resilient, and have no lasting significant problems. At the same time, some children adopted from foster care overseas

at quite young ages (e.g. 3-12 months) can show deficits when compared with non-adopted children (e.g. Bruce, Tarullo, & Gunnar, 2009; Lawler, Hostinar, Mliner, & Gunnar, 2014). The heterogeneity of outcomes for emotionally neglected children reflects a well-known phenomenon termed multifinality in developmental psychopathology (Cicchetti & Rogosch, 1996). Multifinality is the concept that one etiologic factor can lead to any of many possible outcomes, depending on the person and context. This resiliency can inform development of interventions to promote functioning, and also cautions us to avoid limiting expectations for the development of the individual child based on evidence from group analyses.

The impacts of early emotional neglect on self-regulation can be seen at multiple levels of analysis. While the current study examines behavioral-level outcomes in children, it is important to recognize the physiological underpinnings of self-regulation, as well. This will allow for a better understanding of the mechanisms of impact of early emotional neglect and the potential mediators of intervention effects. For example, children living in institutions (Carlson & Earls, 1997) as well as maltreated children (De Bellis, et al., 1999) show abnormal HPA regulation. Children experiencing institutional deprivation do not show the typical daily cortisol rhythm, instead showing flattened slopes in cortisol levels across the day (Carlson & Earls, 1997). After adoption, the normal rhythm begins to be re-established, but children adopted from institutions continue to show lower morning cortisol levels or a less marked diurnal rhythm, especially if they were growth delayed at adoption (e.g. Johnson, Bruce, Tarullo, & Gunnar, 2011). Similar abnormal patterns have been seen in children in foster care,

particularly if they experienced early histories of more severe neglect (Bruce, Fisher, Pears, & Levine, 2009). Additionally, adding credence to the theory that physiological regulation underlies children's behavioral regulation, neuroendocrine dysregulation is associated with performance on executive attention tasks in typically developing children, with lower morning cortisol associated with poorer performance (Davis, Bruce, & Gunnar, 2009).

Further research has shown that this early stress also leads to structural and functional changes in brain architecture, including in regions that underlie self-regulation, such as the prefrontal cortex and cortico-limbic connectivity (Braun, Lange, Metzger, & Poeggel, 1999; Cerqueira, Mailliet, Almeida, Jay, & Sousa, 2007). Electroencephalogram (EEG) and event-related potentials (ERP) measures have also shown differential patterns of brain activity in children who had experienced early emotional neglect compared to community children, and some research has shown these patterns of brain activity mediate the relation between early deprivation and self-regulation related symptoms (Marshall et al., 2004; McLaughlin et al., 2010; Moulson, Fox, Zeanah, & Nelson, 2009; Moulson, Westerlund, Fox, Zeanah, & Nelson, 2009; Tarullo, Garvin, & Gunnar, 2011).

As previously mentioned, children who experienced emotional neglect early in life are at risk for deficits in cognitive, behavioral and emotional self-regulation even after they have been removed from the neglecting conditions. For example, IA children score more poorly than same-aged, typically developing children on tasks where they must attend to target stimuli while ignoring extraneous stimuli (selective attention), learn a sorting rule (e.g. sort by color) and then switch to another rule (e.g., sort by shape;

cognitive flexibility), and search for targets in the shortest number of moves without returning to the same location twice (working memory; Bauer et al., 2009; Bos, Fox, Zeanah & Nelson, 2009; Colvert et al., 2008; Hostinar, Stellern, Schaefer, Carlson, & Gunnar, 2012; Loman, Johnson, Westerlund, Pollak, Nelson, & Gunnar, 2012). These differences are not accounted for by differences in overall IQ. Parent ratings of executive functioning in IA children also show deficits compared with non-adopted children (Merz, & McCall, 2011; Merz, McCall, & Groza, 2013). Similarly, in a sample of preschool aged foster children, neglect and emotional abuse were associated with poorer executive function skills compared with community children (Pears & Fisher, 2005). Inattention at home and at school has been noted as a particularly challenging area for children exposed to early emotional neglect (e.g. Stevens et al., 2008).

Internationally adopted children also preform more poorly than comparison children on behavioral measures of inhibitory control such as restraining from grabbing a prize out of a bin and instead describing verbally which prize they choose (dinky toys task) and selectively responding to the target stimuli while inhibiting responses to equally salient non-target stimuli (Go/no-go task; Bruce, Tarullo, & Gunnar, 2009; Hostinar et al., 2012; Pollak et al., 2010). As previously mentioned, they also show challenges with delay of gratification, showing more difficulty than non-adopted children in resisting eating a small treat to earn a larger treat later (Hostinar et al., 2012). Maltreated foster children also show similar deficits compared with non-maltreated children (Pears et al., 2010), especially if they experience instability in caregivers (Lewis, Dozier, Ackerman, & Sepulveda-Kozakowski, 2007). Parent and teacher ratings also show low behavioral

regulation in everyday settings in children experiencing early emotional neglect (Merz & McCall, 2011; Pears et al., 2010).

Another problem noted for previously emotionally neglected children is difficulty in regulating their responses to auditory and tactile stimulation. This may be why some adults rate such children as dysregulated, as problems in processing stimulation can manifest as hyperactivity and emotional lability. Parents of IA children report both sensory over-responsiveness and accompanying avoidance of stimulation as well as unusual sensory seeking behavior (Cermak & Groza, 1998). In a laboratory task, IA children were more likely to react with either high aversion or high pleasure to tactile stimulation than non-adopted or early-adopted children (Wilbarger, Gunnar, Schneider, & Pollak, 2010).

Unsurprisingly given the cognitive and behavioral regulation challenges found in children who experienced early emotional neglect, there is considerable evidence that these children are at risk for Attention Deficit and Hyperactivity Disorder (ADHD; Kreppner et al., 2010; Wiik et al., 2011). Ames (1997) examined children 3 years post-adoption and found children who had experienced institutional care showed elevated levels of attention problems according to parent report compared with family-reared children, as well as higher levels of parent reported distractibility and hyperactivity. These same children continued to show attention problems 8 years after adoption, and 29% of them had been diagnosed as having ADHD (Le Mare & Audet, 2002 as cited in MacLean, 2003). In a sample of elementary aged IA children adopted out of institutions, 23% were rated above the clinical cut-off by their parents for ADHD symptoms

compared to 9% and 12% for externalizing and internalizing symptoms respectively. Domestically neglected children also showed elevated rates of ADHD diagnoses in a population-based sample, with odds ratios of 1.6 to 2.1 (Ouyang, Fang, Mercy, Perou, & Grosse, 2008).

Children exposed to early emotional neglect also struggle with emotion regulation. Even years after adoption into well-resourced homes, internationally adopted children continue show deficits in emotion regulation compared with typically developing children (Tottenham et al., 2010). Post-institutionalized children report experiencing more intense and frequent bouts of anger and sadness when compared to non-adopted children, especially if they have a parent who had difficulty staying calm in upsetting situations (Adriana Herrera, personal communication, 1/16/13, 3/12/14). Maltreated children also show deficits in emotion regulation compared with non-maltreated peers (e.g. Shields, Cicchetti, & Ryan, 1994). A recent sample of maltreated children (more than 75% of which had been emotionally abused or neglected, typically before age 3) was rated as exhibiting poorer emotion regulation and more emotional lability-negativity than a group of SES matched comparison children (Kim-Spoon, Cicchetti, & Rogosch, 2012).

Self-Regulation as a Mediator. There is a growing body of literature that suggests that these deficits in self-regulation mediate the relationship between early emotional neglect and other areas of development where these children show challenges. One issue frequently seen in children who experienced early emotional neglect is a pattern of social behavior referred to as disinhibited social engagement (also known as

indiscriminate friendliness). While previously thought to be an attachment problem, growing evidence suggests that it is instead related to deficits in self-regulation, particularly attention regulation and inhibitory control (Bruce, et al., 2009; O'Connor, et al., 1999; Pears, et al., 2010; Roy, Rutter & Pickles, 2004). For example, children who had more difficulty stopping themselves from pressing the button on the no-go trials of a Go/no-go task (Bruce et al., 2009) or those who had more difficulty on the Day-Night Stroop task (Pears et al., 2010) also exhibited more disinhibited social engagement. Turnover in caregivers among domestically maltreated children also influences inhibitory control which in turn influences preschool-aged children's ability to appropriately regulate social engagement (Pears et al., 2010).

Additionally, children adopted from institutions sometimes exhibit symptoms similar to children on the Autism Spectrum. Rutter and colleagues (e.g. Rutter et al., 2010) have termed these behaviors "quasi-autistic features." Executive function deficits, measured by the Stroop task, mediated the association between early deprivation and quasi-autistic features in a group of IA children (Colvert et al., 2008).

Emotion regulation has been implicated as a key mediator in the association between emotional neglect and internalizing and externalizing psychopathology. Emotion regulation mediates the relation between maltreatment and teacher reported psychopathology (Alink, Cicchetti, Kim, & Rogosch, 2009). A longitudinal study found that early maltreatment is associated with high emotion labiliy/negativity, which contributes to poor emotion regulation, which in turn predicts increases in internalizing symptomatology (Kim-Spoon et al., 2012). Self-regulation has been implicated as the

mechanism through which maltreatment increases the risk for aggression (Lee & Hoeken, 2007) and has been shown to mediate the association between maltreatment risk and behavior problems (Schatz, Smith, Borkowskia,. Whitmana, & Keogha, 2008). Emotion regulation has yet to be evaluated as a mediator of the effects of institutional deprivation.

Self-regulation may also be the mediator between neglect and other important outcomes. Pears et al., (2010) demonstrated that foster children's inhibitory control skills fully mediated the association of maltreatment with academic competence. In another study, children's self-regulation mediated the relationship between maltreatment risk and pre-academic skills (Schatz et al., 2008). Deficits in emotion regulation that lead to externalizing symptomatology also contribute to the poor peer relations often experienced by maltreated children (Kim & Cicchetti, 2010).

While further research is needed to fully elucidate the mechanisms through which emotional neglect increases the risk for psychopathology and deficits in socioemotional and academic functioning, evidence suggests that self-regulation is a key mediating factor in this process, and therefore is a promising target for intervention.

Interventions to Promote Self-Regulation

Because the generally above average parenting experienced by IA children does not seem to be enough to ameliorate the deficit in self-regulation seen in IA children, typical parenting interventions are not indicated to reverse the effects of early life stress on self-regulation. (However parenting interventions designed to *prevent* early life stress would be expected to promote positive self-regulation in other populations, see Shonkoff,

2011). Therefore interventions directed primarily at the child that are scientifically informed present the highest chance of success.

In recent years, researchers have increasingly cited self-regulation as an ideal target for interventions (e.g. Blair & Diamond, 2008; Diamond & Lee, 2011). In particular, self-regulation has been cited as an essential factor in school readiness (Ursache, Blair, & Raver, 2012) and ideal for increasing resilience in children exposed to early life stress (Shonkoff, 2011). In fact, kindergarten teachers rate self-regulation skills such as sitting still, paying attention, following directions, and regulating behavior, as more important for starting school than academic skills such as knowing the alphabet or counting to 20 (Lewit & Baker, 1995). Moreover, it has been suggested that effects shown by classic preschool programs such as the Perry Preschool Project (Schweinhart, Berrueta-Clement, Barnett, Epstein, & Weikart, 1985), the Abecedarian Project (Ramey & Campbell, 1984), and the Chicago Parent-Child Center program (Reynolds, 2000) were mediated by improvements in children's self-regulation more so than direct effects on academic or cognitive skills (Blair, Berry, & Friedman, 2012).

Universal classroom-based preschool interventions such as Montessori programs, Tools of the Mind, and PATHS/Head Start REDI, have shown promise in promoting various aspects of self-regulation (Lillard & Else-Quest, 2006; Lillard, 2012; Bodrova & Leong, 2007; Diamond, Barnett, Thomas, & Munro, 2007; Barnett et al., 2008; Domitrovich, Cortes, & Greenberg, 2007; Greenberg, Kusche, Cook, & Quamma, 1995; Riggs, Greenberg, Kusche, & Pentz, 2006; Bierman et al., 2008a; Bierman, Nix, Greeenberg, Blair, & Domitrovitch, 2008b). Key components of these interventions

include a focus on social and emotional learning in addition to academic material and the opportunity to repeatedly practice key skills. The Chicago School Readiness Program (CSRP) added a unique contribution in that it was designed specifically to target the teachers and the classroom in order to create an environment conducive to positive self-regulation development (Raver et al., 2008). As part of the CSRP program, a Mental Health Consultant was assigned to each classroom to coach teachers in effective behavior management, help teachers with stress to prevent burnout, and provide targeted, direct services for children with the highest emotional and behavioral problems. CSRP was successful in improving teacher sensitivity and behavioral management skills (Raver et al., 2008), preschool children's internalizing and externalizing symptoms (Raver et al., 2009), and pre-academic skills (Raver, Jones, Li-Grining, Zhai, Bub, & Pressler, 2011). Overall self-regulation also improved significantly and mediated the intervention's effects on pre-academic skills (Raver et al., 2011). This project demonstrated that bottom-up interventions that lower stress levels to allow for effective regulation but do not directly practice top-down skills can also be effective in improving self-regulation. Like other interventions, CSRP also did not show improvements on delay of gratification tasks (Raver et al., 2011).

Executive Function Training Programs. In addition to classroom programs, several short-term executive function training interventions have shown efficacy in improving various aspects of self-regulation. These interventions tend to focus on the cognitive aspects of self-regulation such as selective attention and working memory. Because of the relationship between these specific cognitive skills and broader self-

regulation, it is hypothesized that improving these skills will generalize to other areas. Some studies have tested the transfer and generalization effects of the trainings to other executive functions and/or to behavioral symptoms, with mixed results.

CogMed is a five-week, computer-based working memory training program, designed to improve individuals' executive functioning skills. It has been used and evaluated in both adults and children, particularly in children with ADHD. Research has shown effects of the program in increasing working memory capacity (Klingberg et al., 2005), increasing brain activity in the middle frontal gyrus and parietal cortex (Olsen, Westerberg, & Klingberg, 2004), and transferring to attention tasks (Thorell, Lindqvist, Bergman Nutley, Bohlin, Klingberg, 2009). Evidence on transfer of these skills to other executive functions and to behavior has been mixed. For example, Klingberg and colleagues (2005) originally found transfer to inhibitory control (measured by the Stroop task), nonverbal reasoning (measured by Raven's matrices), and improvement in parent rated inattention and hyperactivity symptoms. However a later study found no transfer to inhibitory control (measured by Stroop and Go/No-go) or reasoning skills (measured by block design; Thorell et al., 2009). Some subsequent studies have shown symptom improvement that persists 4-months later, (e.g. Beck, Hanson, Puffenberger, Benninger, & Benninger, 2010) while others do not show any transfer outside of the working memory domain in either executive function or behavior (Gray et al., 2012). In a preliminary study with children with emotional and behavioral problems, children in the working memory training group showed improved IQ, inhibition, test anxiety and teacher-reported behavior, attention and emotional symptoms, however only 15 children

participated in the study (Roughan & Hadwin, 2011). In studies that did show improvement on parent reported ADHD symptoms, none showed consistent effects in teacher rated behavior (Beck et al., 2010, Klingberg et al., 2005). A recent meta-analysis found direct effects on working memory, but no transfer effects to academic functioning, blinded ratings of behavior, or cognitive tests (Rapport, Orban, Kofler, & Friedman, 2013).

The efficacy of a very brief (5 sessions) attention training intervention was tested in 4- and 6-year-old children (Rueda, Rothbart, McCandliss, Saccomanno, & Posner 2005). Participation in the training was related to improved executive attention on laboratory tasks, more developmentally advanced brain activity patterns, and improved IQ scores (Rueda et al., 2005). Behavioral symptoms were not reported.

A hybrid of computer and non-computer games to train either processing speed or fluid reasoning was evaluated in 7- to 9-year-old children (Mackey, Hill, Stone, & Bunge, 2011). Games were played both individually and in small groups for a total of 16 hours over eight weeks with incrementing difficulty. Both training procedures lead to improvement in their respective domains (on non-trained measures), however neither training generalized to the opposite domain. The fluid reasoning training did transfer to working memory improvements on a visuospatial memory task (Mackey et al., 2011). Further generalization to academic skills or behavior was not tested.

Brief trainings that involve repeated exposure to executive function tasks, such as card sorting tasks, have also shown transfer to other executive function skills, such as inhibitory control (e.g. Dowsett & Livesey, 2000), however the extent of transfer to real

world behavior is unknown. In addition, attention training techniques have been used alternatively to retrain the negative attention biases found in individuals with anxiety. Attention bias training (such as the dot-probe task training) has been shown to improve attentional deployment and emotion regulation (see review Wadlinger & Isaacowitz, 2011).

Executive function training programs are a topic of great interest in recent years, and several studies are currently underway (Bunge, 2013; Munakata, 2013; Carlson, 2013; Diamond, 2013a; Ann Masten, personal communication).

Mind-Body Interventions. Several intervention strategies that integrate connections between the body and mind, have shown promise in promoting self-regulation in children. Both acute aerobic exercise and long-term aerobic training have been shown to improve executive functioning in children. (Hillman, Pontifex, Raine, Castelli, Hall, & Kramer, 2009; Budde et al., 2008; Kamijo et al., 2011; Davis et al., 2011). Traditional martial arts combine physical activity with self-discipline, self-awareness, and control and have demonstrated efficacy in promoting self-regulation (Trulson, 1986; Lakes & Hoyt, 2004).

Mindfulness-based practices focus on breathing and sensory awareness. Mindfulness has been defined as an awareness that results from purposeful, non-judgmental, attention to the individual's moment-to-moment experience (Kabat-Zinn, 2003). By emphasizing non-judgment, the practice of mindfulness fosters the ability to observe both internal and external experiences without interference from cognitive, affective, or physiological reactions. Mindfulness fosters sensory awareness and also

provides practice in processing one's experiences more fully in a purposeful fashion. Mindfulness has been cited as an ideal intervention to improve self-regulation because of its potential to improve top-down regulatory control (e.g. by practicing focused attention, inhibitory control) while also ameliorating stress that may interfere with self-regulation from the bottom-up (e.g. breathing techniques, emotion regulation strategies, compassion exercises; Zelazo & Lyons, 2012). This may be especially important for emotion regulation, which relies heavily on connections between the prefrontal cortex and lower brain regions. It has been suggested that the effects of other previously mentioned strategies such as Montessori programs and martial arts are due primarily to the programs' mindfulness-like techniques (Lillard, 2011; Diamond & Lee, 2011).

Research on mindfulness meditation and related practices in adults, most often examining the effects of Mindfuness Based Stress Reduction (MBSR; Kabbat-Zinn, 1982), has demonstrated a wide range of benefits, including enhancing inhibitory control, attention, cognitive flexibility, improving emotion regulation, alleviating symptoms of anxiety and mood disorders, improving immune function (e.g. Arias, Steinberg, Banga, & Trestman, 2006; Davidson et al., 2003; Holzel et al., 2011; Baer, 2006; Heeren, Van Broeck, & Philippot, 2009; Ortner, Kilner, & Zelazo, 2007). These techniques also alter brain activity (Davidson et al., 2003) and HPA activity (Carlson, Speca, Patel, & Faris, 2007) in adults, which may mediate the effects on other domains.

Recent research with mindfulness-based practices in children and adolescents presents promising evidence for the efficacy of this strategy with younger individuals. A large study of the Mindful Schools curriculum found improvements in teacher rated

behavior after a five-week mindfulness intervention (Black, & Fernando, 2013). Improvements were seen in teacher ratings of children's attention, self-control, participation in activities, and caring/respect for others. However there was no control group in this study and teachers were not blind raters. In a more rigorous, randomized-controlled trial of typically developing children, 64 second and third grade students were assigned to either a mindful-awareness program or to a reading group control (Flook et al., 2010). The mindful-awareness group participated in 16 sessions spread over eight weeks. Children in the mindful-awareness group who were less well regulated at the start of the study showed improved behavioral regulation, metacognition, and overall executive function as measured by parent and teacher report when compared with controls (Flook et al., 2010). In addition, a randomized-controlled trial with first-through third-graders showed improvement in measures of selective attention following 12 mindfulness-based training sessions, but failed to find differences on sustained attention tasks (Napoli, Krech, & Holley, 2005).

Additionally, mindfulness shows potential as a targeted strategy for youths who struggle with self-regulation. A feasibility study of mindfulness with adolescents diagnosed with ADHD showed pre–post improvements in self-reported ADHD symptoms and test performance on tasks measuring attention and cognitive inhibition (Zylowska et al., 2008). Others have suggested adding a mindfulness component to existing ADHD treatments to amplify effects (Cassone, 2013). In a sample of high-risk children, participation in mindfulness based cognitive therapy was associated with improvement in attention and behavior measured by parent and self-report (Semple, Lee,

Rosa, & Miller, 2010). The improvement in attention partially mediated the improvement seen in behavior. Additionally, children who began the intervention with clinical level anxiety symptoms showed reductions in those symptoms at post-test. Improvement in attention was maintained three months after the intervention (Semple, Lee, Rosa, & Miller, 2010).

Further research with children shows promise in improving internalizing and externalizing symptoms, academic competence, physiological anxiety symptoms, and emotion regulation, however well-controlled research and replications are not yet available (for review see Greenberg & Haris, 2012; Burke, 2010; Burke, 2014). Existing studies often lack adequate controls and rely on self or non-blind observer reports of functioning rather than objective measures (Greenburg & Harris, 2011). These methodological concerns make it difficult to draw definitive conclusions about the efficacy of youth mindfulness practice, especially among younger children.

Summary

Self-regulation is imperative for positive development. Children deprived of a single, responsive caregiver early in life fail to develop the necessary physiological foundation for effective self-regulation. Even if such children are later adopted by loving, well-resourced parents, the period when supportive care is the critical factor for self-regulation has passed and more targeted interventions are needed. This may be why many IA children continue to show deficits in self-regulation years after adoption when catch-up in other areas (e.g. IQ) seems near complete (see Gunnar, 2001).

Research suggests that self-regulatory abilities can be improved through a variety of different methods, however further investigation is still needed in this area. Specific training programs seem effective in improving targeted areas of self-regulation, although evidence of generalization to other areas is mixed. One key component in the most successful interventions is incremental increases in challenge throughout the intervention. In addition, interventions that target self-regulation from both top-down (cognitive control) and bottom-up (stress and emotions) processes may be the most efficient in targeting certain aspects of regulation. Additionally, children who struggle with regulation at the outset are more likely to benefit from the interventions in some cases.

Given their specific deficits and the need for a targeted intervention, the programs that appear to have the most promise for improving self-regulation in IA children are executive function training and mindfulness training. While both interventions show promising preliminary evidence, there are several gaps in the current literature. Most studies examining either of these interventions lack methodological rigor and adequate control groups. While mindfulness research in adults has shown replication of effects (e.g. Khoury et al., 2013), mindfulness research in children is in its infancy. In fact, a recent review reported that there have only been 29 intervention studies examining mindfulness based training programs in children and adolescents, and only eight of these were randomized-controlled trials (Burke, 2014). Even fewer were conducted with children younger than 10. While research into the importance of executive functioning has rapidly expanded over recent decades, interventions targeting executive functions are relatively new (for review see Diamond, 2012). This is especially true of non-

computerized training, which has only been reported in a handful of studies (Zelazo, 2013), but shows promise for an engaging, small group intervention for preschool and school-aged children, with the potential for more transfer to real life skills (Diamond, 2013a).

Another crucial but unanswered question is the relative efficacy of different types of self-regulation interventions. To my knowledge, no previous research has compared two different modalities of self-regulation interventions in the same study. Furthermore, additional research is needed to determine the efficacy of such interventions in a secondary prevention context (i.e. in a group at high risk for problems rather than universal programs or clinical treatment).

Importantly, mindfulness and executive function training strategies are being implemented in schools across the country despite the currently tenuous research support. As Greenberg and Harris (2012, p. 161) put it, "enthusiasm for promoting such practices outweighs the current evidence supporting them." There are many books directed at parents and teachers on promoting mindfulness and executive function in their children and students (e.g. Sitting Still Like a Frog: Mindfulness Exercises for Kids (and Their Parents), Snel, 2013; Executive Skills in Children and Adolescents: A practical guide to assessment and intervention, Dawson & Guare, 2004). As of March 2014, a Google search for "mindfulness and children" yields about 12 million results, while "executive function training and children" yields over 10 million. This recent explosion in public interest and enthusiasm in these types of practices further amplifies the importance of rigorously testing them.

The Current Study

The current study will address these critical gaps in the field by using objective, standardized measures and by comparing mindfulness training to executive function training in a randomized, controlled design. Each intervention will act as an active control group for the opposite intervention, and will allow for comparison of relative efficacy of the two strategies. Importantly, the differences in the direct targets of the two interventions (attention, inhibitory control, and cognitive flexibility for EF training; attention, inhibitory control, arousal modulation, and compassion for mindfulness) will allow for examination of the transfer effects (or potentially lack there of). Finally, this study will examine multiple outcomes, including objective laboratory measures as well as parent and teacher reported behavioral outcomes.

Specific Aims

Aim 1: Test the extent to which the mindfulness and executive function interventions lead to improvements in behavioral self-regulation, (measured by objective laboratory measures and parent/teacher report of behavior) and compare their relative efficacy. I hypothesize that both interventions will improve aspects of self-regulation that rely on attention modulation and inhibitory control, as these skills are practiced in mindfulness as well as EF training.

Aim 2: Determine whether the effects of the mindfulness and executive function trainings differ based on baseline regulatory functioning. Consistent with prior literature (e.g. Flook et al., 2010), I hypothesize that children who demonstrate poorer self-regulation at pretest will show greater improvement from the interventions.

Aim 3: Examine the extent to which mindfulness and executive function interventions lead to improvements in emotion regulation and socioemotional functioning. I hypothesize that the mindfulness training will show greater improvements in these areas, as they are more directly targeted in this training.

Method

Participants

Participants were recruited from an existing database of more than 5000 families with internationally-adopted children who indicated they were interested in research, maintained by the Minnesota International Adoption Project. Families on this registry have historically been eager to participate in research, with an average acceptance rate of more than 85%. Due to the high time commitment involved, it was anticipated that the acceptance rate would be lower for the present study. Potential participants were identified from the list if the child's date of birth indicated that he or she would be between 72 and 131 months of age (6-10 years old) at the start of the intervention and the family lived within a 50 miles radius of the University of Minnesota. Participants were not recruited if the registry indicated that the child had a diagnosis of fetal alcohol syndrome, autism spectrum disorders, or severe cognitive impairment.

Four hundred and sixty-four children were identified as potential participants and recruiters attempted to contacted each family by phone. Recruiters were able to make contact with 244 families. Sixteen children were not eligible to participate due to the following exclusions: fetal alcohol spectrum concerns not indicated on the registry (6), autism spectrum disorders not indicated on the registry (2), extensive prior martial arts

experience (7), extensive prior yoga experience (1). Extensive martial arts or yoga experience was defined as continuous participation at least once a week for a year or longer. Children were excluded for such experience because of the mindfulness components of martial arts and yoga. Seventy-seven families declined due to other summer commitments but asked to be contacted for future trainings. Forty-six additional families indicated interest in the study, but then passively decline participation. Twenty-four families indicated they were not interested in participating.

The remaining 81 families agreed to participate and scheduled pretesting sessions. Eight families decided not to participate prior to their pretesting session, citing logistical concerns or time constraints. Seventy-three participants completed the pretesting session. One participant had to be excluded due to a previously undisclosed autism diagnosis. The remaining 72 participants (31% male) were then randomized using a stratified random sampling technique into the mindfulness training (MT; $n = 24$), executive function training (EF; $n = 24$), or no intervention (NI; $n = 24$) groups. Given previous evidence that improvement may only be seen among children scoring low in self-regulation (e.g. Flook et al., 2011), the groups were stratified based on parent rating of attention and inhibitory control during pretest (as measured by the hyperactivity and attention problems scale of the Strength and Difficulties Questionnaire) and pre-adoption experience (predominately foster care or institutional care).

Participants were compensated with a $15 Target gift card for each testing session. Parents were given a $10 Target gift card for returning the follow-up

questionnaires. University of Minnesota Institutional Review Board approval was granted in February 2012.

Five participants withdrew during the course of the study. Three of these cited driving time to the intervention sessions as the reason for withdrawal; one participant withdrew due to dislike of the training classes. One participant in the no intervention group passively declined posttest. Sixty-seven participants completed the post-testing session. One of these participants was excluded from all analyses due to a change in psychotropic medication. Withdrawal did not significantly differ across groups $\chi^2(2, 73)= .35$, *ns*.

The final sample for analyses consisted of 66 children, which did not significantly differ from the original sample ($N = 72$) with respect to age, pre-adoption experience, or baseline attention/hyperactivity. Final distribution across groups was MT, n = 23, EF, n = 21, NI, n = 22. Forty-seven (71%) of the participants were female, 19 (29%) were male. Due to the constraints of international adoption, a higher rate of females than males would be expected for this population. Age at pretest ranged from 71-131 months (M=100.5, SD = 19.8, median =101.5). Participants were adopted from a large variety of countries, from the following regions: 56% South East Asia, 23% Latin America, 15% Russia or Eastern Europe, and 6% Africa. Age at adoption ranged from 3 to 54 months (M=16.5, SD = 11.2, median = 12). Eighty-three percent of participants had spent at least some time in an institution, ranging from one month to 48 months (M=12.6, SD = 11.6, Median = 10). Seven participants (10%) had a documented diagnosis of ADHD. Twenty-four (36%) were receiving special education services in school. Overall means on

symptoms scales at pretest were within the typical range. Mean levels and percentage of participants in the clinical range at pretest are found in Table 1. Median family income was $100,000-$125,000. Seventy-eight percent of primary caregivers had at least a bachelor's degree and 89% of participants lived in a two-parent household.

Training

The MT and EF groups attended two 1-hour training sessions per week for 6 weeks in addition to completing training-related activities with their parents at home. Participants met in groups of seven or eight children. The group delivery method allows for increased generalizability of findings to school-based programs, while the addition of a home-based component increases dosage and aims to improve transfer of learned skills to broader domains of functioning.

The MT group completed a curriculum that involves a variety of very short mindfulness and relaxation practices adapted for children (see Appendix A). These practices include concrete exercises that are explained by simple metaphors and trained via a balance between variety and repetition, to maintain young children's interest and to build a foundation in mindful awareness (Johnson, Forsten, Gunnar & Zelazo, 2011). The curriculum utilizes activities that will naturally harness meditative experiences and are drawn from mindfulness, yoga, and relaxation practices. The curriculum includes breathing activities, sensory awareness exercises, very brief guided meditation sessions (1-5 minutes, increasing in length over the course of the intervention), arousal modulation practice, and compassion activities. The curriculum also includes "homework" activities and games that parents were instructed to complete with their children. These home

activities mirror the progression of the training curriculum, beginning with reinforcing basic skills, and ending with scaffolded use of those skills as regulation strategies.

The EF group completed a curriculum that involves a variety of child-friendly attention, inhibitory control, and mental flexibility/imagination games (see Appendix B). These sessions were be led by the same instructors and implemented at the same frequency as the mindfulness training. The games involved paying attention, following instructions, inhibiting behaviors, and using their imaginations. The curriculum also includes "homework" activities and games that parents were instructed to complete with their children that offer additional practice on these skills, and methods for integrating practice into daily routines (e.g. chores, play time). Versions of these training programs have been used successfully with 4- to 5-year-old, typically developing children (Johnson et al., 2011; Johnson, Lyons, & Zelazo, 2012) and with 6- to 9-year-old PI children in a pilot study (Lawler, Esposito, Doyle, Johnson, & Gunnar, 2012; see below).

The current investigator, a graduate student collaborator, and a trained post-baccalaureate volunteer served as the primary instructors for the intervention classes. The creators of the curricula trained the instructors and provided feedback on implementation of the programs during pilot testing to promote fidelity and minimize discrepancies in delivery. Each instructor led one of each type of training class. Instructors had taught the curricula during the pilot study, so were experienced with both types of interventions. In addition, each class session was video taped and later coded for instructor and child engagement. This was to ensure that there was no instructor bias toward one curriculum over the other, as well as to ensure that there were no

discrepancies between instructors. Independent samples t-test confirmed no difference between interventions on teacher engagement or child engagement (see Table 3). A one-way ANOVA also confirmed no significant differences between instructors on engagement, $F(2,3) = 2.5$, *ns*. Instructors had varied backgrounds in terms of their personal experience with mindfulness. One instructor was a certified yoga teacher. The other two instructors were familiarized with the principles of mindfulness through mindfulness literature. One of the primary instructors was a practicing child therapist (under supervision of a licensed psychologist). Additional child clinical psychology graduate students (practicing under supervision of a licensed psychologist) acted as assistants in each class, to help deliver the curricula, and to intervene when problem behavior or other clinical issues arose. In addition, Maria Kroupina, Ph.D., L.P. acted as a clinical supervisor for the duration of the study. Dr. Kroupina has extensive experience with post-institutionalized children in this age group.

Procedure and Measures

Each testing session (before and after the six-week training) took approximately 90 minutes. Testing was completed at the Center for Neurobehavioral Development at the University of Minnesota. Pre- and post-test sessions were administered by the current author and a graduate student collaborator, as well as trained undergraduates. Graduate students trained undergraduate assistants on administering the tasks and live-coding behavior. Undergraduates remained blind to group status and served as the primary experimenter for post-testing sessions. Each session examined behavior in the following areas: attention, inhibitory control, delay of gratification, emotion regulation and

socioemotional competence. An EEG net was worn during two computerized tasks (Flanker and emotion induction go/nogo) however ERP outcomes are beyond the scope of the current paper. Parent and teacher questionnaires were also used to evaluate behavior and functioning.

Laboratory Tasks.

Inhibitory Control. In the Dinky Toys task the child is shown a box full of small prizes. Although it is impossible to see all of the prizes clearly without riffling through the box, the child is told that they should look carefully and then describe their choice to the experimenter while keeping their hands in their lap. The experimenter rates the child on their ability to inhibit from reaching for or touching the toys (see Appendix C). The task is administered three separate times over the course of the session and scores are averaged.

Delay of Gratification. The Star Game consists of 25 trials where children are presented with a small star on the computer screen. Children are instructed that they can either click on the small star immediately to earn a single point, or wait for it to grow in to a big star (30 second delay) to earn five points. Children were told that they needed "a lot of points to win the big prize" but that just for playing they would earn a small prize. Children were presented with a practice round with 5 stars and a shortened delay time (10 seconds) to ensure proper understanding of the task. The average delay times were calculated by the computer software.

Attention. Selective attention was measured using the Color Flanker Task (McDermott et al., 2007), a computerized executive attention task. The Color Flanker

Task assesses an individual's ability to implement regulatory control by selectively attending to target stimuli in the face of interfering stimuli. The task was adapted for young children and consists of colored circles as stimuli (blue or red). In three blocks of 60 trials (180 trials total), children are asked to press the button that matches the color of the central circle on the screen regardless of the color of the flanking distracter circles. A practice block of 24 trials was administered first, and based on performance on the practice round, participants were given one of four versions that varied in stimulus presentation and response times. The four versions were 250ms, 400ms, 550ms, and 700ms. Accuracy on incongruent trials (target circle and flanking circles differ in color) is scored by computer software.

Emotion regulation. Experimenters, blind to group status, rated participants using a 4-point likert-style scale (from the Preschool Self-Regulation Scale, PSRA, Smith-Donald et al., 2007; see Appendix C). Two experimenters rated 23% of sessions to calculate interrater reliability, which produced an observed Kappa of .80. Experimenters rated participants on overall emotion regulation or dysregulation during the session, including during the Emotion-induction Go/No-go task (Lewis et al., 2006). Similar to a traditional Go/No-go task, children are instructed to press the button for each letter but refrain from pressing when a letter is repeated twice in a row. However, in this task, error feedback is given, and the child is awarded points for correct answers. At the beginning of the task the child is told that a high number of points was needed to win the "big prize." The task is designed to include three blocks of trials; the first and third blocks are typical and are designed to increase the child's points bank, however, the second block is

designed to induce negative mood states such as frustration, anger, and sadness, by depleting the child's points bank. This task adapts to the child's ability level (i.e. speeds up when the child correctly inhibits response, slows down when the child commits an error of commission) to keep the ratio of success to failure consistent across participants. This allows observers to rate frustration and other negative emotions based on the same level of challenge, however this adaptive format does not allow for accuracy on the task to be used as an outcome variable.

Socioemotional competence. Socioemotional competence was measured using 1) Perspective taking measure composed of the False Belief task and Strange Stories Task. In the False Belief task, (Wimmer & Perner, 1983) participants are told the story of Sally and Ann, illustrated with the help of cartoon drawings. The child observes Sally place an object in location A and then leave. While Sally is gone, Ann moves the object to location B. The child is asked where Sally will look for the object when she returns. A correct answer of location A indicates the child is able to understand that individuals can hold false beliefs. The Strange stories task is an advanced measure of perspective taking. Children were read a series of stories with accompanying pictures adapted from Happe (1994). Each story is comprised of a type of perspective taking situation: Lie, White Lie, Joke, Pretend, Misunderstanding, Persuade, Sarcasm, Forget and Double Bluff. Children were asked questions about the characters motivations. This task is designed to measure advanced theory of mind reasoning, to avoid a ceiling effect possible if using only a traditional theory of mind false belief task. 2) Prosocial behavior task. A children's version of the Dictator game was used to measure prosocial behavior. In the child's

Dictator Game, the participant was given 10 stickers and told that he or she may distribute the stickers to between him/herself and another child who didn't have any stickers however he or she desired.

Verbal ability. Verbal ability was measured using the NIH toolbox vocabulary assessment. This measure of receptive vocabulary was administered in a computerized adaptive format. The participant was presented with an audio recording of a word and four photographic images on the computer screen and is asked to select the picture that most closely matches the meaning of the word. This test takes approximately 4 minutes to administer and is recommended for ages 3-85. Vocabulary was measured to allow for control of verbal ability in tasks that required extensive understanding of language (theory of mind tasks) and for a test of discriminant validity of intervention effects.

Parent Questionnaires. While the participant completed the experimental tasks, the parent was seated in a room where they could observe the activities via a live video feed. Parents filled out several questionnaires to measure baseline functioning and intervention effects.

Health and Resources Questionnaire: (HRQ) Demographic survey including family information, education services, pre-adoption history, and post-placement history.

Emotion Regulation Checklist: (ERC; Shields & Cicchetti, 1997) a 24-item questionnaire designed to investigate children's experience of negative or unstable mood, as well as their ability to regulate their emotions over the course of the previous week.

Strengths and Difficulties Questionnaire: (SDQ; Goodman, 1997) Contains 25 items that assess emotional symptoms, peer relationship problems,

hyperactivity/inattention, conduct problems, and prosocial behavior. Items are scored on a three-point Likert scale (0 = not true, 1 = somewhat true, and 2 = certainly true). Scaled scores were constructed using the online scoring system (sdqscore.com). Ratings from the hyperactivity/inattention scale were used to stratify random group assignment.

MacArthur Health and Behavior Questionnaire: (HBQ; Essex et al., 2002). The HBQ is a 140-item parent report questionnaire that assesses the child's mental health, physical health, and academic and social functioning. Parent rated attention, hyperactivity and impulsivity symptoms (ADHD scale) were used as a measure of baseline regulatory functioning.

Follow-up. Approximately four months following the intervention, parents and classroom teachers were asked to fill out questionnaires measuring emotion regulation (ERC), and behavior problems (SDQ). These short questionnaires were selected to minimize time burden on parents and teachers and maximize likelihood of questionnaires being returned. While parents were aware of their child's participation in the intervention, teachers were blind to the study purpose and group status and therefore represent an objective measure of behavior and functioning.

Pilot Study

In a pilot study conducted over the summer of 2012, 27 IA children were randomized into MT, EF, or NI groups. The MT and EF groups attended 12 one-hour group sessions. Paired-sample *t*-tests were used to compare pre- and post-test performance.

The EF group, but not the MT or NI groups, showed improvement on behavioral inhibitory control on the dinky toys task (EF: $t(8)= 2.4$, $p< .05$; MT: $t(8)= 1.08$, *ns*; NI: $t(6)= .13$, *ns*). The MT group showed improvement on parent reported prosocial behavior $t(9)= 2.45$, $p< .05$. While the EF and NI groups showed no difference in this area (*ns*). There was a trend for a difference between groups on delay of gratification (tested only at posttest), with the control group showing the poorest delay performance, ($p = .10$). Children in both intervention groups improved in (blind) experimenter rated emotion regulation, (MT: $t(9)= 2.27$, $p< .05$; EF: $t(9)= 4.0$, $p< .01$), while the no intervention group showed no change (NI: $t(6)= .68$, *ns*).

Data Analysis Plan

Analysis of Covariance (ANCOVA) models were conducted within each domain to measure differences between groups, controlling for pretest performance. Age and sex were covaried when appropriate. Baseline regulatory functioning, indexed by the ADHD scale of the Health and Behavior Questionnaire reported by parents, was included in the models to examine the possibility of an interaction effect of baseline functioning and intervention effects.

An a priori power analyses was conducted based on data from the pilot study. ANOVA effect sizes ranged from $\eta_p^2= .10$ -.19 (medium to large effect sizes according to Cohen's standard, see Cohen, 1988). The power analysis indicated that 74 participants were needed to detect such effect sizes, however only 66 participants completed the study (with fewer completing the parent and teacher follow-up). To address this, an additional 30 participants will be added in the summer of 2014. For this reason and as a guide to

subsequent analyses, in the following sections, findings that are at the trend level ($p < .10$) will be noted and discussed.

Results

Preliminary Analyses

A series of chi-squared tests and one-way ANOVA models were conducted to ensure even distribution across groups. Groups did not significantly differ in age, sex, adoption background (institution vs. foster care), age at adoption, or ADHD status (see Table 2). Groups also did not significantly differ on any of the pretest measures, with the exception of experimenter rated emotion regulation, and a trend for parent rated emotion regulation (see Table 2). Pretest levels were controlled in all analyses.

On average, participants attended 9.9 of the 12 classes (SD = 1.5), and were rated as highly engaged during classes (4.31 out of a possible 5, SD = .55) by an objective observer. Engagement did not vary between interventions, however children in the mindfulness group had significantly higher attendance than children in the EF group, attending on average 1.5 more classes (see Table 3). Neither attendance nor engagement predicted change on any of the outcome measures, with the exception of theory of mind (see Table 4).

An age-adjusted standardized verbal ability score was computed by the NIH Toolbox Vocabulary test. Groups did not significantly differ on verbal ability at pretest, $F(2, 70) = 0.93$, *ns*, or posttest, $F(2, 62) = .78$, *ns*, as expected. Bivariate intercorrelations of variables of interest are found in Table 5, while partial correlations controlling for age

are found in Table 6. Correlations between each measure at pre and posttest, separated by group, are found in Table 7.

Behavioral Regulation

Since behavioral regulation skills such as attention and inhibitory control were practiced in both interventions (albeit in different ways), I anticipated that both interventions would improve these skills. Three laboratory measures (dinky toys, star game and flanker task) and a parent/teacher report scale (hyperactivity and attention problems from the SDQ) were used to measure various aspects of behavioral regulation.

Dinky Toys. Participant's scores across the three trials of the dinky toys task were averaged at pre and posttest to measure inhibitory control. This task proved too easy for some of the children in the study, so to prevent ceiling effects from diluting results, participants who scored at ceiling at pretest (perfect scores on all three trials) were excluded from analyses. Perfect scores at pretest did not vary between groups, $\chi^2(2, N = 66) = .08$, *ns*. Remaining scores were square root transformed to normalize the distribution. Average dinky toys score at posttest was entered into an ANCOVA as the dependent variable, with intervention group and baseline regulation group (median split of parent reported ADHD symptoms on the HBQ) entered as fixed factors, and age, sex, and average pretest dinky toys score entered as covariates. There was an overall effect of group, $F(2,27) = 3.44$, $p = .047$, $\eta_p^2 = .20$ (see Figure 1). There was not a significant interaction effect between group and baseline: $F(2, 28) = 1.07$, *ns*. Post hoc analyses showed a significant effect of EF group vs. NI $F(1, 38) = 4.12$, $p = .05$, $\eta_p^2 = .10$, but no significant effect of mindfulness vs. NI $F(1, 40) = 0.11$, *ns*.

Star Game. Average delay time on the star game was calculated across the 25 trials at pre and posttest as a measure of delay of gratification skills. An ANCOVA was conducted with average delay time at posttest as the dependent variable, intervention group and baseline regulation group entered as fixed factors, and age and average delay time at pretest entered as covariates. There was a non-significant trend for an overall effect of group, $F(2, 58) = 2.71$, $p = .07$, $\eta_p^2 = .09$. There was no significant interaction effect between group and baseline, $F(2, 58) = 0.13$, *ns*. Post hoc analyses showed a non-significant trend for mindfulness vs. NI $F(1, 41) = 3.02$, $p = .09$, $\eta_p^2 = .07$, with the mindfulness group exhibiting longer delay times than the NI group, but no significant effect of EF vs. NI $F(1, 39) = 0.003$, *ns* (see Figure 2).

Flanker Task. Participant's average accuracy on incongruent trials on the flanker task was examined as a measure of selective attention. Five participants were excluded from these analyses because their pretest performance on the congruent trials of the flanker task showed less than 65% accuracy, indicating an insufficient understanding of the task or an insufficient ability to perform at better than chance levels. An additional five participants were excluded from analyses due to a change in EEG net between pre and posttest (i.e. wore a net at pretest but not at post test or vice versa, which affected task demands). Participant exclusions did not vary by group $\chi^2 (2, N = 66) = 3.9$, *ns*. An ANCOVA was conducted with accuracy on incongruent trials entered as the dependent variable, intervention group and baseline regulation group entered as fixed factors, and age, flanker version, and pretest accuracy entered as covariates. The main effect of group was not significant $F(2, 47) = 2.15$, *ns*. There was a significant interaction of group by

parent-rated baseline regulation, $F(2, 47) = 4.94$, $p = .01$, $\eta_p^2 = .17$. Post hoc analyses showed that among children with poor baseline regulation, both the EF group ($F(1, 13) = 6.87$, $p = .02$, $\eta_p^2 = .35$) and the mindfulness group ($F(1, 16) = 4.47$, $p = .05$, $\eta_p^2 = .22$) demonstrated improved accuracy compared with the NI group (see Figure 3).

Hyperactivity and Attention Problems. Classroom teachers and parents rated participants on the hyperactivity and attention problems scale of the SDQ four months following the intervention. Three families informed the study that they preferred not to participate in the teacher report portion of the study. Response rates were 68% and 54% for parent and teacher questionnaires, respectively. Scores were square root transformed to normalize the distribution. An ANCOVA was conducted with parent report entered as the dependent variable, intervention group entered as a fixed factor, and age, sex and average parent-reported behavior regulation at pretest entered as covariates. There was no effect of group on parent reported behavior regulation $F(2, 39) = 0.28$, *ns*. Teacher report was entered into an ANCOVA as the dependent variable, with intervention group as a fixed factor, and age, sex, and pretest parent-reported hyperactivity and attention problems as covariates. There was a significant effect of group on teacher reported behavior regulation $F(2, 28) = 3.86$, $p = .03$, $\eta_p^2 = .22$ (see Figure 4). Due to small sample size and a visual inspection of the data, groups were combined into one treatment group to examine the effects of treatment vs. no intervention. The combined treatment group showed significantly fewer hyperactivity and attention problems than the no intervention group, $F(1, 29) = 6.29$, $p = .01$, $\eta_p^2 = .18$.

Summary. Overall, both interventions improved behavioral regulation. The EF intervention was more successful in improving inhibitory control, while the mindfulness intervention may have had an effect on delay of gratification. Improvement was significantly greater for participants with low baseline regulation in selective attention, but not in other measures. Both interventions led to lasting improvements in classroom behavior.

Emotion Regulation and Socioemotional Competence

Since emotion regulation and compassion were directly targeted in the mindfulness training, I anticipated that these areas would be improved in the mindfulness group but not in the EF group (or at least to a lesser degree). Two laboratory tasks (theory of mind and sticker tasks), an experimenter rating, and a teacher/parent report (emotion regulation composite from the ERC) were used to measure various aspects of emotion regulation and socioemotional competence.

Theory of Mind. Scores were combined across the perspective taking tasks to yield a theory of mind composite. An ANCOVA was conducted with posttest theory of mind score entered as the dependent variable, intervention group entered as a fixed factor, and age, verbal ability, and pretest theory of mind entered as covariates. There was no significant effect of group $F(2, 59) = .31$, *ns*.

Sticker task. Total stickers given to the "other child" were recorded and used as a measure of prosocial behavior. Posttest prosocial score was entered into an ANCOVA as the dependent variable, with intervention group as the fixed factor, and age and pretest

prosocial behavior entered as covariates. There was no significant effect of group F(2, 59) = .02, *ns*.

Emotion Regulation at Posttest. Experimenter rated emotion regulation at posttest was entered into an ANCOVA as the dependent variable, with intervention group and baseline regulation group entered as fixed factors, and age, sex, and emotion regulation at pretest entered as covariates. There were no main effects of group F(2, 59) = 0.29, *ns*, or significant interactions between group and baseline functioning F(2, 59) = 1.44, *ns*.

Emotion Regulation at 4-month Follow-up. Parents and teachers scored participants on emotion regulation four months following the intervention. An ANCOVA was conducted with parent reported emotion regulation entered as the dependent variable, intervention group entered as a fixed factor, and pretest parent reported emotion regulation entered as a covariate. There was no significant effect of group F(2, 41)= 0.47, *ns*. Teacher reported emotion regulation was entered into an ANCOVA as the dependent variable with intervention group entered as the fixed factor, and age and pretest parent-rated emotion regulation as covariates. There was a non-significant trend for group F(2, 28) = 2.88, p = .07, η_p^2 = .17 (see Figure 5). Due to small sample size and a visual inspection of the data, groups were combined into one treatment group to examine the effects of treatment vs. no intervention. The combined treatment group showed significantly better emotion regulation than the no intervention group, F(1, 29) = 5.97, p = .02, η_p^2 = .17.

Summary. Neither treatment group showed improvement on perspective taking or prosocial tasks. Experimenter-rated emotion regulation at pretest also showed no differences between groups, however four months following the intervention, the combined treatment group showed better emotion regulation in the classroom than the NI group.

Discussion

Self-regulation is a crucial competency for successful navigation of everyday life, but early emotional neglect, such as institutional deprivation or foster care, increases children's risk for poor outcomes in this area. The current study investigated the impact of mindfulness and executive function training interventions on IA children's self-regulation using a randomized, controlled trial.

The first aim of this study was to examine the extent to which mindfulness and executive function trainings improve behavioral self-regulation including inhibitory control, delay of gratification, selective attention, and hyperactivity/attention problems. I predicted that both interventions would lead to improvements in these areas as they were directly practiced in some form in both interventions. Overall, both the mindfulness and executive function trainings both appear to improve various aspects of behavioral regulation.

Specifically, children in the executive function training group showed the most improvement in the inhibitory control task where experimenters instructed participants to refrain from reaching into a bin full of prizes. While both interventions practiced inhibition, the executive function training practice was more of a direct parallel to the

demands of this particular laboratory task. For example, activities in the EF training included playing red light/green light, Simon says, and Bear/dragon, all games that involve specific practice in listening for an instruction and then controlling their bodies accordingly. In fact, "stopping our bodies" was one of the three daily themes in the EF training (see Appendix 2), so inhibitory control was practiced at least once in every session. The mindfulness training's practice of inhibitory control was still present but not as obvious of a parallel to the dinky toys task. For example, in one mindfulness activity, children were instructed to mindfully smell different hidden scents. While an automatic response would often be to shout out a guess as to the identity of the hidden scent, children instead were asked to practice focusing on other aspects of the scent such as if it was pleasant or unpleasant, what people or places it reminded them of, and what emotions it stirred. This result supports the conclusion that interventions are most effective in improving the skills that are directly practiced (see Diamond, 2012). At least by the time of posttest, one to three weeks following the conclusion of the interventions, there does not appear to be a great amount of transfer or generalization in this area (i.e. from skills practiced in the mindfulness training). It is possible, however, that transfer and generalization develop over time following an intervention and may not be present so soon after this short-term intervention. It is important to note that several participants were excluded from this analysis due to ceiling effects at pretest. This reinforces the need for tasks that challenge the executive function capacities of participants, as has been noted by others (e.g. Diamond, 2013b). It also may offer insight into the findings that

children with poorer baseline regulation show more improvement from interventions, which will be discussed further below.

In the area of delay of gratification, there was a trend for an effect of the mindfulness group in improving children's ability to delay. Due to limited statistical power, this trend will be interpreted, although with caution. The pilot study also showed a non-significant trend for better delay of gratification in the mindfulness group using a different delay of gratification task (gift delay) in a small group, adding some additional confidence in this potential effect.

Children's delay of gratification has demonstrated remarkable power in predicting future outcomes, however, it has been notably difficult to improve through intervention (e.g. Raver et al., 2011, Lillard & Else-Quest, 2006, Diamond, 2013a). The task is complex and requires various self-regulation skills working in concert. Controlling for age, delay of gratification was not significantly associated with any of the other self-regulation laboratory tasks, or teacher or parent ratings of hyperactivity/inattention or emotion regulation. Previous studies (e.g. Sonuga-Barke, Delen, & Remington, 2003) have also found that delay of gratification is somewhat tangential to many other executive function skills, which leads one to wonder what additional abilities are being tested. In order to successfully delay in the star game, one must inhibit the impulse to click the button upon seeing the first star, carefully direct attention so as to not miss the big star while also not focusing too much on the little star and/or the button which could lead to premature clicking, tolerate the boredom that may result from having to wait while nothing is happening, and regulate feelings of frustration.

One reason that mindfulness may have improved children's ability to delay gratification on this task, if subsequent work confirms this effect, is its increasing practice of brief meditation. This practice may have increased children's ability to tolerate the boredom associated with the task. Children also might have used the focused attention practiced in mindfulness to direct their attention away from the little star and the button to other senses.

While this result is promising, further research is necessary to determine if mindfulness can improve children's delay of gratification. For example, this result may not replicate with other delay of gratification tasks. Since delay of gratification tasks used with preschoolers, such as the marshmallow task, are too easy for older children and would not challenge their inhibitory control abilities sufficiently, different tasks must be used with different ages. At the same time, by changing the tasks one runs the risk of assessing different facets of child functioning. While the star game appears to measure a similar underlying skill as the marshmallow task, it also differs in several ways that could lead to different findings. Further research is also needed to determine if changes in laboratory measures of delay of gratification would lead to changes in future outcomes that have been associated with the task in longitudinal studies. Despite these limitations, this trend is encouraging for the potential to improve an area of self-regulation wide-reaching effects. As Moffit and colleagues state (2011, p. 2), "interventions that achieve even small improvements in self-control for individuals could shift the entire distribution of outcomes in a salutary direction and yield large improvements in health, wealth, and crime rate for a nation."

In arguably the most exciting finding of the study, children in both the mindfulness and executive function training groups showed fewer teacher-rated hyperactivity and attention problems than children in the no intervention group. While response rate from teachers was limited, teacher report is an excellent method of detecting "real world" behavioral change from a completely objective source. Not only were teachers blind to group status, they were also not informed about the study purpose at all (i.e. they were not aware that the student was participating in an intervention study or that it was focused on self-regulation). It is very encouraging that even with a limited sample size and a brief questionnaire, significant differences arose between the groups on hyperactivity and attention problems. Some of the skills measured by the questionnaire were directly practiced in the interventions, such as focusing attention (SDQ item: "Easily distracted, concentration wanders"). While others likely signify some generalization of skills practiced in the training (e.g. "Sees tasks through to the end," "thinks things out before acting"). Overall, differences in this measure mean that improvements in self-regulation skills transferred to classroom behavior observable by teachers. This result extends previous research studying mindfulness or executive function training interventions. While teacher reported behavior change has been reported in previous studies of mindfulness based interventions, these studies were conducted in the school and therefore teachers were not blind to group status (e.g. Flook et al., 2010, Semple, Reid, & Miller, 2005). EF training interventions have found limited evidence of transfer to classroom behavior improvement (Rapport, Orban, Kofler, & Friedman, 2013), and a recent meta-analysis of a computerized EF training showed no effects when

teachers were blind to condition (Dongen-Boomsma, Vollebregt, Buitelaar, & Slaats-Willemse, 2014).

Since both interventions were effective in this area, it is also possible that any summer small group classes would lead to fewer hyperactivity and attention problems the following year in school. In both classes, children met with a group of other children, practiced following a teacher's instructions, and were reinforced for positive behavior. It may be these attributes of the classes, and not the content of the mindfulness or executive function interventions per se that led to the group differences. Thus in subsequent follow up work, an active comparison group that does not involve attention or mindfulness training, such as a reading group, needs to be employed.

It is interesting that parent's reports of behavior did not show the same effect as teacher reports especially since these measures were significantly correlated. In general, parent's perceptions of their children's behavior are quite stable over time, and it is possible that these stable perceptions do not readily change with relatively small changes in children's behavior. It is also possible that children's behavior showed more improvement in a classroom context than at home. At least one study of mindfulness training with typically developing children demonstrated improvement across both contexts, although reporters were not blind to group status (Flook et al., 2010).

The second aim of the study was to examine whether baseline regulatory functioning moderated the effects of the interventions. Previous studies have found stronger effects for those children who demonstrate poorer self-regulation at pretest (e.g. Flook et al., 2010; Karbach & Kray, 2009). The findings of the current study were mixed

in this area. There was a significant interaction of baseline regulatory functioning on the flanker task of selective attention. The training interventions improved selective attention only in the group of participants who began the intervention with poorer self-regulation. Some researchers have argued that moderation effects such as these are results of ceiling effects on outcome measures rather than true evidence of differential influence of the interventions (e.g. Calamia, Markon, & Tranel, 2012). While it is possible that ceiling effects played a role in this result, the effect should be minimal due to the adaptation of the task based on practice performance. Those participants who scored near or at ceiling on the practice trials were given a significantly harder task (faster stimulus presentation and response time allowance) than participants who scored poorly on the practice trials. Because of this task modulation, we can say with greater confidence that the intervention exerted greater effect on those children with poorer baseline functioning, at least in the domain of selective attention.

While there was not an interaction with baseline functioning for the inhibitory control task, a large minority of children who scored at ceiling on the task at pretest were excluded from the analyses. A task that challenges the inhibitory control capacities of all participants is needed to test for moderation without influence from ceiling effects. Interactions with baseline were not seen for delay of gratification; the trend for improvement in the mindfulness group was consistent across baseline functioning. Due to small sample sizes and poor statistical power, interaction terms were not included in the parent and teacher report models.

These findings lend some support to the conclusion that the children who struggle most with self-regulation benefit the most from interventions, at least in certain areas of functioning. Therefore, early interventions targeted at children most in need might level the playing field by reducing disparities in self-regulation and thus reducing disparities in academic and other outcomes. However in other areas, baseline regulatory functioning did not moderate effects, indicating that these interventions may also be useful in a universal prevention context.

The final aim of this study was to examine the effects of mindfulness and executive function training in improving socioemotional outcomes. I hypothesized that mindfulness training would improve children's theory of mind, prosocial behavior, and emotion regulation, while the EF training would show little or no effects in this area. Contrary to my hypothesis, neither treatment group showed significantly better theory of mind or prosocial behavior compared with the no intervention group. Mindfulness-based training practices considering one's own thoughts and emotions, as part of its focus on the present, as well as the thoughts and emotions of others as part of its focus on compassion. It is possible that other mindfulness-based interventions that have found effects in the area of prosocial behavior (e.g. Flook, 2013) focused more on the compassion aspect of mindfulness practice. It is also possible that prosocial behavior is more resistant to change in a group of children with highly resourced parents such as this. Anecdotal evidence from interactions with study parents suggests that many of these parents were already focusing on perspective taking and prosocial behaviors with their children. Additionally, IA children have deficits in theory of mind in comparison with

typically developing children (e.g. Tarullo, Bruce, & Gunnar, 2007). It is possible that early emotional neglect fundamentally changed the way that IA children perceive the social world around them, preventing the intervention from having an effect in this area, but that mindfulness training would improve theory of mind in typically developing children. Conversely, it is also possible that a brief mindfulness intervention such as this was not sufficient to affect theory of mind skills or prosocial behaviors, or that young children, who do not have fully developed capacities for reflective thinking, may not fully benefit from the reflective nature of mindfulness.

Treatment groups also did not show improved emotion regulation compared with the no intervention group at posttest or by parent ratings, however there was a trend for a significant effect of group on teacher rated emotion regulation that achieved significance when treatment groups were combined and compared with the no intervention group. It is possible that the effects of the intervention were not yet evident at posttest, but developed overtime as participants continued practicing techniques learned in the classes. There were also weak correlations between pretest and posttest on the experimenter rated emotion regulation, even in the control group, which might indicate that ratings on this measure had more to do with transient factors such as the child's mood the day of the testing rather than their overall emotion regulation skills. The change in experimenters from pre to posttest also introduced potential measurement error that may have affected the results; however inter-rater reliability was in the excellent range (Fleiss, 1981). Parent report, again, may be resistant to change despite improvements in child behavior. Alternatively, teachers might have a more general view of students as well-behaved or

not well-behaved, that clouds their reports on specific scales. This could be why both intervention groups showed improvement despite the fact that arousal modulation and emotion regulation strategies are more explicitly taught in the mindfulness training than in the EF training. Otherwise, improvements in emotion regulation might be mediated by improvement in attention, which both interventions appear to have fostered. Further research is needed to elucidate the effects of mindfulness and executive function training in improving children's emotion regulation. One challenge is the lack of validated, objective measures of emotion regulation. Development and use of such measure would be extremely valuable, especially in clarifying disparate findings between observer reports.

Limitations

Although there are a number of strengths to the present analyses, including the robust randomized, controlled design, there are also several limitations. First and foremost, while the initial recruited sample size (81) was sufficiently powered to detect medium to large effect sizes, withdrawal and failure to respond rates were higher than anticipated, leading to insufficient power for many of the analyses. Additionally, the withdrawal and response rates may affect the generalizability of the findings, and as always with a sample of volunteers, one must wonder what segment of the population agreed to participate in the first place. It is possible that the families who agreed to participate in this study were more concerned about their child's self-regulation and more motivated than other families to improve this. The families that stayed in the study and who returned follow-up questionnaires may have been more organized and/or more

motivated. While all studies face these challenges due to the voluntary nature of research, future studies can include larger sample sizes that will allow for better analyses of those families who do not complete the study in order to identify predictors of withdrawal and attempt to address barriers to completion.

Second, the primary investigators in the study were also the leaders of the intervention. While objective engagement coding showed no differences in delivery between the two interventions, or between instructors, more ideal would have been for independently trained instructors to lead the classes. Third, the internationally adopted population studied in this analysis is a very specific group, and these results cannot speak to the potential for mindfulness or executive function trainings to affect self-regulation in typically developing populations, or even in populations experiencing other types of adversity. Fourth, the large age range of participants in the study can be seen as both a strength and a limitation. The large range adds to the generalizability of the interventions which appear to show effects over a wide period of development, however some of the measures used in the current study did not sufficiently challenge the self-regulatory capacities of all the participants, in part due to the rapid development of self-regulation skills over this period. Again, a larger sample size would have allowed for careful analysis of the intervention effects at different ages. Finally, because this was a preliminary, efficacy trial, and because of lack of power, intent-to-treat analyses were not completed. Intent-to-treat analyses are the gold standard in intervention/treatment research and should be used in follow-up studies.

Conclusion and Future Directions

Even with these limitations, the results indicate that mindfulness and executive function trainings improve self-regulation in internationally adopted children. Particularly promising are the results indicating that following the brief summer trainings, teachers of children in the treatment groups saw fewer hyperactivity and attention problems and better emotion regulation in the classroom. The sizes of the effects on classroom behavior were medium to large (see Cohen, 1988) indicating meaningful real world differences. Both interventions showed improvements in self-regulation, but each showed greater improvements in some areas and not others. Direct practice of skills appears essential for change, at least in the short term. It is unclear at this point whether further generalization and transfer would occur over time. Additionally, our results did not support the hypothesis that "bottom-up" arousal modulation of the mindfulness curriculum (combined with "top-down" attention focus practice) would allow for better emotion regulation than the "top down"-only practice of the EF training. Neither intervention showed effects in emotion regulation soon after the trainings, while both intervention groups showed greater emotion regulation than the control group by teacher report at the four-month follow-up. It appears that "top down" and "bottom up"/combined approaches work equally well in improving emotion regulation but future research is needed to investigate this further.

Results of this study have important implications for both practitioners and researchers. Practitioners working with children who have weak self-regulatory skills can apply the strategies of these interventions to therapeutic and educational settings to promote self-regulatory improvement. In fact, a manualized individual therapy program,

adapted from the interventions tested in this study, is currently under development and pilot testing at the International Adoption Clinic at the University of Minnesota Amplatz Children's hospital. Future research will be needed to determine the effectiveness of these interventions in a clinical setting.

Furthermore, it is also possible that these interventions would be successful in improving self-regulation in all children if offered in a universal setting such as a school program. While some of the results of this study suggest that the interventions are more helpful to children with low baseline regulation, other results showed improvement across the spectrum. Although internationally adopted children are at higher risk for self-regulation problems in general, many of the children in the study were far below clinical level problems. These results warrant further research into the effectiveness of the interventions for different populations and in different settings. Some research into the use of mindfulness (Greenberg, 2013) and executive function training (Wexler, 2013) in school programs is currently underway but additional research is needed. Such research will also require additional measures of positive development such as wellbeing, rather than simply looking for a lack of problems.

Further research is also needed to elucidate the mechanisms of change of these interventions. Since both interventions led to change in some of the areas of self-regulation, it especially warrants further investigation into the active ingredients. Component analyses would help illuminate which aspects of the interventions are having the most effect. Additionally, it is not clear for the mindfulness intervention whether mindfulness itself improved in children and whether that mediated changes in other areas.

Currently there is no validated measure of mindfulness for children under 10, however development and use of such an instrument would be valuable for understanding the process of mindfulness in children (see Burke, 2014). Further research should also investigate the optimal dosage for mindfulness and executive function trainings. Number of classes attended (a crude measure for dosage) did not predict intervention effects in the current study, but further investigation is needed in this area.

Moreover, overall group effects are valuable, but future research with larger samples should also examine the predictors of individual improvement. Naturally, some children will show more benefits of the interventions than other children and it is useful to examine these individual differences. Also, given that both interventions showed improvement, but in somewhat different areas, it would be useful to examine which children benefited more from the mindfulness and which benefited from the EF training, for the potential to tailor interventions to the individual child in the future.

Another important future direction is to do long term follow-up studies to detect if improvements seen in self-regulation cascade into other areas of development as would be predicted by the model of self-regulation as the mediating mechanism. Follow-up studies of a year or more would be able to look at group differences in peer problems, academic success, and deprivation specific problems such as disinhibited social engagement and quasi-autistic features, and would be able to empirically test the mediating effects.

Finally, while interventions focused on the child are useful, and are especially justified with the international adoption community, children are greatly affected by their

environment, especially their parents and school. Future research should examine the combination of such trainings with parent- and school-targeted intervention. Mindful parenting has already garnered a good deal of attention as a strategy for intervention (e.g. Coatsworth, Duncan, Greenberg, & Nix, 2010) as has teacher directed mindfulness training (e.g. Singh, Lancioni, Winton, Karazsia, & Singh, 2013; Jennings, Frank, Snowberg, Coccia, & Greenberg, 2013). Mindful parenting might be useful across a wide range of parents, as it could both improve sensitivity and responsiveness and decrease intrusiveness if successful. Interest has also been shown in training executive functioning skills in parents (Sanders & Mazzucchelli, 2013), especially high-risk parents such as those exposed to violence (e.g. Berkowitz, 2003). And adding a parenting component to the current interventions could encourage further home practice increasing the dosage, and potentially leading to greater and more lasting effects.

In conclusion, the findings of the current study are promising given the significant differences that emerged between groups showing immediate and short term follow-up effects of a relatively brief intervention period (12 hours of formal training) in this relatively small sample. Following replication of these results in a larger sample, effectiveness trials should look at these interventions in real world settings such as a mental health clinic or school. Introduction of these types of practices in elementary education may prove to be a viable and cost-effective way to improve self-regulation processes in general, and perhaps specifically in children with self-regulation difficulties, and thus enhance young children’s development.

Table 1.
Means, standard deviations, and percentages within the clinical range on Strength and Difficulties Questionnaire symptoms scales as rated by parents at pretest.

	Mean (SD)	Possible Range (Clinical cut off)	Percent in Clinical Range
Emotional Distress	2.5 (2.3)	0-10 (5 or above)	26%
Conduct Problems	2.0 (1.9)	0-10 (4 or above)	18%
Hyperactivity/Inattention	4.7 (2.8)	0-10 (7 or above)	29%
Peer problems	1.2 (1.5)	0-10 (4 or above)	11%
Prosocial behavior	8.1 (1.7)	10-0 (4 or below)	3%
Total Difficulties	10.4 (6.1)	0-40 (17 or above)	15%

Note: Clinical cutoffs taken from Goodman (1997).

Table 2.
Descriptive statistics and between group analyses for pretest variables for study-completing participants

		Mindfulness	Executive Function	No Intervention	F(*p*)
		M (SD)	M (SD)	M (SD)	
Age at pretest (months)		94.6 (21.3)	101.9 (17.3)	105 (19.5)	1.77 (.18)
Age at adoption (months)		18.0 (12.2)	17.2 (12.9)	14.1 (8.13)	.75 (.48)
Verbal ability		87.2 (15.4)	96.3 (23.8)	94.5 (21.6)	1.25 (.30)
Flanker accuracy		.71 (.15)	.79 (.13)	.76 (.13)	1.88 (.16)
Dinky toys		.77 (1.02)	.77 (.95)	.74 (.95)	.01 (.99)
Delay time (seconds)		18.1 (11.0)	17.2 (11.0)	19.1 (8.65)	.19 (.83)
P-report HAPS		4.43 (2.33)	4.71 (3.10)	4.95 (2.98)	.19 (.82)
Theory of mind		4.48 (1.95)	5.52 (2.33)	5.09 (1.71)	1.5 (.23)
Prosocial behavior		4.43 (2.17)	5.35 (2.46)	4.73 (2.19)	.90 (.41)
E-rated ER		1.43 (.79)	1.86 (.85)	2.05 (.84)	3.2 (.05*)
P-report ERC		3.39 (.29)	3.17 (.41)	3.35 (.31)	2.76 (.07^)
		n (%)	n (%)	n (%)	χ^2 (*p*)
Sex					
	male	5 (22%)	8 (38%)	6 (27%)	1.47 (.48)
	female	18 (78%)	13 (62%)	16 (73%)	
Adoption history					
	Institution	16 (70%)	14 (67%)	15 (68%)	0.04 (.98)
	Foster care	7 (30%)	7 (33%)	7 (32%)	
ADHD					
	Diagnosed	2 (9%)	2 (9%)	3 (14%)	3.5 (.47)
	Not	21 (91%)	19 (91%)	19 (86%)	

Note: n = 66, ^p < .10, *p < .05. P-report = parent-reported, HAPS = Hyperactivity and Attention Problems Scale from the Strength and Difficulties Questionnaire, E-rated = Experimenter rated, ER = Emotion regulation, ERC= Emotion Regulation Checklist

Table 3.
Instructor and child engagement and attendance for treatment groups

	Mindfulness M (SD)	EF M (SD)	Between groups t(p)
Instructor Engagement	4.90 (.13)	4.96 (.04)	-.76 (.49)
Child Engagement	4.23 (.57)	4.41 (.53)	-1.10 (.28)
Attendance	10.6 (1.06)	9.00 (1.59)	4.12*** (.000)

Note: n = 44, ***p < .001. Engagement was rated on a five point Likert-style scale.

Table 4.
Partial correlations between attendance, child engagement and outcome measures, controlling for pretest performance and age.

	Attendance	Child Engagement
Dinky toys (df = 40)	.20	-.05
Delay time (df = 40)	.19	.12
Flanker (df = 33)	-.17	.08
Parent HAPS (df=27)	-.05	.10
Teacher HAPS (df = 16)	-.09	-.28
Theory of mind (df = 39)	.11	.47**
Prosocial (df = 39)	-.05	-.22
E-rated ER (df = 40)	-.04	.18
Parent ERC (df = 27)	-.16	-.17
Teacher ERC (df = 15)	.19	.19

Note: **p < .01, HAPS= Hyperactivity and Attention Problems Scale from the Strength and Difficulties Questionnaire, E-Rated= Experimenter rated, ER=Emotion regulation, ERC= Emotion Regulation composite from the Emotion Regulation Checklist

Table 5.

Bivariate correlations among variables at post-test/follow-up

	1	2	3	4	5	6	7	8	9	10
	r (n)	r (n)	r (n)	r (n)	r (n)	r (n)	r (n)	r (n)	r (n)	r (n)
1. Age	-									
2. Flanker	.54***(66)	-								
3. Dinky Toys	.01 (66)	-.08 (66)	-							
4. Delay time	.50***(66)	.40***(66)	-.09 (66)	-						
5. PR HAPS	-.10 (45)	-.26^ (45)	.15 (45)	-.08 (45)	-					
6. TR HAPS	-.28 (34)	-.50**(34)	.24 (34)	-.26 (34)	.51**(29)	-				
7. ToM	.43***(65)	.44***(65)	.04 (65)	.48***(65)	.08 (44)	-.25 (33)	-			
8. Prosocial	.34**(66)	.26* (66)	-.08 (66)	.20 (66)	-.18 (45)	.003 (34)	.13 (65)	-		
9. ER Emo R	.22^ (66)	.27* (66)	-.02 (66)	-.05 (66)	-.31* (45)	-.44**(34)	.10 (65)	-.14 (66)	-	
10. PR ERC	-.25^ (45)	-.11 (45)	.12 (45)	-.19 (45)	-.24 (45)	-.19 (29)	-.23 (44)	-.16 (45)	.12 (45)	-
11. TR ERC	-.08 (33)	-.05 (33)	-.14 (33)	.01 (33)	-.35^ (28)	-.46**(33)	.06 (32)	-.19 (33)	.05 (33)	.54**(28)

Note: ^p < .10, *p < .05, **p < .01, ***p < .001, PR=Parent report, TR= Teacher report, ER= Experimenter rated, HAPS= Hyperactivity and Attention Problems Scale from the Strength and Difficulties Questionnaire, ToM= Theory of Mind, ERC= Emotion Regulation composite from the Emotion Regulation Checklist.

Table 6.

Partial correlations among variables at post-test/follow-up controlling for age

	1	2	3	4	5	6	7	8	9	10
	r (df)	r (df)	r (df)	r (df)	r (df)	r (df)	r (df)	r (df)	r (df)	r (df)
1. Flanker	-									
2. Dinky Toys	-.10 (63)	-								
3. Delay time	.18(63)	-.11 (63)	-							
4. PR HAPS	-.25 (42)	.16 (42)	-.04 (42)	-						
5. TR HAPS	-.43*(31)	.25 (31)	-.14 (31)	.50**(26)	-					
6. ToM	.27*(63)	.03 (62)	.34**(62)	.14 (41)	-.14 (30)	-				
7. Prosocial	.10 (63)	-.09 (63)	.03 (63)	-.16 (42)	.11 (31)	-.03 (62)	-			
8. ER Emo R	.19 (63)	-.02 (63)	-.19 (63)	-.30* (42)	-.40*(31)	.004 (62)	-.23^ (63)	-		
9. PR ERC	.04 (42)	.12 (42)	-.08 (42)	-.28^ (42)	-.28 (26)	-.13 (41)	-.08 (42)	.18 (42)	-	
10. TR ERC	.003 (30)	-.14 (30)	.04 (30)	-.36^ (25)	-.50**(30)	.10 (29)	-.17 (30)	.06 (30)	.54**(25)	

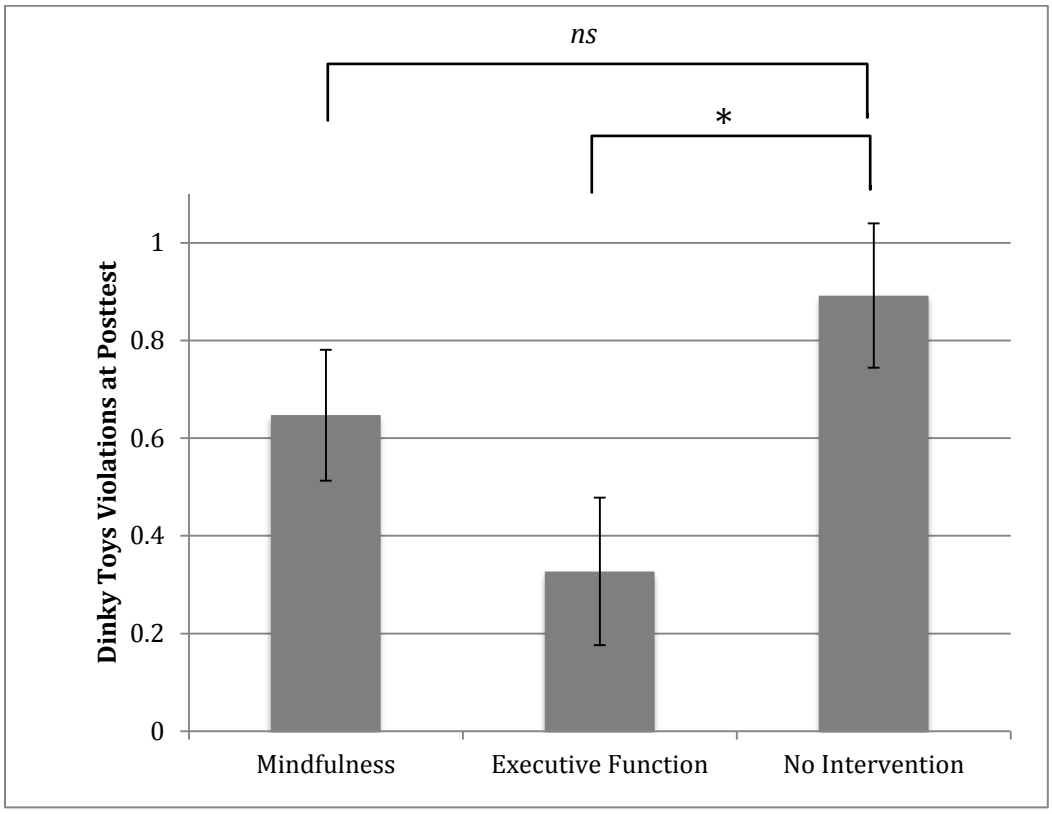
Note: ^p < .10, *p < .05, **p < .01, ***p < .001, PR=Parent report, TR= Teacher report, ER= Experimenter rated, HAPS= Hyperactivity and Attention Problems Scale from the Strength and Difficulties Questionnaire, ToM= Theory of Mind, ERC= Emotion Regulation composite from the Emotion Regulation Checklist.

Table 7.
Pre to posttest/follow-up correlations by group

	Mindfulness	Executive Function	No Intervention
Dinky toys	.54**	.48*	.81*
Delay time	.87***	.85***	.84***
Flanker	.68***	.66**	.65**
Parent HAPS	.39	.85***	.93***
Theory of mind	.08	.61**	.66**
Prosocial	.73***	.92***	.65**
E-rated ER	.33	.36	.20
Parent ERC	.59*	.80**	.69**
Vocab	.83***	.85***	.87***

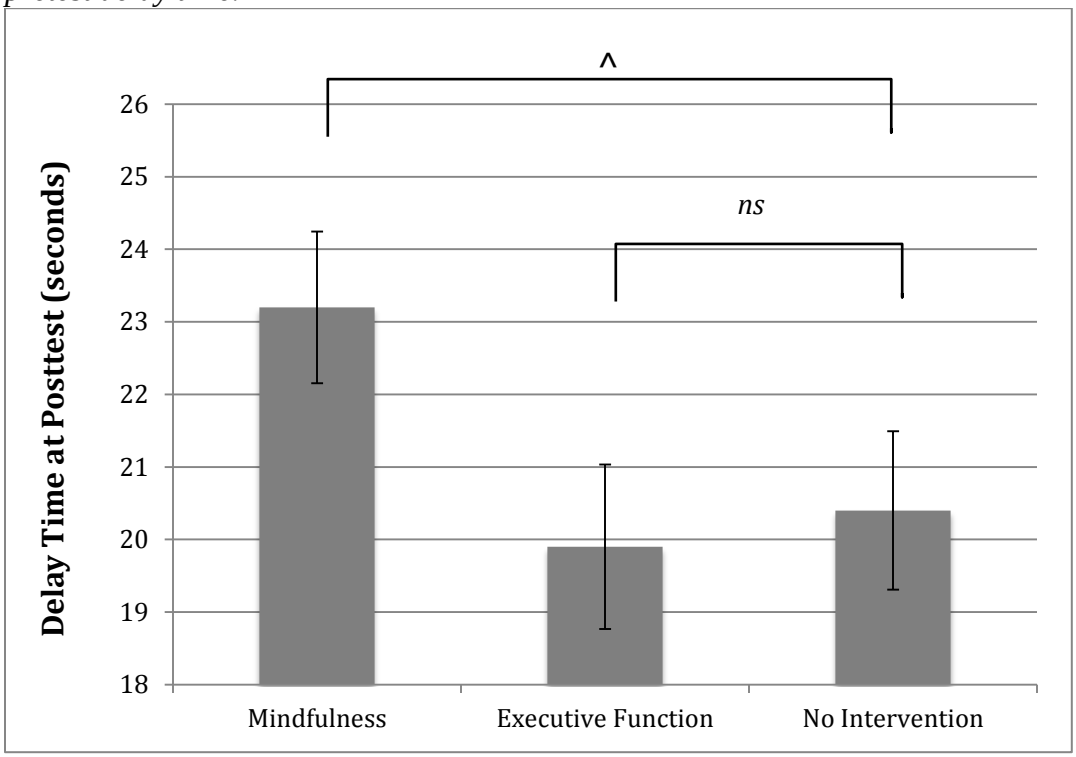
Note: *p < .05, **p < .01, ***p < .001. HAPS= Hyperactivity and Attention Problems Scale from the Strength and Difficulties Questionnaire, E-Rated= Experimenter rated, ER=Emotion regulation, ERC= Emotion Regulation composite from the Emotion Regulation Checklist

Figure 1. *Estimated Marginal Means of average dinky toys violations at posttest, controlling for age, sex, and pretest score.*



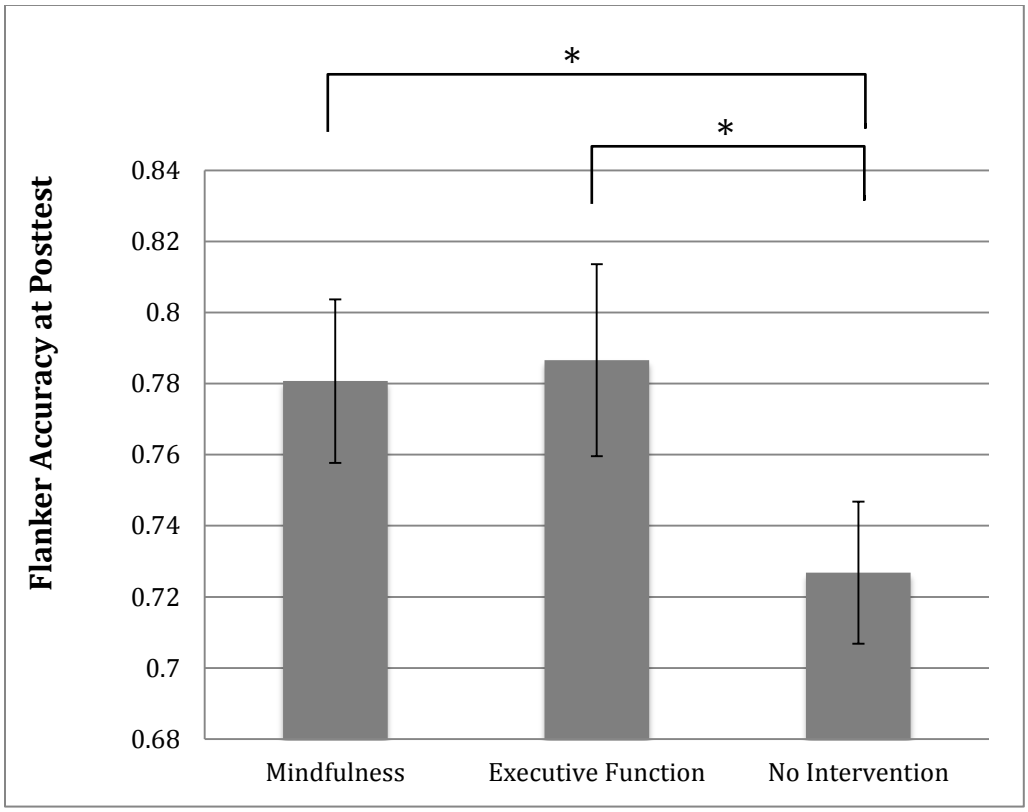
Note: *p < .05. Covariates appearing in the model are evaluated at the following values: age = 98.2, sex = 1.63 (male = 1, female = 2), Dinky Toys violations at pretest = 1.11.

Figure 2. *Estimated Marginal Means of delay time at posttest, controlling for age and pretest delay time.*



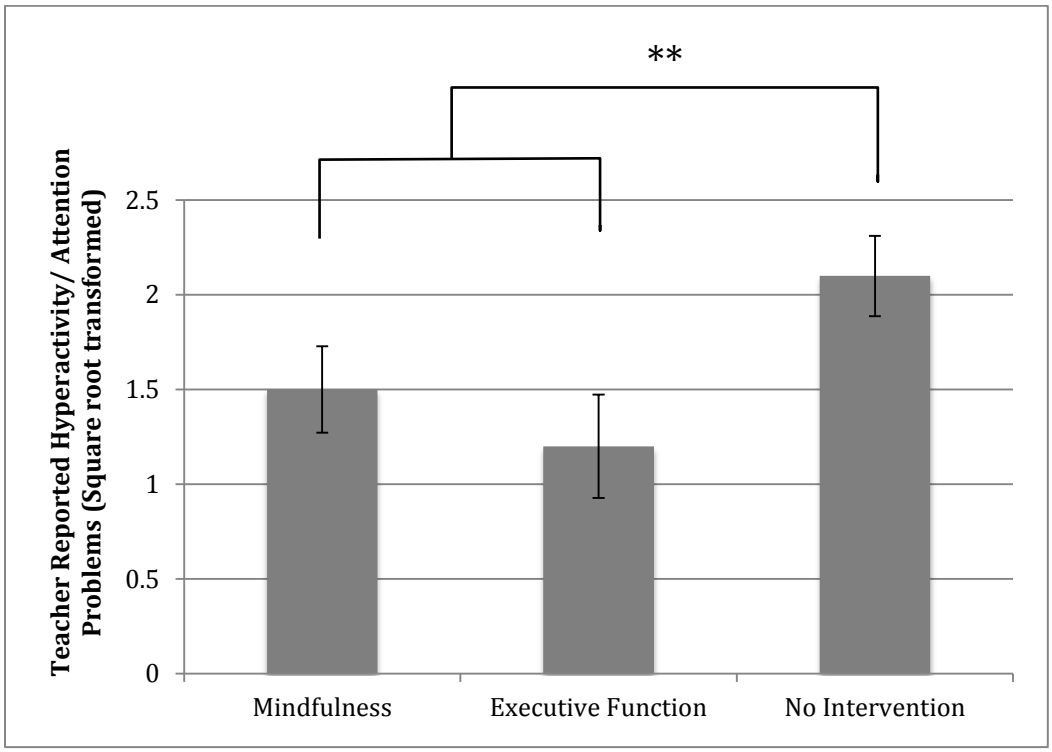
Note: ^p < .10. Covariates appearing in the model are evaluated at the following values: age = 100.5 months, pretest delay time = 18.3 seconds.

Figure 3. *Estimated Marginal Means of Flanker accuracy within the low baseline regulation group, controlling for age, flanker version, and pretest accuracy.*



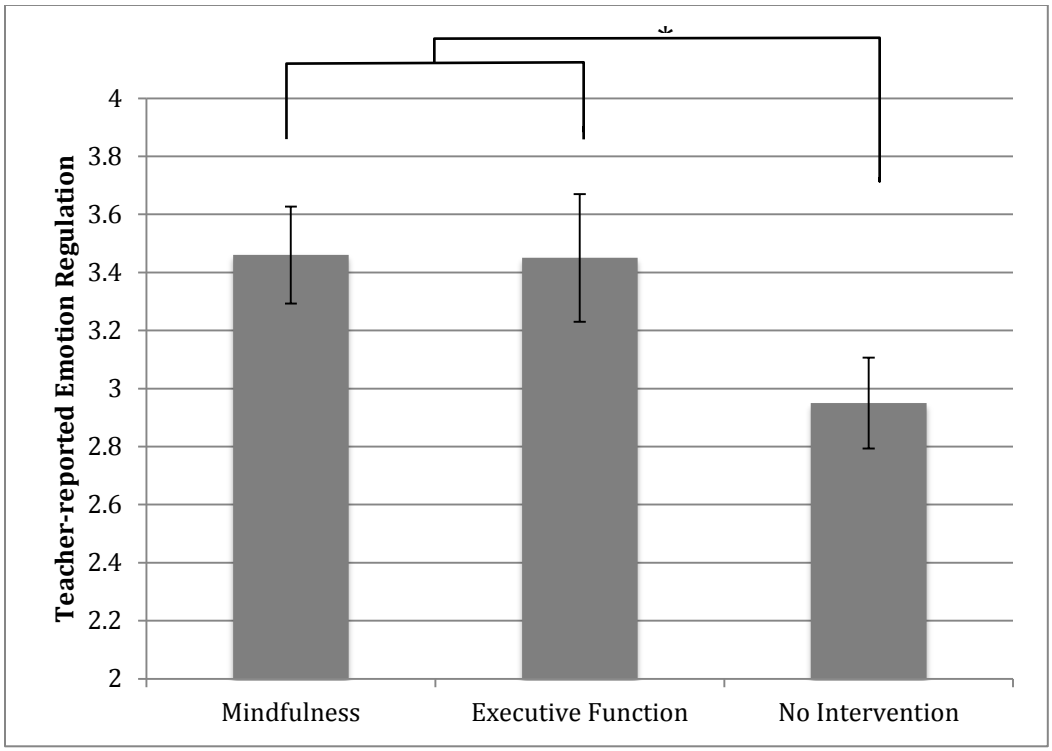
Note: *n = 27*, *p < .05. Covariates appearing in the model are evaluated at the following values: Age = 102.8 months, Flanker Version = 400, Flanker accuracy at pretest = .76.

Figure 4. *Estimated marginal means of teacher-reported hyperactivity and attention problems from the Strengths and Difficulties Questionnaire, controlling for age, sex, and pretest hyperactivity and attention problems.*



Note: **p < .01. Covariates appearing in the model are evaluated at the following values: age = 102.1, sex = 1.62 (male =1, female = 2), and parent-rated pretest hyperactivity and attention problems (square root transformed) = 2.09.

Figure 5. *Estimated marginal means of teacher-reported emotion regulation from the Emotion Regulation Checklist, controlling for age and pretest emotion regulation.*



Note: *p < .05. Covariates appearing in the model are evaluated at the following values: age = 101.7, pretest parent-rated emotion regulation = 3.24.

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Appendix A

Outline of Mindfulness Curriculum

Week	Topic/ Objective	Example Activities
1	Getting to know our breath	Lungs/Breath Diagram: Learn about where our breath goes in our bodies Parachute Breathing: All of the children hold onto a parachute and lift it as they inhale slowly and deeply, then let it fall as they slowly exhale. Pinwheel Breathing: practice taking short and long breaths, taking note of the calm, relaxed feelings during slow breathing Rocking the Beanie to Sleep: Practice deep belly breathing with a beanie toy on belly. Starfish Stretch: Lie down and as you inhale, stretch all limbs out from the center of the body, relax on the exhale.
2	Getting to know our bodies and feelings	Tic Toc: sit cross-legged and rock side-to-side to a drumbeat, practice listening to the drum and matching its pace Body Scan: practice being aware of different sensations in each region of the body Mindfulness Journals: practice being mindful of feelings and emotions, color/decorate a blank outline of a person to describe feelings Hopping Game: practice mindful breathing and listening for a cue to hop forward at the same time as other students in line Friendly Wishes: practice mindful breathing while sending positive, friendly wishes to ourselves, friends, family, and the whole world
3	Mindful Seeing and Hearing	Shape hunt: practice mindfully observing surroundings, find shapes in classroom (e.g., the table is a square) Sounds right: match plastic Easter eggs filled with different object by sound only (e.g., salt, paperclips)

4	Mindful Touch, Smell, and Taste	Behind My Back: practice identifying familiar objects behind the back, using touch only Focus on Smell: practice identifying objects in opaque canisters by smell, being mindful of what these smells make us think, remember, and feel The Mindful Raisin: practice mindfully observing a raisin's appearance and texture and noticing how it feels to eat it
5	Breathing, Listening, Feelings, and Thoughts	Read "You are Not Your Thoughts" Deep Body Scans with Mindfulness Journaling Baking Soda in Water: add baking soda to a clear bowl of water and get wiggly and "jazzed up," practice slow mindful breathing as baking soda settles and water becomes clear again
6	Breathing, Listening, Feelings, and Thoughts	Read "Peaceful Piggy Meditation" Snow Globe: shake a snow globe and practice mindful breathing and awareness while the snow settles Read "Moody Cow Meditates" Make your Own Snow Globe "mind jar", practice using mind jar to help regulate

Appendix B

Outline of Executive Function Training Curriculum

Each class will consist of inhibitory control games, selective attention games, and cognitive flexibility/ imagination games.

Inhibitory Control Games ("Stopping our bodies")

Objective: be able to stop oneself from performing actions that one is not supposed to do, understand that rules can change and be able to change behavior to adhere to new rules.

Sample Activities

- Head-Shoulders-Knees-and-Toes (classic children's song): during each verse, the name of a body part is omitted. Children must remember not to say the name of the body part even though they are pointing to it.
- Red Light, Green Light: game in which children move after they hear "Green light!" and freeze when they hear "Red light!"
- Simon Says: children perform an action only after the leader precedes the command with "Simon says…"
- Bear/Dragon: puppet twist on Simon Says. Children perform an action only if the friendly bear tells them to do it. A more complex variation involves switching the rule halfway through so that children only respond to the dragon.
- Freeze Dance: children dance (matching pace to the music, which shifts from fast to slow) while the music is playing, have to freeze in place when it stops.

Selective Attention Games ("Paying attention")

Objective: Be able to focus attention on relevant information to achieve specific goals. Be able to keep in mind information in order to achieve a goal.

Sample Activities

- Sound Bingo: Each child has a card with 4 animals on it, when they hear an animal sound they place a marker on the matching picture.
- Blink!: sort cards by a different characteristic (color, shape, or number)
- Familiar Figures: Children match a card with a picture of an animal on it to one of three photos of animals that look similar to each other.
- Matching/ Memory Game: Children will be shown 3-6 (depending on the week) picture cards that will then be placed on a board face down. Each child

gets a turn selecting a card from a deck, and trying to match it to the card on the board.
- Spot the Difference: Children have to spot all of the subtle differences between two pictures

Cognitive Flexibility Activities ("Using our imaginations")

Objective: Be able to think flexibly and creatively. Be able to reason under changing circumstances.

Sample Activities
- Sing "The Opposite Song"
- Cheerios Box: Bring a Cheerios box with a surprising object inside it. Children guess what might be inside besides Cheerios.
- Read *Black? White! Day? Night!*: a story about opposites where children are prompted to guess what will happen next based on a clue
- *Planet Opposites* story and Drawing Activity: After reading *Planet Opposites*, children draw pictures of things that could be silly or opposite in the classroom
- Imagine Island: the class brainstorms and then collectively works on a large poster/ picture of "Imagine Island," where everything is silly and opposite.
- "Who am I" imagination game

Appendix C

Behavioral Tasks and Coding Schemes

Dinky Toys Administration:

> *I have some surprises in this box. You may have one prize. But first, can you put your hands on your lap like this?* (Model for child. Key for scoring.) *Very good! When you decide which toy you want,* ***use your words*** *to tell me. I will hand it to you. Think hard so you pick the one you really like.* (Open box.) *Ok, look in this box and* ***tell me*** *which prize you want.* ***Keep your hands in your lap****.*
>
> Remind child of rules if using hands (2 reminders only).
> If child FREEZES, modify instructions, "If you don't know what words to use, you can *point to* but not touch the toy."
> Score **immediately** on data sheet!

Dinky Toys Scoring:

> 0- hands never left lap; child used words to indicate toy (or, child correctly follows modified instructions)
> 1- hands left lap or otherwise started to grab, but quickly recovered and used words to indicate toy. No toy contact with hands
> 2- hands touched toys, but withdrew and used words
> 3- grabbed toy, but still used words
> 4- uninhibited toy grab
> 5- seemed unable to control impulse to grab, dug extensively in toy bin, attempted to take more than one toy

If child freezes, modify instructions, "If you don't know what words to use, you can *point to* but not touch the toy." Then score a 0 if point only, or 1-5 as above.
Score child's first response, where subsequent responses due to continued lack of clear communication. Ex: "I want a star" follows instructions, but when you ask what color star and he points/touches, count the first response (0).

Emotion Regulation Experimenter coding

Modulates and regulates arousal level in self—keeps "an even keel"

3. Child highly regulated. Never becomes sad, frustrated, or silly

2. Child becomes briefly sad, frustrated, OR silly, but quickly calms without help from adult assessor

1. Child becomes sad, frustrated, OR silly and needs prompt from assessor but is able to calm down

0. Child becomes very sad, frustrated OR silly, and has difficulty regaining self-control