Review Article

Human Development 2019;63:112–131
DOI: 10.1159/000503822

Published online: October 22, 2019

Mindful Family Routines and the Cultivation of Executive Function Skills in Childhood

Andrei D. Semenov Philip David Zelazo

Institute of Child Development, University of Minnesota, Minneapolis, MN, USA

Keywords

Executive function skills · Family systems · Mindful family routines · Parent-child interactions

Abstract

In order to address the deleterious effects of poverty and toxic stress on the development of children's executive function (EF) skills, it is important for researchers to consider interventions that address multiple overlapping family systems. Interventions should consider influences on children's developing EF skills, including parent stress, household chaos, and the quality of parent-child interactions. One particularly important component of successful EF intervention is the promotion of cognitive reflection. However, common methods of promoting reflection in children (e.g., mindfulness meditation) might not be appropriate in all contexts. This paper outlines a framework for considering the promotion of cognitive reflection within daily family routines. This integration of practices has the potential to improve children's EF skills as well as other important family outcomes.

For the things we learn before we can do them, we learn by doing them.
Aristotle, Nicomachean Ethics Book II

Behavioral routines and the habits they engender have long been recognized to play a foundational role in human development. As Aristotle points out in *Nicomachean Ethics*, *we become just by doing just acts, temperate by doing temperate acts, and brave by doing brave acts.* Over the years the importance of habits has been explored by scholars such as William James, who stressed the importance of forming "habits of order," as well as Clark Hull, Donald Hebb, Rumelhart and McClelland, and many others. More recently, research in developmental neuroscience has shed light on the neural mechanisms whereby habits and routines play such an important

KARGER

E-Mail karger@karger.com
www.karger.com/hde

Andrei D. Semenov
Institute of Child Development, University of Minnesota
51 East River Road
Minneapolis, MN 55455-0345 (USA)
E-Mail seme0027@umn.edu

role in shaping our behavior. Indeed, research with nonhuman animals, adults, and children has revealed that when specific behaviors are repeated, and the neural networks that underlie them are activated, these networks become stronger and more efficient through processes such as myelination, synaptic pruning, and dendritic thickening (e.g., Constantinidis & Klingberg, 2016). In this way, behavioral routines lead to structural and functional changes in the brain and can promote lasting behavior change.

Poverty is often associated with uncertainty, stress, and the disruption of daily family routines, and research has examined the potential negative effects of poverty and chaos on cognitive (e.g., Blair & Raver, 2016), socio-emotional (e.g., Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005), and academic development (e.g., Shonkoff et al., 2012). In this article, we explore the potential power of structured family routines focused on mindfulness and reflection to promote positive behavior change in childhood and buffer the negative influences of poverty and chaos.

Dyadic routine-based interventions for at-risk children have the potential to improve a wide range of outcomes (e.g., health, well-being, academic success), but we focus here on the role of routines in supporting the development of children's executive function (EF) skills. EF skills are neurocognitive skills involved in the conscious, goal-directed regulation of attention and behavior. They are predictive of important developmental outcomes, such as school success, associated with socioeconomic status (SES), and responsive to targeted intervention (Zelazo, Blair, & Willoughby, 2016). We first summarize contemporary research on EF skills that reveals behavioral and environmental influences on the development of these skills and highlights their importance for development more broadly. We then discuss the potential power of mindful, reflective family routines to support the development of EF skills in both parents and children. Despite the extensive literature on the importance of EF skills, routines, and mindfulness, there is a need for an integrative approach across these domains to create powerful and sustainable family interventions to the benefit of parent and child EF skills, health, and well-being.

EF Skills

EF skills are a set of attention-regulation skills that make it possible to hold information in mind, inhibit irrelevant responses, respond flexibly to changing circumstances, and more generally, to act in a goal-directed fashion (Zelazo et al., 2016). Typically, EF skills are measured as the three distinct skills: working memory (or sometimes, in particular, updating), inhibitory control, and cognitive flexibility (Miyake et al., 2000). Working memory is the skill of holding information in mind, manipulating it and then using it in a goal-directed fashion. Updating, a subfunction of working memory, involves monitoring and appropriately adapting the contents of working memory in light of changing circumstances. Inhibitory control, sometimes called impulse control, involves ignoring distractors and preventing a dominant, or prepotent, response in favor of a less impulsive, more goal-directed one. Cognitive flexibility, sometimes called set shifting, is the skill involved in being able to switch between two (or more) rule sets or to think about things in a different way. Together, these EF skills allow for the top-down (cognitive) regulation of attention, thoughts, and actions.

EF skills also vary continuously based on emotion and motivational significance (Zelazo & Müller, 2002). Whereas more "cool" EF skills are invoked when regulating attention and behavior in relatively emotionally neutral contexts, such as arbitrary laboratory-based tasks, more "hot" EF skills are used in contexts where emotions and motivation play a larger role. An example of a hot EF skill is the delay of gratification task (Mischel, Shoda, & Rodriguez, 1989), in which participants are asked to refrain from eating a tempting treat (i.e., marshmallow) for a set duration of time in order to receive a bigger reward (i.e., two marshmallows). Hot and cool EF skills typically work together when solving real-world problems (Zelazo, 2015).

The distinction between hot and cool EF skills as well as their development across childhood helps frame intervention strategies in such a way as to provide appropriate support to children in a given context. For example, considering how to reduce the emotional charge of a task can help reduce the demands on hot EF skills and may allow children to succeed where previously they would fail. Using strategies such as reframing, psychological distancing, and reflection can help support children when they are struggling to use their EF skills effectively.

Influences on EF Skill Development

EF skills are embedded within multiple biological and social processes, which suggests that individual differences in EF skills are likely to be associated with multiple overlapping processes and contexts to be considered at multiple levels of analysis. One significant source of individual differences in EF skills is genetic (Friedman et al., 2008), at least within the samples and environments tested. High heritability does not imply immutability, however. Indeed, longitudinal, cross-sectional, and training/intervention studies have identified multiple pathways and potential mechanisms by which biological and sociocultural factors can influence EF skills.

Parenting is heavily implicated as a major source of individual differences in EF (for a review, see Fay-Stammbach, Hawes, & Meredith, 2014). Parents can help structure how their child interacts with the world and scaffold, or support, their goal-directed activities, allowing them to learn by doing (Zelazo, 2015). For example, maternal (Bernier, Carlson, & Whipple, 2010) scaffolding and autonomy supportive behavior, along with limited controlling behavior, is associated with better child EF skills. Furthermore, these types of parenting behaviors predict child EF skills above and beyond parent EF skills and are not moderated by SES (Distefano, Galinsky, McClelland, Zelazo, & Carlson, 2018). These findings suggest that parenting behaviors are a potential vector for intervention for improving child EF skills. Other parenting behaviors such as engaging children in stimulating interactions and parental sensitivity are also associated with child EF (Clark et al., 2013), and there is evidence to suggest that these behaviors improve child EF skills through the mediating role of child language (Matte-Gagné, & Bernier, 2011) as well as the regulation of the hypothalamic-pituitary-adrenal axis (Blair et al., 2011).

Another important predictor of childhood EF is family SES (Hackman, Gallop, Evans, & Farah, 2015). Low SES-related conditions such as poor sleep schedules, iron deficiency, prenatal stress, higher levels of unpredictability and chaos, and higher levels of toxic stress are all implicated as risk-factors for difficulty with EF skills and may lead to a developmental cascade of effects with long-lasting implications on individ-

ual health and well-being (Masten & Cicchetti, 2010; Shonkoff et al., 2012; Lefmann & Combs-Orme, 2014).

It is important to note that these predictors of individual differences in childhood EF are not the same as causes of those differences. Further work is necessary to identify causal pathways. Nevertheless, there is strong evidence that EF skills are amenable to intervention. Family-based, two-generation interventions have the potential to promote both caregivers' and children's healthy development of EF skills while reducing stress, building relationships, and supporting healthy sleep routines and eating behaviors (Coatsworth, Duncan, Greenberg, & Nix, 2010).

EF Skills Predict Key Developmental Outcomes

Empirical research shows that children with better EF skills do better academically, learn more from the same amount of instruction, and have better outcomes (e.g., higher SES, lower criminality, better psychical and mental health) throughout their lives. The links between EF skills and academic functioning in early childhood are now well-established, with a recent meta-analysis showing a mean effect size of $r = 0.27$ across studies, indicating a moderate and statistically significant association (Allan, Hume, Allan, Farrington, & Lonigan, 2014). Children who arrive at school with well-practiced EF skills should find it easier to sit still, pay attention, and manage emotions, but also to remember new information and flexibly adopt new perspectives as they learn. Evidence also shows clearly that preschoolers with better EF skills actually learn more from a given amount of instruction and practice (Benson, Sabbagh, Carlson, & Zelazo, 2013). For example, one study found that children with better EF skills show a larger gain in math achievement between kindergarten and first grade, especially on math/spatial problems (Hassinger-Das, Jordan, Glutting, Irwin, & Dyson, 2014). Research has found that EF skills measured in childhood predict a wide range of academic outcomes, including not only school readiness for both math and reading (Morrison, Ponitz, & McClelland, 2010) and a successful transition to kindergarten (Blair & Razza, 2007), but also overall school achievement (Bull, Espy, & Wiebe, 2008), grades (Duckworth & Seligman, 2005), high school completion (Vitaro, Brendgen, Larose, & Tremblay, 2005), and college graduation (McClelland, Acock, Piccinin, Rhea, & Stallings, 2013). EF skills in childhood are associated with better physical health, higher SES, and fewer drug-related problems and criminal convictions in adulthood (Moffitt et al., 2011).

The nature of the relations between strong EF skills and better developmental outcomes is likely to be complex. In some cases, EF skills such as working memory may contribute directly to particular outcomes, such as math achievement (Bull & Lee, 2014). In other cases, however, the relation between EF skills and developmental outcomes may be less direct. For example, the influence of EF skills may be mediated through factors such as the quality of student-teacher relationships (Liew, Chen, & Hughes, 2010).

EF Skills Are Responsive to Training

EF skills first develop early in life with particularly rapid changes occurring during the preschool years, when the neural networks associated with EF skills (e.g., involving prefrontal cortex) are especially susceptible to positive and negative social

and environmental influences (Zelazo, 2015). For this reason, many interventions to date have targeted EF skills in preschool age children.

EF interventions range from isolated EF training (e.g., computerized games) to full curriculum overhauls. There is strong evidence to suggest that individual EF skills can be improved through intensive computerized training such as improving working memory through the Cogmed program (for a review, see Diamond & Lee, 2011; Diamond & Ling, in press). Programs that combine computerized and noncomputerized games in intensive multiweek cognitive training paradigms have also been found to improve fluid reasoning skills, closely related to EF skills (Mackey, Hill, Stone, & Bunge, 2011). Other, more integrative and scalable approaches focus on adding on EF components to existing preschool and kindergarten curricula (e.g. PATHS; Riggs, Greenberg, Kusché, & Pentz, 2006). Finally, there are interventions in the form of fully redesigned curricula (e.g., *Tools of the Mind*; Bodrova & Leong, 2001) that harness skills and contexts important for EF development (e.g., pretend play).

Although these interventions have led to improvements in trained skills, they have shown varying levels of near and far transfer, including transfer to "real-world" contexts (e.g., Dunning, Holmes, & Gathercole, 2013). Reviews and meta-analyses generally indicate that some types of EF-focused interventions (e.g., classroom-based; mindfulness-based) show evidence of at least near transfer. We argue that in order to increase the likelihood of transfer, children might usefully practice and use their EF skills in a wide variety of contexts, including in the real-world contexts that matter (e.g., at home). Additionally, interventions must be sustained and practiced over time, with ever increasing levels of challenge tailored to individual performance. Outside of school, the home environment is where children spend most of their time, sometimes in interactions with caregivers, and as such it is here that children have the most opportunity to practice and improve their EF skills. Furthermore, recent evidence also indicates the importance not only of practicing EF skills but of helping children to reflect upon these skills, so that they learn the purpose and utility of EF skills, as well as how and when to apply those skills in new situations (Hadley, Acluche, & Chevalier, 2019).

EF and Reflection

Reflection, in the cognitive sense, is a process by which mental representations (construals) are processed and reprocessed over time, so that additional considerations can be incorporated into the new and revised construal (Zelazo, 2015). Reflection takes place over time, requires deliberate, goal-directed effort and attention, and is often the difference between reacting impulsively and acting deliberately and thoughtfully. Engaging in reflection entails a pause between stimuli and responses, and during this delay it is possible to consider context and goals and then engage EF skills to orchestrate and coordinate an adaptive, goal-directed response. Failure to reflect on a situation and to take context into account can lead to traditional failures on EF tasks despite the EF skills themselves remaining unchanged (Zelazo, 2015). Consistent with this theoretical account, empirical evidence demonstrates that after deliberate reflection training, in which children are encouraged to reflect on their behavior, consider what they know, and formulate rules for responding, children are able to succeed on EF tasks they previously failed on, with evidence of far transfer to

an untrained task (false belief task) and corresponding changes in neural activity (Espinet, Anderson, & Zelazo, 2013). EF plus reflection training has also been shown to improve children's EF skills in a recent school-based intervention (Zelazo, Forston, Masten, & Carlson, 2018). Reflection, and the metacognitive awareness that comes from it, is a promising avenue for interventions that seek to improve EF skills. One reason for this is that the metacognitive awareness gained through reflection might be able to improve the contextualization of EF skill use and thereby improve the transfer of training-related improvements in EF to real-world contexts, such as school performance.

Reflection and Mindfulness

The practice of reflection to help regulate thoughts, emotions, and behaviors is not a recent discovery; indeed, it is a cornerstone of ancient meditation practices focused on mindfulness. Mindfulness is a particular way of paying attention on purpose, in the present moment, and nonjudgmentally (Kabat-Zinn, 1990). During mindfulness, the meditator pays attention to a particular *mental object*, such as the experience of one's breathing. Whenever a distracting thought or emotion or feeling comes to the forefront of attention, then the meditator is trained to notice but not dwell on it. The proximal goal of mindfulness meditation is therefore to train one's attention to be more reflective, focused, and deliberate. Additionally, the practice of paying attention to a specific mental object while ignoring distractors has the benefit of training meditators to recognize but not dwell on negative emotions – to be nonjudgemental. Mindfulness has been shown to be beneficial in many domains including pain management, stress, anxiety, and depression (e.g., Kabat-Zinn, 1990; Davidson et al., 2003).

Recently, researchers have turned their focus towards adapting mindfulness practice to improve neurocognitive skills such as EF skills (e.g., Zelazo et al., 2018). From this perspective, mindfulness combines aspects of cognitive training (e.g., adaptive practice of attention regulation skills, such as sustaining attention for longer and longer) along with emotion regulation strategies (reappraisal, psychological distancing) to deal with influences, such as anger and stress, that can hijack EF skills and result in reactive behavior. The combination of paying attention in a goal-directed way while also attenuating and contextualizing the impact of emotions and their consequences situates mindfulness as a unique practice that helps address top-down (reflective) as well as bottom-up (reactive) influences on behavior. It is no surprise then that mindfulness practice has shown promise as a practice that can improve EF skills (e.g., Ortner, Kilner, & Zelazo, 2007). Indeed, it has recently been suggested that one of the essential aspects of mindfulness-based practices is that the practice supports greater attentional control, emotion regulation, and self-regulation (Crane et al., 2017).

Mechanisms of Mindfulness

Human behavior depends, in part, on an interaction between two complementary physiological systems: a top-down controlled system and bottom-up reactive system. Our top-down system engages our conscious attention and is effortful and

typically metabolically expensive. Our bottom-up system is the quicker-to-respond reactive system. This system allows for automatic, habitual, and impulsive reactions to a situation without the need for thought and deliberation. Typically, these two systems trade off in terms of priority and activation, and this tradeoff is largely dependent on context (e.g., you don't want your top-down system contemplating what to do when you stumble across a grizzly). However, the reliance on our evolutionarily older bottom-up system has diminished as humans have traded in savannahs for cities, and we often prioritize more cognitive and deliberate control of behavior rather than impulsive, reactive behavior – for example, in school settings. Mindfulness operates as a regulator of reactivity that creates an opportunity for more the exercise of top-down control of attention while also minimizing the potentially interfering influence of bottom-up, reactive systems. Reflection takes place over time and allows for the reprocessing of information given a certain context, and for reflection to happen, impulsive responses must be inhibited. Meditators are trained to respond to stimuli nonjudgmentally, which encourages a more reflective, psychologically distanced construal of the stimuli and supports a more informed evaluation and response. This section will highlight specific neural pathways and structures likely involved in mindfulness practice.

There are well-documented behavioral and neural differences between novice and expert meditators, and these differences demonstrate an inverted U-shaped relation between experience and network activation (Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007). Prior to any contemplative training there is little to no deliberate awareness or regulation of mental states. Novice meditators develop increased awareness of mental states, but they often still lack the ability to directly regulate them. As meditators become more practiced, they acquire awareness of and the ability to regulate those states (albeit with effort). By the later stages of practice, as control processes become more efficient and well established, meditators enter stages of nonawareness; the relatively automatic regulation of attention becomes routinized, also known as embodied practice (Tang, Hölzel, & Posner, 2015; Roeser, 2016). This transition from novice to expert meditation is important for understanding the neural networks involved in mindfulness, but when thinking about the developmental utility of mindfulness we should not necessarily expect all stages of mindfulness practice to be present.

Emotion Regulation

One of the primary benefits of mindfulness is improved emotion regulation. One proposed mechanism by which mindfulness can aid in emotion regulation is by improving somatic awareness (Teper, Segal, & Inzlicht, 2013). By attending to the present moment, nonjudgmentally, individuals are able to foster a better understanding of their emotions and better anticipate responses to stimuli/events that might otherwise capture their attention.

Emotional responses to stimuli and events can be either reactive (e.g., viewing an unpleasant picture and closing one's eyes to avoid it) or proactive (e.g., anticipating that a conversation will be unpleasant and preparing for it). Both strategies vary across contexts and can be adaptive or maladaptive depending on the situation. For example, holding in mind a proactive response can be cognitively and metaboli-

cally expensive whereas relying on reactive control may preclude a more reasoned response. Developmentally, as children's EF skills improve, children transition from relying more exclusively on reactive forms of control to also displaying more proactive forms of control (Munakata, Snyder, & Chatham, 2012). This transition allows children to be more flexible in their task-related activities and select which strategy (proactive vs. reactive) is more appropriate for the context. Consideration of these proactive and reactive EF skills and their role in emotion regulation can also help clarify *how* mindfulness can assist with emotion regulation developmentally.

Theoretically, mindfulness practice and the associated increase in metacognition can improve both proactive and reactive control mechanisms. Primarily, the increased somatic awareness cultivated by mindfulness practice can make the individual more sensitive to environmental and mental cues (Teper et al., 2013), thus allowing for more appropriate strategy selection. Developmentally, this may take the form of a child understanding their current negative feeling and tying it to a strategy to prevent further negative feelings. For example, in the PATHS curriculum (Kusché & Greenberg, 1994) a child may learn that if they start feeling their heart beat faster while not engaged in physical activity, then perhaps they are frustrated and should assume the turtle pose and take a set of deep breaths. One component of mindfulness that helps children respond in this way is the labeling of emotions and emotional states of mind. In addition to being able to identify a feeling more readily, the use of labels has been shown to improve the developmental transition from reactive to proactive control (Doebel, Dickerson, Hoover, & Munakata, 2018).

Emotion regulation in mindfulness may occur in at least two distinct ways, which may be interrelated developmentally (Chiesa, Serretti, & Jakobsen, 2013). The first way is more deliberate and effortful. By engaging in mindful reflection, meditators are trained to understand that emotions and the things that cause them are momentary, and that it is within their cognitive ability to inhibit impulsive responses or reactions to these emotions. In this way, mindfulness practice requires meditators to engage their EF skills in an emotional context, which evidently strengthens the projections between the prefrontal cortex and the amygdala (Hölzel et al., 2011). With this type of emotion regulation, meditators can also learn over time to anticipate situations or events that can provoke an emotional response and proactively prepare a top-down response to those situations beforehand.

A second way emotion regulation works in mindfulness is by changing how emotionally charged stimuli are processed in the first place, thereby stripping the stimuli of the ability to rouse an emotional response when noticed. This type of emotion regulation is evidenced by the adult emotion interference task (Buodo, Sarlo, & Palomba, 2002). In this task, participants are asked to respond to a tone while viewing stimuli that vary in their affective valence (either positive, negative, or neutral); the emotion interference effect is measured by looking at reaction times to the tone in the presence of emotionally affective pictures compared to emotionally neutral pictures. In one study, university students completed the emotion interference task and then were assigned to one of two control conditions or to a 7-week mindfulness group. After 8 weeks, post-test data indicated the elimination of the emotion interference effect in the mindfulness group but not the control groups (Ortner et al., 2007). The reduction in the emotion interference effect was accompanied by a corresponding

reduction in the amplitude of participants' skin conductance responses to the affective pictures, as well as a reduction in their ratings of the pictures' affective intensity, suggesting rapidly occurring and relatively automatic changes in the way the pictures were processed.

The mechanisms responsible for the modulation of the emotion interference effect may also play a role in modulating the length and intensity of emotional responses to stressors (Carthy, Horesh, Apter, Edge, & Gross, 2010), with evidence from adults implicating the anterior cingulate cortex, insula, and somatosensory cortices (Chiesa et al., 2013). Together, these findings suggest that over time, participants can use mindfulness practice to transform effortful regulation of salient and emotional stimuli into more automatic processing of such stimuli that attenuates their salience and emotional intensity.

Self-Awareness

The cultivation of self-awareness through mindfulness can take the form of either paying attention to interpersonal objects (thoughts, sensations, feelings) or intrapersonal objects (other people and their mental states). While it is common to conceptualize mindfulness as the training of the interpersonal awareness, then the intrapersonal awareness, such a conceptualization, might preclude some from engaging in mindfulness. The cultivation of self-awareness can help one recognize when they are feeling hungry or tired and how this might affect their behavior as well as recognizing the presence of others and their mental states. Indeed, there is evidence to suggest brain-related changes in practiced meditators in areas associated with internal body awareness (Lazar et al., 2005).

Mindfulness practice with children often uses props to scaffold children's efforts to direct their attention and to encourage self-awareness. For example, instead of relying on a verbally guided body scan, child meditators might be given a hula hoop and told to describe the feeling in their body as the hula hoop passes over them "like a scanner". Another activity often used with children is to color in an outline of a body to describe how one is feeling at the moment. For example, coloring in the stomach red could indicate stomach pain. This type of introspective reflection prompts children to think about and label their feelings and, later, their thoughts. Research on children's cognitive development suggests that the use of task-relevant labeling can improve performance on certain EF tasks (e.g., Doebel & Zelazo, 2013; Lucenet, Blaye, Chevalier, & Kray, 2014). Crucially, the use of labels can be used to accelerate the cognitive transition from using reactive control strategies to proactive control strategies (Karbach & Kray, 2007). The transition from reactively recruiting top-down control when it is needed to proactively recruiting top-down skills based on context marks a key dimension along which the development of EF skills occurs (Munakata et al., 2012). Therefore, promoting strategies and behaviors that help children use labeling and self-directed speech while also engaging in attentional control (e.g., mindfulness) may prove to be supportive in helping children transition from more reactive to more proactive control.

Self-directed speech has been shown to play an integral role in the development of self-regulation (Vygotsky, 1962). The cultivation of mindfulness and the development of self-directed speech in childhood are similar. Often, mindfulness instructors

engage in joint attention with their students as they point out instructions and scaffold the focus of attention much in the same way as parents engage in joint attention with their child and verbalize thought processes and encourage child self-talk and the eventual transition to private speech. A key Vygotskian concept is that development happens from the outside in, external self-speech becomes internalized as private speech, similarly we see the cultivation of self-awareness progress from externally guided meditation to embodied practice. Therefore, the cultivation of awareness should be thought of along the same guiding principles as Vygotskian cognitive development.

Mindfulness for the Development of EF

The evidence provided thus far has demonstrated how mindfulness and reflection practices can support emotion regulation by reducing the automatic influence of stimuli on attention, thereby allowing for more efficient and effective engagement of top-down EF skills to control of behavior. Mindfulness has also been shown to be associated with key meta-cognitive and self-awareness processes, and to employ important EF-promoting practices, like self-directed speech. These associations show how mindfulness may indirectly improve EF development both by reducing bottom-up influences that interfere with this development and promoting the use of top-down strategies in a proactive way. However, there are more direct associations between mindfulness and EF skills, mostly based on research with adults.

The benefit of mindfulness for EF skills can be seen in the direct improvements on neural pathways associated with both mindfulness and EF (Tang et al., 2015), increases in processing speed (Moore & Malinowski, 2009), and observed improvements in EF skills including working memory (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010), cognitive flexibility (Moore & Malinowski, 2009), and inhibitory control (Oberle, Schonert-Reichl, Lawlor, & Thomson, 2012). However, by reducing interference from bottom-up influences and simultaneously engaging in reflection and strengthening top-down networks, mindfulness can serve as an especially useful practice to cultivate and strengthen EF skills in young children and in caregivers who might struggle with EF skills themselves.

Consistent with a developmental contemplative science approach (Roeser & Zelazo, 2012), mindfulness has the potential to promote the development of EF skills during early childhood (Zelazo & Lyons, 2012). However, there are potential obstacles and challenges that prevent a child from fully participating in mindful activities; for example, a sitting meditation exercise might require a higher level of EF than is typically observed in early childhood. As children develop their EF skills, the need for mindfulness does not disappear but rather becomes more pressing. Adolescence is a time where cooler EF skills are more developed but not yet caught up to the development of the nucleus accumbens, making risky behavior and emotional responses more prevalent during this time (Steinberg, 2007). While there is evidence to suggest improvement in adolescent EF in response to mindfulness training (Oberle et al., 2012), more research is needed to understand how mindfulness can support adolescent hot EF, emotion regulation, self-identity, and compassion (Roeser & Pinela, 2014).

Mindfulness for Parents

Parents play an important role in the development of children's EF skills, including scaffolding EF learning, moderating environmental influences on the development of EF, as well as providing contexts in which EF develops (for a review, see Fay-Stammbach et al., 2014). Given the importance of parents for child development, it is increasingly important for interventions to take a two-generation approach by addressing factors that support both parents and their children (Shonkoff & Fisher, 2013). Two-generation approaches have the potential to address common shortcomings of other developmental interventions, which is well illustrated by examining how mindful parenting addresses child outcomes.

Mindfulness practice for parents and caregivers can help bring out important, desirable qualities in parents, such as listening, emotional awareness, nonjudgmental acceptance, perceived self-competence, well-being, compassion, and empathy (Coatsworth et al., 2010). Important for parent-child interactions, mindful parenting can help reduce parenting stress and parent reactivity, improve parent EF skills, change parenting patterns and possibly break the intergenerational transmission of dysfunctional parenting habits, and improve marital relationships and promote co-parenting (Bögels, Lehtonen, & Restifo, 2010). When parents and children practice mindfulness together, parents have an opportunity to model reflection and EF skills, and interact with their children in warm and supportive ways. They may promote the development of EF skills by encouraging children to reflect on their feelings and experiences using open-ended questions (Espinet et al., 2013), and they may support this development through autonomy-supportive parenting practices (Bernier, Carlson, Bordeleau, & Carrier, 2010).

One concern about EF interventions is that, like mindfulness interventions, they often require sustained intentional practice (like daily rituals and routines), which may itself depend on a minimum level of EF skill. In two-generational approaches, parents of children with EF delays or disorders who themselves have EF delays or disorders might be at greater risk for behavior problems. For example, in one study, fathers with higher levels of impulsivity showed higher rates of arguing during parent-child interactions while mothers with higher levels of impulsivity showed higher rates of "lax parenting" (Harvey, Danforth, McKee, Ulaszek, & Friedman, 2003). Furthermore, parents with conditions such as attention deficit/hyperactivity disorder may show lower rates of improvement following a parenting intervention (Sonuga-Barke, Daley, & Thompson, 2002). Together, these findings suggest that without addressing parent EF, it is unlikely that an intervention will bring about positive parent or child outcomes, particularly for those with lower baseline EF skills. However, as outlined previously, the mechanisms of mindfulness have the potential to improve top-down regulation and reduce bottom-up interference for both children and caregivers. Furthermore, many mindfulness techniques encourage individuals to pause prior to responding and reflect, a practice which can improve EF skills. In addition to improving the mechanisms of attention, mindfulness can also provide moments of calm and tranquility for parents, which may assist in reducing chaos and facilitating family interactions (Bögels et al., 2010). So, while pre-intervention levels of EF may serve as an obstacle to any intervention, two-generational mindfulness interventions specifically address both internal and external factors that contribute to lower EF skills.

One context that can make parenting difficult, even for parents with above average levels of EF, is the presence of toxic stress. Stress can disrupt cognitive functioning and have lasting health impacts (Shonkoff et al., 2012). Furthermore, parenting stress, even prenatally, can have lasting adverse impacts on both the parent and child (Feldman, Eidelman, & Rotenberg, 2004). High levels of stress, particularly prolonged and uncontrollable stress, impair the function of key brain regions involved in reflection and EF skills (e.g., prefrontal cortex and hippocampus), and they interfere with brain development (e.g., Blair et al., 2011; Hostinar, Sullivan, & Gunnar, 2014). Therefore, reducing parenting stress and parenting-related stress should be a goal of any intervention aimed at improving child EF, particularly in contexts where stress and stressors are pervasive. Because mindfulness can create the capacity to reduce the influence of bottom-up stressors on behavior, thereby freeing up top-down resources for self-regulation, adapting mindfulness practice into the context of daily parent-child interactions is a promising way of promoting reflective behaviors in busy families, perhaps especially families facing challenges associated with poverty.

When developing and implementing mindfulness-based interventions for parents, it is especially important to consider cultural differences in attitudes towards meditation, mindfulness, and introspection. For example, one should consider racial representation among mindfulness teachers, reframing spiritual components of mindfulness practice in a culturally relevant way, and supplementing reading material with culturally relevant work (Woods-Giscombé & Gaylord, 2014). Finally, it is important to recognize that top-down attentional control might not be equally adaptive in all environments. Being reactive might be more adaptive in certain contexts, such as abusive and neglectful environments (e.g. Shackman, Shackman, & Pollak, 2007). However, it is not necessarily the case that the end-goal of all mindfulness practice is to be in a constant reflective and proactive state; rather, mindfulness aims to reduce maladaptive behaviors such as cycles of reactivity and rumination, and to allow for the possibility (vs. necessity) of reflective action. Furthermore, because the traditional method of teaching mindfulness – weekly mindfulness classes – may not be appropriate for all contexts, it is important to consider distilling the practice down to important core components and implementing those components in more accessible ways, for example by promoting participation in short daily routines designed to turn mindfulness practices into daily habits.

Routines

Given the importance of mindfulness and its potential for EF in parents and children, it is necessary to consider *how* to integrate sustainable mindfulness practice across cultures and socioeconomic strata. Doing so necessarily involves adapting the practice and personalizing it given the context and also creating an environment in which such practice is possible. Sustained family routines provide a potential vector by which daily mindfulness can be practiced. Furthermore, there are added benefits for the promotion of EF skills and the reduction of stress associated with the use of predictable family routines.

Daily family routines may include systematic practices around mealtimes, transition periods, and bedtimes. Routines can vary in terms of their purpose and content with some routines being more procedural (e.g., sequence of events to get to the

school bus on time) while other routines may take the form of family discussion before mealtimes or reading books before bedtime. Routines can contain within themselves activities beneficial for EF skill development (e.g., mindfulness practice), but the mere presence of routines and the associated predictability they provide creates a stable and predictable environment that also supports the development of these skills. Furthermore, family routines can entrain and reinforce other beneficial behavior such as consistent sleep patterns, thereby reducing negative bottom-up influences on reflection and EF skills (Adam, Snell, & Pendry, 2007; Hahn et al., 2012).

The Need for Structure and Routines

The structure of daily routines has an impact on child development and family dynamics. For example, in a wealthy sample, overly structured schedules with minimal "free play time" for children were associated with lower child EF skills compared to schedules with more child-directed activities (Barker et al., 2014). The content of routines also plays a role in the development of child EF skills; for example, programs such as martial arts have been associated with higher EF skills (Diamond, 2012; Diamond & Ling, in press). Irregularity in family environments can contribute to sleep problems in childhood, as shown by a longitudinal study of 3- to 10-year-olds' sleep patterns and their associated psychopathology (Koopman-Verhoeff et al., 2019), whereas the presence of smoothly run positive routines positively predicts the amount of sleep time 5- to 11-year-olds received (as well as a regular sleep schedule; Adam et al., 2007). Sleep and diet are both important factors for the development of EF (Bernier et al., 2010). Evidence from the classroom suggests that mindfulness practices with elementary (Jennings et al., 2017) and middle school (Braun, Roeser, Mashburn, & Skinner, 2019) teachers can improve classroom organization and student outcomes. This is particularly important given the link between teacher stress and child EF skills (Neuenschwander, Friedman-Krauss, Raver, & Blair, 2017). These findings from the classroom provide further support for two-generation approaches that target both caregiver and child outcomes.

Many low SES families face high levels of unpredictability, or chaos, and the lack of a predictable family structure has been associated with diminished EF development, higher parent and child stress, and other poor health outcomes. Chaos includes components associated with, but distinct from, SES, including household crowding, noise levels, a lack of routines and rituals, housing mobility and instability, and parental partner instability. Together, these processes can interfere with how children interact with their caregivers and may preclude important dynamic interactions between them. Chaotic (and unpredictable) environments are associated with diminished EF skills (Vernon-Feagans, Willoughby, & Garrett-Peters, 2016). Furthermore, there is reduced opportunity for parents to buffer children's stress because children are spending less quality time with their parents. For these reasons, the lack of routines associated with chaotic households seems to put the development of EF skills at risk.

Chaotic and unpredictable environments make it harder for children's EF skills to develop because it is difficult for children to proactively regulate their thoughts (e.g., anticipate patterns, plan for the future, delay gratification) when the future is unpredictable. In addition to helping children predict events and behavior, routines have been shown to be a protective factor for children with parents who experience

high levels of parenting stress (Markson & Fiese, 2000). Furthermore, higher levels of parental stress are likely to disrupt the quality of parent-child interactions and may undermine the extent to which parents provide scaffolded support for the development of children's EF skills.

Routines have been shown to create scaffolding for children in order to help them set goals and follow a sequence of actions to achieve them (Fiese, 2006), whereas less organized schedules and a lack of routines are associated with reduced self-regulatory behaviors (Brody & Flor, 1997) and may be associated with the intergenerational transmission of depressive symptoms (Manczak, Williams, & Chen, 2017). For example, the simple routine of getting ready for dinner may include an end goal of having food and dishes on the table, and the child can observe and take part in this routine to help establish an appropriate temporal sequence of events to achieve this goal.

Because of chaos, unpredictability, and other more pressing commitments, it may be difficult for parents to participate in a traditional 8-week structured mindfulness course. Mindfulness-based school curricula, while beneficial, may address children and their self-regulation skills *while in the classroom*, but it is not yet clear that those benefits extend beyond the classroom or if they end up being washed out by the influence of children's experiences outside the classroom. Brain training and other proven EF interventions suffer the same problem: it may be possible to improve a child's or a parent's EF skills through a targeted intervention or program, but it is not clear whether those benefits will persist in the face of chaos and adversity.

Though the introduction of sustained family routines in and of themselves would seem to reduce chaos and stress and benefit EF development, their coupling routines with mindfulness practices would address two key issues: (a) the need for mindfulness practice to be sustained and developed over time through the use of regular routines and (b) the ability to integrate mindfulness in a nontraditional way into a household in order to promote mindfulness practice across contexts and socioeconomic strata. One example of a program to promote mindfulness through family routines is Ready4Routines (Semenov, Levine, Henderson, & Zelazo, in progress). Ready4Routines is an 8-week parenting intervention designed to be implemented in Head Start classrooms. Small groups of parents meet with a facilitator for 2 h per week and are introduced to parenting training in EF-promoting activities, autonomy supportive parenting, and mindfulness and reflection training. In addition to attending 8 facilitated sessions, parents are given a set of activity cards designed to scaffold parent-child interactions in a reflective and autonomy supportive way. Each activity follows a set of 5 steps called the PEER(E) mantra: pause, engage, encourage, reflect, extend. Behind each of these steps are a set of lessons designed to maximize the quality of parent-child interaction through promoting mindfulness, autonomy-supportive parenting, supportive praise, reflection, and contextual crossover. By promoting mindfulness (in the pause and reflect steps), parents are introduced to the core components of mindfulness through accessible bite-sized, enjoyable activities with their children.

Given the benefits of mindfulness on reflection, emotion regulation, attention, stress, and other important markers paired with the need for structured routines as a remedy for chaos, it seems clear that an important method of improving child and parent EF skills is by implementing structured daily routines that include mindfulness and moments of reflection. These types of routines should have multifaceted benefits. First, by attending to the present moment and ignoring distractions, parents might pay more attention to their time with their child without being influenced by

distractions like mobile phones. Mindfulness practice might improve emotion regulation in parents and children, and reduce the interfering influence of stress and negative stimuli on top-down attentional control. Engaging in reflection can be a moment of scaffolding for children that strengthens important neural circuits involved in EF skills. Finally, the content of these routines can be enriched with practices proven to be beneficial to child development.

Conclusion

EF skills, necessary for regulating behaviors and problem solving, are particularly vulnerable to disruptions from the environment early in life. Chaotic and unstructured environments, often associated with at-risk communities and low SES families, carry with them not only the lack of positive buffering effects of family routines, but also the deleterious effects of chaos on the development of EF skills. Introducing mindfulness and reflection into sustainable family routines can help lay the foundation for further family interactions that promote strong attachments and support the development of reflection and EF skills. Furthermore, cultivating mindful and reflective habits may help prevent bottom-up influences, like emotional interference, from hijacking top-down control of behavior. Mindful practices cultivate the habit of pausing and allowing time to reflect and reprocess information before responding, thereby allowing top-down skills to influence behavior in a considered fashion. These practices may also allow parents to better regulate their behavior around their children and prevent them from entering into negative habits of mind that can be deleterious to their interaction with their children. Once a few reflective routines settle in, however, the probability of other positive routines co-occurring should increase. And while the context of poverty and adversity may not be remedied through improved family routines, children will have additional buffers in place to protect the development of their EF skills and allow them to develop the tools necessary for succeeding in a challenging environment.

Acknowledgment

The authors would like to acknowledge the editor of this journal and the anonymous reviewers for their supportive comments and suggestions, which have guided the development of this paper.

References

Adam, E. K., Snell, E. K., & Pendry, P. (2007). Sleep timing and quantity in ecological and family context: A nationally representative time-diary study. *Journal of Family Psychology, 21*(1), 4–19. https://doi.org/10.1037/0893-3200.21.1.4

Allan, N. P., Hume, L. E., Allan, D. M., Farrington, A. L., & Lonigan, C. J. (2014). Relations between inhibitory control and the development of academic skills in preschool and kindergarten: A meta-analysis. *Developmental Psychology, 50*(10), 2368–2379. https://doi.org/10.1037/a0037493

Barker, J. E., Semenov, A. D., Michaelson, L., Provan, L. S., Snyder, H. R., & Munakata, Y. (2014). Less-structured time in children's daily lives predicts self-directed executive functioning. *Frontiers in Psychology, 5*, 593. https://doi.org/10.3389/fpsyg.2014.00593

Benson, J. E., Sabbagh, M. A., Carlson, S. M., & Zelazo, P. D. (2013). Individual differences in executive functioning predict preschoolers' improvement from theory-of-mind training. *Developmental Psychology, 49*(9), 1615–1627. https://doi.org/10.1037/a0031056
Bernier, A., Carlson, S. M., Bordeleau, S., & Carrier, J. (2010). Relations between physiological and cognitive regulatory systems: Infant sleep regulation and subsequent executive functioning. *Child Development, 81*(6), 1739–1752. https://doi.org/10.1111/j.1467-8624.2010.01507.x
Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development, 81*(1), 326–339. https://doi.org/10.1111/j.1467-8624.2009.01397.x
Blair, C., & Raver, C. C. (2016). Poverty, stress, and brain development: New directions for prevention and intervention. *Academic Pediatrics, 16*(3, Suppl), S30–S36. https://doi.org/10.1016/j.acap.2016.01.010
Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*(2), 647–663. https://doi.org/10.1111/j.1467-8624.2007.01019.x
Blair, C., Granger, D. A., Willoughby, M., Mills-Koonce, R., Cox, M., . . . the FLP Investigators. (2011). Salivary cortisol mediates effects of poverty and parenting on executive functions in early childhood. *Child Development, 82*(6), 1970–1984. https://doi.org/10.1111/j.1467-8624.2011.01643.x
Bodrova, E., & Leong, D. J. (2001). Tools of the mind: A case study of implementing the Vygotskian approach in American early childhood and primary classrooms. Innodata Monographs 7. Geneva, Switzerland: International Bureau of Education.
Bögels, S. M., Lehtonen, A., & Restifo, K. (2010). Mindful parenting in mental health care. *Mindfulness, 1*(2), 107–120. https://doi.org/10.1007/s12671-010-0014-5
Braun, S. S., Roeser, R. W., Mashburn, A. J., & Skinner, E. (2019). Middle school teachers' mindfulness, occupational health and well-being, and the quality of teacher-student interactions. *Mindfulness, 10*(2), 245–255. https://doi.org/10.1007/s12671-018-0968-2
Brefczynski-Lewis, J. A., Lutz, A., Schaefer, H. S., Levinson, D. B., & Davidson, R. J. (2007). Neural correlates of attentional expertise in long-term meditation practitioners. Proceedings of the National Academy of Sciences of the United States of America, 104(27), 11483–11488. https://doi.org/10.1073/pnas.0606552104
Brody, G. H., & Flor, D. L. (1997). Maternal psychological functioning, family processes, and child adjustment in rural, single-parent, African American families. *Developmental Psychology, 33*(6), 1000–1011. https://doi.org/10.1037/0012-1649.33.6.1000
Bull, R., & Lee, K. (2014). Executive functioning and mathematics achievement. *Child Development Perspectives, 8*(1), 36–41. https://doi.org/10.1111/cdep.12059
Bull, R., Espy, K. A., & Wiebe, S. A. (2008). Short-term memory, working memory, and executive functioning in preschoolers: Longitudinal predictors of mathematical achievement at age 7 years. *Developmental Neuropsychology, 33*(3), 205–228. https://doi.org/10.1080/87565640801982312
Buodo, G., Sarlo, M., & Palomba, D. (2002). Attentional resources measured by reaction times highlight differences within pleasant and unpleasant, high arousing stimuli. *Motivation and Emotion, 26*(2), 123–138. https://doi.org/10.1023/A:1019886501965
Carthy, T., Horesh, N., Apter, A., Edge, M. D., & Gross, J. J. (2010). Emotional reactivity and cognitive regulation in anxious children. *Behaviour Research and Therapy, 48*(5), 384–393. https://doi.org/10.1016/j.brat.2009.12.013
Chiesa, A., Serretti, A., & Jakobsen, J. C. (2013). Mindfulness: Top-down or bottom-up emotion regulation strategy? *Clinical Psychology Review, 33*(1), 82–96. https://doi.org/10.1016/j.cpr.2012.10.006
Clark, C. A., Sheffield, T. D., Chevalier, N., Nelson, J. M., Wiebe, S. A., & Espy, K. A. (2013). Charting early trajectories of executive control with the shape school. *Developmental Psychology, 49*(8), 1481–1493. https://doi.org/10.1037/a0030578
Coatsworth, J. D., Duncan, L. G., Greenberg, M. T., & Nix, R. L. (2010). Changing parent's mindfulness, child management skills and relationship quality with their youth: Results from a randomized pilot intervention trial. *Journal of Child and Family Studies, 19*(2), 203–217. https://doi.org/10.1007/s10826-009-9304-8
Constantinidis, C., & Klingberg, T. (2016). The neuroscience of working memory capacity and training. *Nature Reviews Neuroscience, 17*(7), 438–449. https://doi.org/10.1038/nrn.2016.43
Crane, R. S., Brewer, J., Feldman, C., Kabat-Zinn, J., Santorelli, S., Williams, J. M. G., & Kuyken, W. (2017). What defines mindfulness-based programs? The warp and the weft. *Psychological Medicine, 47*(6), 990–999. https://doi.org/10.1017/S0033291716003317

Davidson, R. J., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Müller, D., . . . Sheridan, J. F. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic Medicine, 65*(4), 564–570. https://doi.org/10.1097/01.PSY.0000077505.67574.E3

Diamond, A. (2012). Activities and programs that improve children's executive functions. *Current Directions in Psychological Science, 21*(5), 335–341. https://doi.org/10.1177/0963721412453722

Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4–12 years old. *Science, 333*, 959–964. doi:science.1204529.Interventions

Diamond, A., & Ling, D. S. (in press). Fundamental questions surrounding efforts to improve executive functions (including working memory). In M. Bunting, J. Novick, M. Dougherty, & R. W. Engle (Eds.), An integrative approach to cognitive and working memory training: Perspectives from psychology, neuroscience, and human development. New York, NY: Oxford University Press.

Distefano, R., Galinsky, E., McClelland, M. M., Zelazo, P. D., & Carlson, S. M. (2018). Autonomy supportive parenting and associations with child and parent executive function. *Journal of Applied Developmental Psychology, 58*, 77–85. https://doi.org/10.1016/j.appdev.2018.04.007

Doebel, S., & Zelazo, P. D. (2013). Bottom-up and top-down dynamics in young children's executive function: Labels aid 3-year-olds' performance on the Dimensional Change Card Sort. *Cognitive Development, 28*(3), 222–232. https://doi.org/10.1016/j.cogdev.2012.12.001

Doebel, S., Dickerson, J. P., Hoover, J. D., & Munakata, Y. (2018). Using language to get ready: Familiar labels help children engage proactive control. *Journal of Experimental Child Psychology, 166*(Supplement C), 147–159. https://doi.org/10.1016/j.jecp.2017.08.006

Duckworth, A. L., & Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science, 16*(12), 939–944. https://doi.org/10.1111/j.1467-9280.2005.01641.x

Dunning, D. L., Holmes, J., & Gathercole, S. E. (2013). Does working memory training lead to generalized improvements in children with low working memory? A randomized controlled trial. *Developmental Science, 16*(6), 915–925. https://doi.org/10.1111/desc.12068

Espinet, S. D., Anderson, J. E., & Zelazo, P. D. (2013). Reflection training improves executive function in preschool-age children: Behavioral and neural effects. *Developmental Cognitive Neuroscience, 4*, 3–15. https://doi.org/10.1016/j.dcn.2012.11.009

Evans, G. W., Gonnella, C., Marcynyszyn, L. A., Gentile, L., & Salpekar, N. (2005). The role of chaos in poverty and children's socioemotional adjustment. *Psychological Science, 16*(7), 560–565. https://doi.org/10.1111/j.0956-7976.2005.01575.x

Fay-Stammbach, T., Hawes, D. J., & Meredith, P. (2014). Parenting influences on executive function in early childhood: A review. *Child Development Perspectives, 8*(4), 258–264. https://doi.org/10.1111/cdep.12095

Feldman, R., Eidelman, A. I., & Rotenberg, N. (2004). Parenting stress, infant emotion regulation, maternal sensitivity, and the cognitive development of triplets: A model for parent and child influences in a unique ecology. *Child Development, 75*(6), 1774–1791. https://doi.org/10.1111/j.1467-8624.2004.00816.x

Fiese, B. H. (2006). *Family routines and rituals*. New Haven, CT: Yale University Press.

Friedman, N. P., Miyake, A., Young, S. E., DeFries, J. C., Corley, R. P., & Hewitt, J. K. (2008). Individual differences in executive functions are almost entirely genetic in origin. *Journal of Experimental Psychology. General, 137*(2), 201–225. https://doi.org/10.1037/0096-3445.137.2.201

Hackman, D. A., Gallop, R., Evans, G. W., & Farah, M. J. (2015). Socioeconomic status and executive function: Developmental trajectories and mediation. *Developmental Science, 18*(5), 686–702. https://doi.org/10.1111/desc.12246

Hadley, L. V., Acluche, F., & Chevalier, N. (2019). Encouraging performance monitoring promotes proactive control in children. *Developmental Science, 12861*, e12861. https://doi.org/10.1111/desc.12861

Hahn, C., Cowell, J. M., Wiprzycka, U. J., Goldstein, D., Ralph, M., Hasher, L., & Zelazo, P. D. (2012). Circadian rhythms in executive function during the transition to adolescence: The effect of synchrony between chronotype and time of day. *Developmental Science, 15*(3), 408–416. https://doi.org/10.1111/j.1467-7687.2012.01137.x

Harvey, E., Danforth, J. S., McKee, T. E., Ulaszek, W. R., & Friedman, J. L. (2003). Parenting of children with attention-defecit/hyperactivity disorder (ADHD): The role of parental ADHD symptomatology. *Journal of Attention Disorders, 7*(1), 31–42. https://doi.org/10.1177/108705470300700104

Hassinger-Das, B., Jordan, N. C., Glutting, J., Irwin, C., & Dyson, N. (2014). Domain-general mediators of the relation between kindergarten number sense and first-grade mathematics achievement. *Journal of Experimental Child Psychology, 118*, 78–92. https://doi.org/10.1016/j.jecp.2013.09.008

Hölzel, B. K., Lazar, S. W., Gard, T., Schuman-Olivier, Z., Vago, D. R., & Ott, U. (2011). How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective. *Perspectives on Psychological Science, 6*(6), 537–559. https://doi.org/10.1177/1745691611419671

Hostinar, C. E., Sullivan, R. M., & Gunnar, M. R. (2014). Psychobiological mechanisms underlying the social buffering of the hypothalamic-pituitary-adrenocortical axis: A review of animal models and human studies across development. *Psychological Bulletin, 140*(1), 256–282. https://doi.org/10.1037/a0032671

Jennings, P. A., Brown, J. L., Frank, J. L., Doyle, S., Oh, Y., Davis, R., . . . Greenberg, M. T. (2017). Impacts of the CARE for Teachers program on teachers' social and emotional competence and classroom interactions. *Journal of Educational Psychology, 109*(7), 1010–1028. https://doi.org/10.1037/edu0000187

Jha, A. P., Stanley, E. A., Kiyonaga, A., Wong, L., & Gelfand, L. (2010). Examining the protective effects of mindfulness training on working memory capacity and affective experience. *Emotion (Washington, D.C.), 10*(1), 54–64. https://doi.org/10.1037/a0018438

Kabat-Zinn, J. (1990). Full catastrophe living: Using the wisdom of your body and mind to face stress, pain and illness. New York, NY: Delacorte.

Karbach, J., & Kray, J. (2007). Developmental changes in switching between mental task sets: The influence of verbal labeling in childhood. *Journal of Cognition and Development, 8*(2), 205–236. https://doi.org/10.1080/15248370701202430

Koopman-Verhoeff, M. E., Serdarevic, F., Kocevska, D., Bodrij, F. F., Mileva-Seitz, V. R., . . . Luijk, M. P. C. M. (2019). Preschool family irregularity and the development of sleep problems in childhood: A longitudinal study. Journal of Child Psychology and Psychiatry, and Allied Disciplines, 60(8), 857–865. https://doi.org/10.1111/jcpp.13060

Kusché, C. A., & Greenberg, M. T. (1994). The PATHS curriculum: Promoting alternative thinking strategies. Seattle, WA: Developmental Research & Programs.

Lazar, S. W., Kerr, C. E., Wasserman, R. H., Gray, J. R., Greve, D. N., . . . Fischl, B. (2005). Meditation experience is associated with increased cortical thickness. *Neuroreport, 16*(17), 1893–1897. https://doi.org/10.1097/01.wnr.0000186598.66243.19

Lefmann, T., & Combs-Orme, T. (2014). Prenatal stress, poverty, and child outcomes. *Child & Adolescent Social Work Journal, 31*(6), 577–590. https://doi.org/10.1007/s10560-014-0340-x

Liew, J., Chen, Q., & Hughes, J. N. (2010). Child effortful control, teacher–student relationships, and achievement in academically at-risk children: Additive and interactive effects. *Early Childhood Research Quarterly, 25*(1), 51–64. https://doi.org/10.1016/j.ecresq.2009.07.005

Lucenet, J., Blaye, A., Chevalier, N., & Kray, J. (2014). Cognitive control and language across the life span: Does labeling improve reactive control? *Developmental Psychology, 50*(5), 1620–1627. https://doi.org/10.1037/a0035867

Mackey, A. P., Hill, S. S., Stone, S. I., & Bunge, S. A. (2011). Differential effects of reasoning and speed training in children. *Developmental Science, 14*(3), 582–590. https://doi.org/10.1111/j.1467-7687.2010.01005.x

Manczak, E. M., Williams, D., & Chen, E. (2017). The role of family routines in the intergenerational transmission of depressive symptoms between parents and their adolescent children. *Journal of Abnormal Child Psychology, 45*(4), 643–656. https://doi.org/10.1007/s10802-016-0187-z

Markson, S., & Fiese, B. H. (2000). Family rituals as a protective factor for children with asthma. *Journal of Pediatric Psychology, 25*(7), 471–480. https://doi.org/10.1093/jpepsy/25.7.471

Masten, A. S., & Cicchetti, D. (2010). Developmental cascades. *Development and Psychopathology, 22*(3), 491–495. https://doi.org/10.1017/S0954579410000222

Matte-Gagné, C., & Bernier, A. (2011). Prospective relations between maternal autonomy support and child executive functioning: Investigating the mediating role of child language ability. *Journal of Experimental Child Psychology, 110*(4), 611–625. https://doi.org/10.1016/j.jecp.2011.06.006

McClelland, M. M., Acock, A. C., Piccinin, A., Rhea, S. A., & Stallings, M. C. (2013). Relations between preschool attention span-persistence and age 25 educational outcomes. *Early Childhood Research Quarterly, 28*(2), 314–324. https://doi.org/10.1016/j.ecresq.2012.07.008

Mischel, W., Shoda, Y., & Rodriguez, M. I. (1989). Delay of gratification in children. *Science, 244*(4907), 933–938. https://doi.org/10.1126/science.2658056

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "Frontal Lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*(1), 49–100. https://doi.org/10.1006/cogp.1999.0734

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., . . . Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. Proceedings of the National Academy of Sciences of the United States of America, 108(7), 2693–2698. https://doi.org/10.1073/pnas.1010076108

Moore, A., & Malinowski, P. (2009). Meditation, mindfulness and cognitive flexibility. *Consciousness and Cognition, 18*(1), 176–186. https://doi.org/10.1016/j.concog.2008.12.008

Morrison, F. J., Ponitz, C. C., & McClelland, M. M. (2010). Self-regulation and academic achievement in the transition to school. In S. D. Calkins & M. A. Bell (Eds.), Child Development at the Intersection of Emotion and Cognition (pp. 203–224). Washington, DC: APA. https://doi.org/10.1037/12059-011

Munakata, Y., Snyder, H. R., & Chatham, C. H. (2012). Developing cognitive control: Three key transitions. *Current Directions in Psychological Science, 21*(2), 71–77. https://doi.org/10.1177/0963721412436807

Neuenschwander, R., Friedman-Krauss, A., Raver, C., & Blair, C. (2017). Teacher stress predicts child executive function: Moderation by school poverty. *Early Education and Development, 28*(7), 880–900. https://doi.org/10.1080/10409289.2017.1287993

Oberle, E., Schonert-Reichl, K. A., Lawlor, M. S., & Thomson, K. C. (2012). Mindfulness and inhibitory control in early adolescence. *The Journal of Early Adolescence, 32*(4), 565–588. https://doi.org/10.1177/0272431611403741

Ortner, C. N. M., Kilner, S. J., & Zelazo, P. D. (2007). Mindfulness meditation and reduced emotional interference on a cognitive task. *Motivation and Emotion, 31*(4), 271–283. https://doi.org/10.1007/s11031-007-9076-7

Riggs, N. R., Greenberg, M. T., Kusché, C. A., & Pentz, M. A. (2006). The mediational role of neurocognition in the behavioral outcomes of a social-emotional prevention program in elementary school students: Effects of the PATHS Curriculum. *Prevention Science, 7*(1), 91–102. https://doi.org/10.1007/s11121-005-0022-1

Roeser, R. W. (2016). Processes of teaching, learning, and transfer in mindfulness-based interventions (MBIs) for teachers: A contemplative educational perspective. In K. A. Schonert-Reichl & R. W. Roeser (Eds.), *Handbook of mindfulness in education* (pp. 149–170). New York, NY: Springer. https://doi.org/10.1007/978-1-4939-3506-2_10

Roeser, R. W., & Pinela, C. (2014). Mindfulness and compassion training in adolescence: A developmental contemplative science perspective. *New Directions for Youth Development, 2014*(142), 9–30. https://doi.org/10.1002/yd.20094

Roeser, R. W., & Zelazo, P. D. (2012). Contemplative science, education and child development: Introduction to the special section. *Child Development Perspectives, 6*, 143–145. https://doi.org/10.1111/j.1750-8606.2012.00242.x

Semenov, A.D., Levine, L., Henderson, A., & Zelazo., P. D. (in progress). Ready4Routines: A two-generation intervention for improving executive function skills. Unpublished manuscript, University of Minnesota, Minneapolis, MN.

Shackman, J. E., Shackman, A. J., & Pollak, S. D. (2007). Physical abuse amplifies attention to threat and increases anxiety in children. *Emotion (Washington, D.C.), 7*(4), 838–852. https://doi.org/10.1037/1528-3542.7.4.838

Shonkoff, J. P., & Fisher, P. A. (2013). Rethinking evidence-based practice and two-generation programs to create the future of early childhood policy. *Development and Psychopathology, 25*(4 Pt 2), 1635–1653. https://doi.org/10.1017/S0954579413000813

Shonkoff, J. P., Garner, A. S., Siegel, B. S., Dobbins, M. I., Earls, M. F., . . . the Section on Developmental and Behavioral Pediatrics (2012). The lifelong effects of early childhood adversity and toxic stress. *Pediatrics, 129*(1), e232–e246. https://doi.org/10.1542/peds.2011-2663

Sonuga-Barke, E. J., Daley, D., & Thompson, M. (2002). Does maternal ADHD reduce the effectiveness of parent training for preschool children's ADHD? Journal of the American Academy of Child and Adolescent Psychiatry, 41(6), 696–702. https://doi.org/10.1097/00004583-200206000-00009

Steinberg, L. (2007). Risk taking in adolescence: New perspectives from brain and behavioral science. *Current Directions in Psychological Science, 16*(2), 55–59. https://doi.org/10.1111/j.1467-8721.2007.00475.x

Tang, Y. Y., Hölzel, B. K., & Posner, M. I. (2015). The neuroscience of mindfulness meditation. *Nature Reviews. Neuroscience, 16*(4), 213–225. https://doi.org/10.1038/nrn3916

Teper, R., Segal, Z. V., & Inzlicht, M. (2013). Inside the mindful mind: How mindfulness enhances emotion regulation through improvements in executive control. *Current Directions in Psychological Science, 22*(6), 449–454. https://doi.org/10.1177/0963721413495869

Vernon-Feagans, L., Willoughby, M., & Garrett-Peters, P., & the Family Life Project Key Investigators (2016). Predictors of behavioral regulation in kindergarten: Household chaos, parenting, and early executive functions. *Developmental Psychology, 52*(3), 430–441. https://doi.org/10.1037/dev0000087

Vitaro, F., Brendgen, M., Larose, S., & Tremblay, R. E. (2005). Kindergarten disruptive behaviors, protective factors, and educational achievement by early adulthood. *Journal of Educational Psychology, 97*(4), 617–629. https://doi.org/10.1037/0022-0663.97.4.617

Vygotsky, L. S. (1962). *Thought and language* (E. Hanfmann & G. Vakar, Trans.). Cambridge, MA: MIT Press (Original work published 1934). https://doi.org/10.1037/11193-000

Woods-Giscombé, C. L., & Gaylord, S. A. (2014). The cultural relevance of mindfulness meditation as a health intervention for African Americans: Implications for reducing stress-related health disparities. *Journal of Holistic Nursing, 32*(3), 147–160. https://doi.org/10.1177/0898010113519010

Zelazo, P. D. (2015). Executive function: Reflection, iterative reprocessing, complexity, and the developing brain. *Developmental Review, 38*, 612–624. https://doi.org/10.1016/j.dr.2015.07.001

Zelazo, P. D., & Lyons, K. E. (2012). The potential benefits of mindfulness training in early childhood: A developmental social cognitive neuroscience perspective. *Child Development Perspectives, 6*, 154–160. doi:.1111/j.1750-8606.2012.00241.x https://doi.org/10.1111/j.1750-8606.2012.00241.x

Zelazo, P. D., & Müller, U. (2002). Executive function in typical and atypical development. In U. Goswami (Ed.), *Blackwell handbook of childhood cognitive development* (pp. 445–469). Malden, MA: Wiley; https://doi.org/10.1002/9780470996652.ch20

Zelazo, P. D., Blair, C. B., Willoughby, M. T., (2016). Executive function: Implications for education. US Department of Education, Institute of Education Sciences, National Center for Education Research. Retrieved from: https://files.eric.ed.gov/fulltext/ED570880.pdf

Zelazo, P. D., Forston, J. L., Masten, A. S., & Carlson, S. M. (2018). Mindfulness plus reflection training: Effects on executive function in early childhood. *Frontiers in Psychology, 9*(February), 208. https://doi.org/10.3389/fpsyg.2018.00208