

## Mindfulness Training in Childhood

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Mindfulness is a way of attending – an attentional practice – that is derived from Asian contemplative traditions but has been secularized (and Westernized) in the context of clinical psychology [e.g., Segal, Williams, & Teasdale, 2002] and the emerging field of contemplative neuroscience [e.g., Lutz, Donne, & Davidson, 2007]. A major impetus for contemporary research on mindfulness was the creation of mindfulness-based stress reduction, a therapeutic intervention developed by Kabat-Zinn [1982] that, together with variants such as mindfulness-based cognitive therapy [Segal et al., 2002], is now widely used to improve functioning in patients with a variety of disorders, from depression and anxiety disorders to chronic pain [for a review, see Grossman, Niemann, Schmidt, & Walach, 2004]. As Kabat-Zinn [1994, p. 4] described it, ‘Mindfulness means paying attention in a particular way; on purpose, in the present moment, and nonjudgmentally.’ As such, mindfulness training typically entails focusing one’s attention on a particular aspect of one’s current experience, including practicing refocusing one’s attention after one’s mind has wandered. For example, during mindfulness training, participants might focus their attention on their breathing. When they notice that their attention has instead been diverted by salient anticipations, recollections, or perceptions, they may observe (nonjudgmentally) the ease with which the mind wanders and then bring their attention back to their breathing. Participants generally find that with practice, it becomes easier to sustain their full attention for longer periods of time. Mindfulness practice may occur in the context of sitting meditation, but may also occur in the context of other activities, such as walking or eating. Indeed, a useful way to think about acting (or thinking) mindfully is as ‘super-intending’ one’s behavior, as suggested by a classic text from the Buddhist canon, the *Saundaranandakavya* (*Nanda the Fair*), in which the author, Āśvaghōṣa (approx. 1st century), writes: ‘... You should super-intend your walking by thinking, “I am walking,” your standing by thinking, “I am standing,” and so on; that is how you are asked to apply mindfulness to all such activities’ [c. 50 CE/1959, p. 107]; see also the Mindful Attention Awareness Scale by Brown and Ryan [2003].

Understood in this way, mindfulness entails reflecting deeply on what one is experiencing; attending more fully to more aspects of one’s experience, as opposed to processing them in a shallow fashion and quickly moving on to thinking about

something else. This kind of sustained, reflective reprocessing of information results in a psychological state that is quite different from multitasking [e.g., Ophir, Nass, & Wagner, 2009], and can also be contrasted with mind-wandering [see Smallwood & Schooler, 2006]. According to one model of reflection, the iterative reprocessing model [Cunningham & Zelazo, 2007, 2010; Zelazo & Cunningham, 2007], the reprocessing of information (via neural circuits involving prefrontal cortex) entails reflecting on one's subjective experiences, allowing those experiences to be considered consciously in light of additional aspects of the context in which they occur. Iterative reprocessing places one's experiences into a richer perspective, yielding a richer, more nuanced experience, in just the way that mindfulness entails processing one's experiences more fully in a purposeful fashion.

Experimental evidence from research with adults indicates that mindfulness training produces a variety of salubrious effects, including reduced stress, better immune function, and improved performance on measures of executive function and emotion regulation [e.g., Baer, 2003; Davidson et al., 2003; Grossmann et al., 2004; Tang et al., 2010; Zylowska et al., 2008]. For example, in a randomized design, 7 weeks of mindfulness training attenuated interference from negative stimuli on performance on a simple cognitive task (with corresponding reductions in skin conductance responses to those stimuli), as compared to an active control group trained in relaxation meditation [Ortner, Kilner, & Zelazo, 2007]. In that study, participants were shown positive, negative, or neutral pictures, and then 4 s after the picture appeared (and while it remained visible), they also heard a tone. Their task was simply to categorize the tone as high or low pitched as quickly as possible. Participants who received mindfulness training showed faster categorization in the face of negative pictures (compared to pretraining reaction times), meaning that, as a result of the training, they were better able to disengage from the emotionally engaging pictures and attend to the tone. Participants in the relaxation training condition did not show this effect. Other research has found evidence that mindfulness training produces patterns of neural activation that are indicative of positive affect [Davidson et al., 2003], more efficient emotion regulation [Goldin & Gross, 2010], and better conflict monitoring [Jha, Krompinger, & Baime, 2007], among a host of other beneficial outcomes. There is also evidence that even short-term training (11 h) produces changes in brain structure (i.e., white matter connectivity) [Tang et al., 2010].

As yoga programs for children proliferate, and more and more children are being exposed to mindfulness exercises in and out of school [e.g., Garrison Institute, 2005], there is a growing need to examine systematically whether mindfulness training also has beneficial effects during childhood. In children, mindfulness training often includes small group activities designed to promote awareness of various aspects of children's experiences [e.g., Flook et al., 2010]. For example, children might listen to the sound of a bell as it fades and raise their hands when they can no longer hear it. These exercises may be scaffolded by props, for example, by placing a stuffed animal on children's abdomens to help them pay attention to their breathing.

What research exists to date [for a review, see Burke, 2010] suggests that self-regulation may improve as a result of mindfulness training during childhood. In particular, mindfulness training studies with school age children and adolescents have documented improvements on teacher and parent report indices of self-regulation [Flook et al., 2010; Semple, Lee, Rosa, & Miller, 2010], although it remains unknown whether improvements are also observed on behavioral measures, and/or in

younger (preschool-aged) children. The existing research has been valuable in paving the way for additional investigations, clearly demonstrating that it is possible to adapt mindfulness exercises for children, and that children are able and willing to engage in these exercises. However, more research is needed to demonstrate the efficacy of mindfulness interventions in larger-scale studies with behavioral outcome measures and adequate experimental control: with random assignment of both trainers and trainees, active control conditions, efforts to equate both student and teacher expectancy effects across conditions, and validated behavioral measures administered by researchers who are blinded to the experimental condition.

Research that meets these criteria is currently under way at a variety of sites, and emerging results are promising. Preliminary findings from our laboratory [Johnson, Forston, Gunnar, & Zelazo, 2011], for example, indicate that compared to a control condition, a small sample of preschool children randomly assigned to a brief mindfulness training curriculum (administered in small groups in biweekly sessions over the course of 5 weeks) showed improved sustained attention (based on the NIH Toolbox Flanker task) [Weintraub et al., 2011] and perspective taking (assessed using the theory of mind battery of Wellman and Liu [2004]), but not cognitive flexibility (NIH Toolbox Dimensional Change Card Sort). Emotion regulation was not measured directly in this study.

Executive function, perspective taking, and emotion regulation are closely related in development, arguably because they all depend on the same underlying processes of reflection made possible by neural circuits that coordinate hierarchically arranged regions of prefrontal cortex [Bunge & Zelazo, 2006; O'Reilly, 2010]. According to the iterative reprocessing model [e.g., Cunningham & Zelazo, 2007], the reflective reprocessing of information is essential for the deliberate selection, activation (or deactivation), and maintenance in working memory of relatively explicit goals that serve to influence self-regulation in a top-down fashion. These processes are important for self-regulation in contexts that may be more or less social, and more or less emotional.

From the perspective of research on the neurodevelopment of self-regulation, mindfulness training has considerable potential as an intervention because it targets *both* top-down and bottom-up influences on self-regulation. That is, mindfulness training may provide practice in reflective reprocessing (and exercise the prefrontal circuits on which this reprocessing depends) while also minimizing influences that interfere with prefrontal cortical function (e.g., cortisol/stress) [e.g., Sapolsky, 1996] and maximizing influences that promote this function (e.g., dopamine/approach-oriented emotions such as happiness and curiosity) [e.g., Ashby, Isen, & Turken, 1999]. As such, mindfulness training may scaffold the development of self-regulation by creating conditions conducive to reflection, both in the context of problem solving and in the context of playful exploration.

In summary, emerging research suggests that age-appropriate mindfulness exercises are feasible for use with young children, even during the preschool period, and that such exercises may foster the healthy development of self-regulation. Improvements in self-regulation might be expected to have lasting implications, including implications for children's performance in school [e.g., Blair & Razza, 2007] and children's social and emotional development [e.g., Bierman et al., 2008]. Clearly, however, additional research is required to assess the efficacy of mindfulness training in childhood, and to understand the mechanisms that may underlie any beneficial effects.

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