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## Contemplative Practices and Mental Training: Prospects for American Education

Mind and Life Education Research Network (MLERN)

### Abstract

Drawing upon research in neuroscience, cognitive science, developmental psychology and education, as well as scholarship from contemplative traditions concerning the cultivation of positive development, we highlight a set of mental skills and socio-emotional dispositions that we believe are central to the aims of education in the 21<sup>st</sup> century. These include self-regulatory skills associated with emotion and attention, self-representations, and prosocial dispositions such as empathy and compassion. These positive qualities and dispositions can be strengthened through systematic contemplative practice. Such practice induces plastic changes in brain function and structure, supporting prosocial behavior and academic success in young people. These putative beneficial consequences call for focused programmatic research to better characterize which forms and frequencies of practice are most efficacious for which types of children and adolescents. Results from such research may help refine training programs to maximize their effectiveness at different ages and to document the changes in neural function and structure that might be induced.

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Current global conditions, including increasing economic interdependence, widespread intercultural contact, and the emergence of knowledge-based societies require new forms of education (Partnership for 21st Century Skills, 2011). As central cultural contexts of human development, schools play a major role in cultivating the kinds of mental skills and socio-emotional dispositions that young people will need to realize productive, satisfying, and meaningful lives in the 21<sup>st</sup> century (Heckman, 2007).

Here, drawing upon research in neuroscience, cognitive science, developmental science, and education, as well as insights from contemplative traditions concerning the cultivation of virtuous qualities, we highlight a set of mental skills and socio-emotional dispositions that we believe are central to the aims of education in the 21<sup>st</sup> century. These include self-regulatory skills associated with emotion and attention, self-representations, and prosocial dispositions such as empathy and compassion.

Research is beginning to document how positive mental skills and socio-emotional dispositions support academic success and pro-social behavior in young people (Zins, Weissberg, Wang, & Walberg, 2004). Consistent with contemplative insights into mental training, research indicates that qualities such as emotion regulation can be cultivated and can change the mind and brain (Urry et al., 2006) much in the same way as other skills are learned in which sustained repetitive practice over time leads eventually to automatized habit (Fischer & Bidell, 1998).

### An Organizing Framework

A framework for understanding how contemplative practices may impact neural systems, psychological functions, and behavioral outcomes is depicted in Figure 1. By contemplative practices, we refer to a wide variety of strategies and methods originally rooted in

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contemplative traditions such as Buddhism. In modern scientific terms, these practices can be thought of as forms of mental and behavioral training that are intended to produce alterations in basic cognitive and emotional processes, such as attention and the regulation of certain forms of negative affect, as well to enhance particular character traits that are considered virtuous, such as honesty and kindness. As Figure 1 illustrates, there are many constituencies within the educational context who may potentially benefit from contemplative practice including administrators, principals and counselors, teachers and students. Of course, parents are also important to include though they fall outside the educational context per se. While there is much to say about each of these groups, this article will focus on the application of contemplative practices to students. The figure depicts three levels of analysis that each may reflect the potential impact of contemplative practices—neural substrates; psychological functions; and behavioral outcomes. Extant evidence suggests that contemplative practices can effect change in measures that reflect each of these different levels. It is likely that such practices operate directly on psychological functions such as attention and emotion regulation. These psychological functions are subserved by alterations in neuronal processes that can be interrogated with modern neuroimaging methods. Some evidence also suggests that contemplative practice occurring over more extended periods of time can induce structural changes in the brain as well as functional changes. Finally the output of changes in neural substrates and psychological functions will be alterations in measurable behavioral outcomes. Rarely have studies included measures in the same individual at each of these different levels over the course of contemplative training. It is only when we piece together the available strands of evidence across many different studies that a more coherent picture of the transformations across different levels of analysis emerges. In the sections below we first consider research on the impact of contemplative practices and we then place these findings within a developmental context in the following section. The concluding section offers some suggestions and recommendations for future research in this emerging area.

## Research on Contemplative Practices

Contemplative practices such as forms of meditation and yoga are examples of structured and socially-scaffolded activities that train skills by placing some constraint or imposing some discipline on a normally unregulated mental or physical habit. A defining characteristic of such practices is that they require individuals to exercise volitional control to sustain the focus of attention on particular objects (i.e., the breath) or mental contents (such as the suffering and relief from suffering of particular individuals). Other objects of attentional focus may include moment to moment fluctuations in the “stream of consciousness” in order to develop the ability to concentrate, to effectively understand and manage stress and emotion, to gain knowledge about oneself, and to cultivate pro-social dispositions. With such sustained practice, complex skills like mindfulness and empathy are hypothesized to become routinized at neural/mental levels and, subsequently, to regulate behavior in relatively automatic ways by being highly accessible and available (Higgins, 1996).

Various contemplative practices such as meditation have received increasing use as integral components of interventions that have been found to promote general wellness and alleviate a variety of medical symptoms. Perhaps the most widely implemented model of a meditation-based approach is mindfulness-based stress reduction (MBSR), an 8-week program designed for both normal and clinical populations that incorporates traditional meditation techniques, including both mindfulness and compassion-based elements (Kabat-Zinn, Lipworth, & Burney, 1985). MBSR provides systematic training in meditation as a self-regulatory approach to stress reduction and emotion management. Studies have shown its efficacy for improving chronic pain, rheumatoid arthritis, fibromyalgia, anxiety, and

depression (Arias, Steinberg, Banga, & Trestman, 2006). In addition, studies have revealed improvements in different indices of immune and endocrine function with eight weeks of MBSR training (Witek-Janusek et al., 2008).

One explanatory mechanism underlying alterations in health may rest on the fact that MBSR strengthens neural systems important for emotion regulation and other cognitive control functions. Indeed, there is growing evidence that mindfulness training improves the regulation of attention and executive function in adults, including the orienting of attention and monitoring of conflict (Jha, Krompinger, & Blame, 2007) and inhibition of irrelevant information that is emotionally charged (Ortner, Kilner, & Zelazo, 2007) in novice meditators. Intensive meditation practice improves performance on the attentional blink task and decreases reaction time variability in a selective attention task, altering functional brain activity that supports these attentional changes (Slagter et al., 2007; Lutz et al., 2009). In adults, meditation practice can also induce present-oriented forms of self-awareness (Farb et al., 2007) that are likely to enhance motivation and learning (Roeser & Peck, 2009). Training likewise enhances the neural circuits that underlie empathy in adults (Singer & Lamb, 2009). Finally, a series of studies of “experts” who have dedicated a minimum of 10,000 hours to formal meditation practice underscore the potential for enduring cognitive, emotional, and neuroplastic change (Lutz, Slagter, Dunne, & Davidson, 2008), and provide a scientific warrant for educational interventions that aim, through sustained regular practice, to cultivate attention, emotion regulation, and empathy (Diamond & Lee, 2011).

## Basic Research on Human Development

There are important developmental changes in brain structure and function that guide emotional and cognitive development. Gray-matter volume peaks in late childhood (ages 9 to 11 years) and then declines, while white matter volume, which supports connections among brain regions continues to increase into early adulthood and possibly beyond. The functional consequences include more efficient communication between the prefrontal cortex (PFC) and other cortical and sub-cortical regions, enabling better regulation of thought, emotion and action (Paus, Keshavan, & Giedd, 2008). During adolescence, the PFC and subcortical structures (e.g., hippocampus) associated with memory-related processes are particularly plastic and highly vulnerable to poorly managed stress or prolonged allostatic load (Andersen & Teicher, 2008). It is very likely that these cortical and sub-cortical areas are also highly sensitive to positive influences during development, though little research has directly addressed this issue. Here we review basic research on the core mental and behavioral processes that are potential targets of contemplative interventions. In doing so, our review is intended to set the stage for synergistic collaboration between scientific research on contemplative practice and educational programs designed to foster the cognitive, emotional, social, and ethical development of 21<sup>st</sup> century youth.

## Emotion and Emotion Regulation

Clearly, the brain can change in response to experience and training, and wittingly or unwittingly, environmental influences shape brain function and structure. A large corpus of research in animals indicates that stressful events impact the brain deleteriously. In adult male rodents, environmental stressors such as restraint, tail shock, and sleep deprivation cause dramatic levels of immunosuppression, cardiovascular dysfunction, decreased neurogenesis, increased neuronal cell death, hippocampal atrophy, and impairments in long-term potentiation (Lupien, McEwen, Gunnar, & Heim, 2009). It is likely that psychosocial stress produces similar detrimental effects in humans. Childhood abuse in humans, for example, has been linked recently to specific alterations in the expression of genes for glucocorticoid receptors involved in the regulation of stress-related neuroendocrine response (McGowan et al., 2009) as well as alterations in prefrontal structures critical to the

regulation of emotion (Hanson et al., 2011). Whether caused by physical or psychosocial stress, cumulative allostatic load may lead to developing psychopathologies in infancy, adolescence and adulthood, such as cognitive deficits, sleep disturbance, schizophrenia, anxiety-related disorders, and depressive symptomatology (Shirtcliff, Dahl, & Pollak, 2009).

Research also indicates that positive behaviors, specifically maternal nurturing (e.g., licking and grooming), induces beneficial alterations in the brain and in behavior that promote resilience (Champagne et al., 2008). Psychosocial factors, such as decreased levels of denial and avoidant coping behavior, increased levels of social engagement, positive emotion, and dispositional optimism have all been shown to promote resilience (Feder, Nestler, & Charney, 2009). Collectively these data establish that our brains are continuously shaped both functionally and structurally by experience on which explicit training can capitalize to promote more adaptive brain functioning and prosocial behavior.

At the same time, there are substantial individual differences in emotion regulation beginning early in life, which play an important role in both resilience and vulnerability to psychopathology (Goldsmith, Pollak, & Davidson, 2008). For example, when confronted by a stressful event, some individuals react with a context-appropriate emotional response and then rapidly return back to baseline, whereas others show a more enduring maladaptive response that recovers slowly. Such differences in reactivity and recovery can affect available cognitive resources. In a school context, for example, if a teen has an argument with a friend during a class break and is not able to recover quickly, the lingering consequences of emotional arousal into the next class could have a deleterious impact on his or her learning. Such impacts have been experimentally demonstrated; arousal and related anxiety interfere with attention and working memory, disrupting corresponding brain circuitry (Shackman et al., 2006; 2011).

Considerable evidence has revealed developmental changes in the circuitry critical to emotion regulation, especially in pre-frontal cortical networks. When adolescents engage in tasks that require emotion regulation, greater cognitive demand ensues, along with greater activation in PFC regions compared to adults (Blakemore & Choudhury, 2006). Moreover, the circuitry of emotion regulation overlaps considerably with the circuitry of cognitive control. Yet despite enormous cognitive gains across childhood and adolescence (Paus, 2005), adolescents engage in more risk taking than adults (Steinberg, 2007). Rates of accidents, suicide, homicide, depression, substance abuse, violence, and risky sexual behaviors skyrocket during adolescence (Steinberg, 2009). These major sources of adolescent death and disability are related to difficulties in the control of emotion and behavior. Whereas adolescents demonstrate decision-making on par to adults under conditions of low arousal, these cognitive processes are particularly impaired under intense emotional arousal (Steinberg, 2005). Consequently, strategies that promote skills in emotion regulation and self-awareness are particularly important to identify and to incorporate into educational curricula.

### **Attention and Executive Function**

Executive functions (EF) constitute a family of mental operations that involve attentional and cognitive control, planning, and working memory. Both socio-emotional competence and academic achievement depend on EF skills (Blair & Razza, 2007). However, while EF skills are central to competent behavior and thought, they degrade easily and are depletable. Psychosocial stressors, particularly during childhood, reduce their efficiency (Evans & Schamberg, 2009). Individuals whose EF efficiency is low have greater difficulty inhibiting emotional expression, modulating emotions, and controlling both mind-wandering and rumination after an emotionally charged event (Kane et al., 2007). A particular subcomponent of EF—self control, has been found to be especially related to long-term

outcome. Moffitt et al. (2011) have recently reported that self-control during children predicts physical health, substance dependence, personal finances and criminal offenses in young adulthood in a cohort of 1000 children followed from birth to age 32 years. Thus, well functioning EF appears to benefit both cognitive control and emotion regulation. Also, it appears that PFC-related executive functions can be improved through behavioral training in young children (Blair & Diamond, 2008; Diamond & Lee, 2011) and younger and older adults (Dahlin, Nyberg, Bäckman, & Neely, 2008). In order to capitalize on the benefits of early EF skill training, new strategies that promote attentional control and EF will be particularly important to identify and to incorporate into the K-12 educational curricula today.

### Self-Representation and Motivation

Self-representations play key roles in EF, emotion and motivation, and social cognition (Dweck, 2008; Hassin, Bargh, & Zimmerman, 2009). These representations index (a) the moment-to-moment physiological state of the body and visual-spatial orientation, which spring from the spinothalamocortical networks (Craig, 2009); and (b) the narrative self based on memory, reflecting the default network and cortical midline structures (LeGrande & Ruby, 2009).

The narrative self emerges during the toddler years (Lewis & Carmody, 2008). It affords a schema for assimilating and accommodating speech-mediated strategies and self-representations that motivate and regulate normative behavior from within (Dweck, 2008; Zelazo, 2004). During adolescence, the representational complexity and coherence of the narrative self increase, as do meta-cognitive strategies that enable introspection and reflection on past and imagined future selves (Harter, 2006).

Substantial individual differences in self-representations and related patterns of motivation arise from early childhood onward, and are associated with variation in readiness to learn and school achievement (Wigfield, Eccles, Schiefele, Roeser, & Kean, 2006). Student beliefs that their intelligence is a fixed capacity, for example, are associated with maladaptive attributions following failure, greater test anxiety, and worse standardized test performance regardless of actual cognitive ability. Interventions that construe intelligence, and traits more broadly, to be malleable reduce anxiety and increase persistence and achievement (Dweck, 2008). Contemplative traditions feature this worldview in a salient way. Many traits, particularly those associated with virtuous character, are regarded as the product of skills that can be cultivated through training.

In addition, pessimistic explanatory styles and rumination that construe the self to be a cause of negative life events are core features of anxiety, depression and academic problems beginning in childhood (Rood, Roelofs, Bogels, Nolen-Hoeksema, & Schouten, 2009). Contravening such construals, studies are beginning to link mindfulness-based clinical interventions to reductions in anxiety and depression in adolescents (Biegel, Brown, Shapiro, & Schubert, 2009). Although the mechanisms are not yet well understood, recent research suggests that through contemplative training, cognitive and affective processes can be engaged and disengaged more easily by means of dissociated networks of self-reference and self-regulation. Specifically, mindfulness practice seems to cultivate more present-oriented experiential forms of self-awareness (ESA) as opposed to introspective, narrative forms of self-awareness (NSA) (Farb et al., 2007). The ESA involves relative increases in activity in a network comprised of the ventral and dorsolateral PFC, right anterior insula, somatosensory cortex (SII) and the inferior parietal lobe; whereas, the NSA involves relative increases in activation of cortical midline structures (CMS). These findings suggest that contemplative practices may reduce rumination and self-focused negative attributions by increasing present-oriented self-awareness (Watkins, 2008). In turn, such present-oriented

forms of awareness may be beneficial for academic motivation and learning (Roeser & Peck, 2009).

### **Empathic Concern and Prosocial Behavior**

Although empathy has a biological basis and dispositional differences in empathic responding and prosocial action exist from early life onwards (Rothbart & Bates, 2006), patterns of empathic responding and related prosocial action are relatively plastic not only during childhood and adolescence, but also during adulthood. Specifically, studies of the effects of mental training in adults have revealed enhancements in functional activity of the insula, a key component of empathy-related brain circuitry (Lutz, Brefczynski-Lewis, Johnstone, & Davidson, 2008). In addition, a recent article has demonstrated that short-term compassion training based upon traditional contemplative practices, increases prosocial behavior on an economic decision making game in a rigorous randomized controlled designed that involved comparison with an active comparison training group (Leiberg, Klimecki & Singer, 2011).

Emotion regulation also coordinates empathic concern and helping. To the extent that empathic concern for another in distress accompanies emotional arousal (e.g., fear) that is effectively regulated, helping behavior becomes more likely; to the extent that empathic concern generates unregulated emotional distress, individuals are less likely to manifest helping behavior or to help others as a means of ending their own distress (Eisenberg, Smith, Sadovsky, & Spinrad, 2004). Thus, in so far as emotion regulation skills can be trained, improvements in empathic responding to others in need could also follow. Given these considerations, new strategies that promote empathy and prosocial behavior in school settings are needed today (Sternberg & Subotnik, 2006).

### **Prospects for American Education**

The research reviewed here provides a substantial empirical warrant to investigate the potential of contemplative practices for enhancing the quality of present-day American public education. The view of many today is that the kind of education needed in the 21<sup>st</sup> century includes developmental outcomes well beyond academic learning (Sternberg & Subotnik, 2006), including young people's social, emotional and ethical development (Noddings, 2005).

For instance, social-emotional learning (SEL) is an umbrella term for a variety of skills-based programs designed to help young people improve relationships with peers and adults, and to develop emotional understanding, self-control and healthy values. SEL programs have been shown to prevent substance abuse, violence and other anti-social behavior, and mental health problems, as well as promoting positive youth development (O'Connell, Boat, & Warner, 2009). Furthermore, a recent meta-analysis of over 250 experimental studies of universal SEL programs also showed that they generally produced significant and meaningful improvements on achievement test performance; the effect was equivalent to an approximately 10% point gain on achievement testing (Durlak et al., 2011). Further, SEL programs have led to greater school attendance, less disciplinary action, and better grades among students. Recently, interdisciplinary work in developmental neuroscience has likewise linked SEL programs to improvements in executive functions, including inhibitory control and working memory (Greenberg & Rhoades, 2008).

The use of contemplative practices in educational settings could both complement and add value beyond these kinds of programs and policies in two ways. First, a key characteristic of contemplative practices is just this – they represent forms of mental training that can induce plastic changes in the brain (Lutz, Slagter, Dunne, & Davidson, 2008). At the heart

of such practices is repetition and practice to cultivate more positive habits of mind. The idea of regularity of practice and repetition meshes well with neuroscientific understanding of how new connections are formed in the brain and the impact of regular practice on brain circuits and complex cognitive function (see Klingberg, 2010). Contemplative traditions provide a wealth of such practices that could be and are getting adapted to the secular setting of schools and youth clinics (Black, Milam & Sussman, 2009; Burke, 2009; Roeser & Peck, 2009). Second, contemplative practices can and are being adapted for cultivating mindful social-emotional competences in teachers and school leaders as well. Thus, a second benefit we see in introducing these practices into education is their enhancement of professional development in educators to nurture the very qualities we want educators, in turn, to nurture in students. Furthermore, the development of these skills in teachers may support their abilities to create cooperative and caring classroom climates and to support students through emotional conflicts (Jennings & Greenberg, 2009). For example, one study found that mindfulness training reduced self-reported emotional, behavioral, and gastronomic stress symptoms among a sample of 21 secondary school student teachers (Winzelberg & Luskin, 1999). Yet much more research is needed to identify the key ingredients that promote both teacher and student well-being while facilitating student cognitive and social-emotional learning.

Of course, our discussion may raise legitimate practical concerns regarding the use of contemplative practices in public school settings and whether there are worldview and church/state concerns implicated here. We believe these are important issues. Any use of contemplative practices in schools necessarily needs to be thoroughly secular, developmentally and culturally appropriate, and predicated upon evidence-based practices. Key issues must be addressed in these regards, including, first and foremost, how do we insure that we do no harm in this area of education? What are the realistic barriers and risks to implementing such practices in educational settings? Given the nature of the developing brain and social environments, are there particular “windows of opportunity and/or risk” that may be particularly beneficial/ill-advised times to introduce contemplative practices to children and youth in educational settings? How can we study both the intra-individual biological and mental effects of contemplative practices on individuals, as well as their interpersonal effects in the contexts of families, schools and community settings? How do the quality of relationships and degree of interpersonal trust influence cultivation of these skills and positive qualities? What can we learn about the social and emotional dimensions of teaching and learning by introducing contemplative practices to young people in educational settings? Is compassion best regarded as a skill that can be educated? Attention also should focus on whether or not skills learned in a contemplative-practice context transfer to the contexts of teaching and learning in the classroom, and on understanding what factors inhibit or facilitate such transfer.

Several scientific challenges must be addressed in creating and validating secular versions of contemplative practices for educational settings. First, continuing curriculum development is needed to establish a set of sequenced pedagogical techniques for children and adolescents that are age-appropriate, culturally sensitive and amenable to careful scientific scrutiny. Although a number of models for secular contemplative education have recently been developed, they require further assessment and scrutiny (Birdee et al., 2009; Black, Milam, & Sussman, 2009; Burke, 2009). Second, significant issues of sustainability affect this kind of work. Research into how best to deliver contemplative programs to young people, if deemed advisable, would necessarily include a focus on preservice and inservice teacher education programs.

At present these proposals concerning contemplative practices in education are speculative and there is little evidence of their effectiveness. We call on researchers from a variety of

disciplines to join in the study of their efficacy. As in all areas of evidence-based practice, the use of carefully designed randomized clinical trials (RCTs) will be a key part in legitimizing such efforts (see MacCoon et al., in press for a recent discussion of the complexity of this task as applied to contemplative interventions), as will careful qualitative analyses documenting processes of change in a deep and rich way. Along the way, a number of related concerns must be addressed too. First there is a need to clearly specify the nature of the intervention and how the practices are adapted to be age-appropriate. This should include clear descriptions of specific instructions and availability of manuals that provide such detail. Second, because many practices come from ones originally used with adults, investigation regarding the role of developmental processes is paramount. While joining neuroscience with education, cognitive science, developmental science, and prevention science, it will be important to explore whether there are particular “windows of opportunity” for the developing brain, mind and social environments that may be particularly beneficial times to introduce contemplative practices to young people in secular school settings. Third, there is a need to clearly specify the training necessary for fidelity of implementation, as well as the dosage/frequency necessary for beneficial effects. Fourth, in order to avoid unjustified broad claims, educational researchers should clearly specify the logic of their intervention models and more fully differentiate objectives and practices designed to achieve them. Fifth, trial designs should be lengthy enough to study the effects of such practices not only in the short-term (post-test) but also in subsequent years. Sixth, to fully understand the potential impact of such practices, outcomes should be measured using multiple methods including those from neuroscience (both function and structure), behavioral measures of cognition and attention, physical health outcomes, academic performance on standardized tests, and reports by students, teachers and parents of behavior and experience. Finally, economic analyses that clearly indicate the potential cost effectiveness and financial benefits of practices will be required and can greatly influence broad diffusion.

## Concluding Comment

Ideas drawn from contemplative practices that promise to improve the regulation of attention, emotion and motivation, social cognition and behavior are one potential strategy for reducing the risks children face and improving both social and academic outcomes through the schools today. A growing body of evidence in adults highlights the benefits of these practices in the regulation of attention and emotion, in cultivating empathy, and in altering brain function and structure to support these behavioral changes. However, there is a paucity of methodologically rigorous research confirming that such programs can positively impact children’s developmental trajectories. In concluding their recent report on relations between childhood self-control and adult outcomes, Moffitt et al., (2011) suggest that “Interventions addressing self-control might reduce a panoply of societal costs, save taxpayers money and promote prosperity.” By conducting methodologically rigorous evaluations, the emerging field concerned with research on contemplative practices, education, developmental science, cognitive science, and neuroscience may come to a clearer understanding of whether, when, how, and for whom such practices can have substantial impact.

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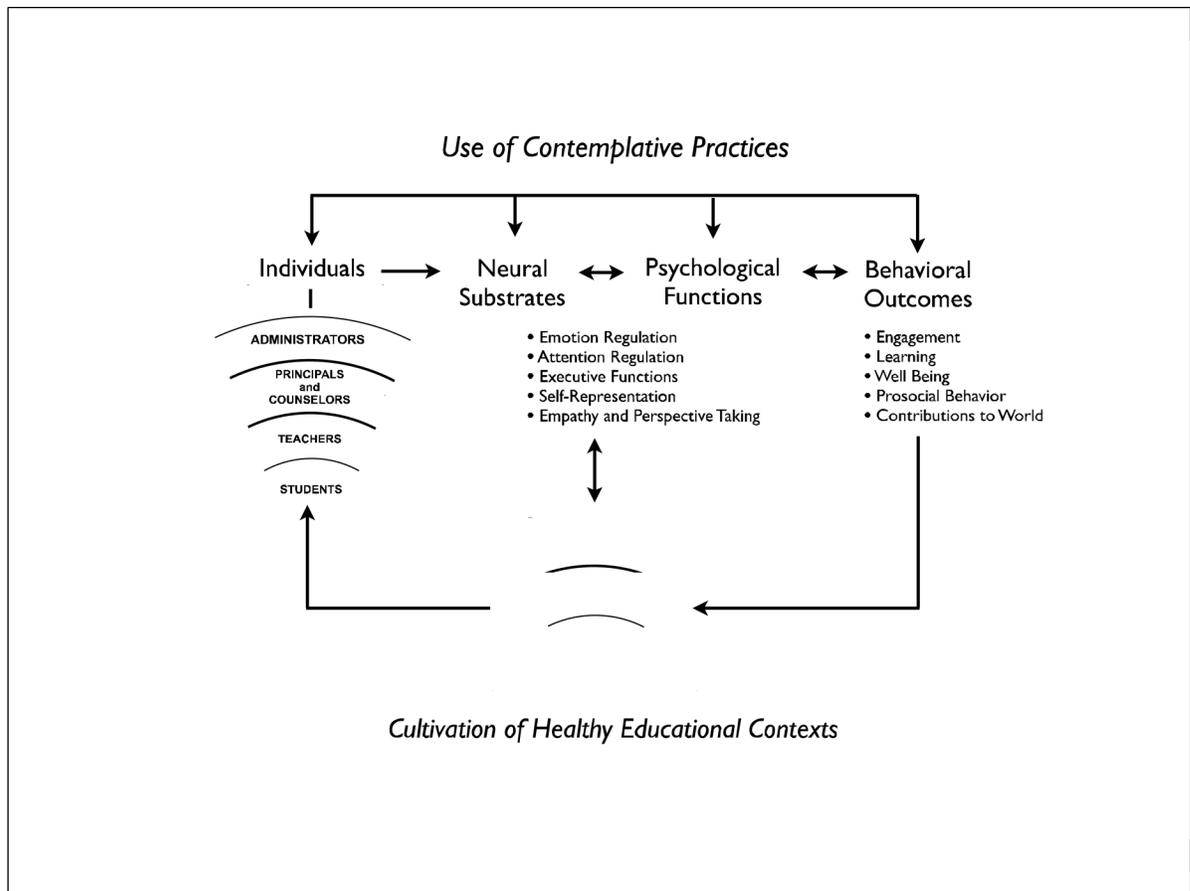
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## Appendix

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**Figure 1.**

Model of the psychological constructs most impacted by contemplative practices and the key behavioral outcomes that are being studied. The classes of individuals who might benefit from such mental training are delineated on left and include all of the major constituents in a school system. Contemplative practices impact specific neural substrates and in turn impact key psychological constructs leading to specific behavioral outcomes. Other school more macro variables such as the leadership, school culture and classroom environment are also noted as these will impact the key neural and psychological systems as well.