



# “Safe in My Own Mind:” Supporting Healthy Adolescent Development Through Meditation Retreats



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## ABSTRACT

The current field study used a quasi-experimental, between-groups design to test the effectiveness of a weeklong intensive, residential meditation retreat for adolescents. Before and after the retreat, teens ( $N = 79$ ,  $M_{\text{age}} = 17.02$  years) completed a battery of self-report measures assessing emotional functioning and self-regulation, and a performance measure of working memory. In parallel, parents completed questionnaires about their child's emotional functioning and self-regulation. Compared to a control condition, adolescents who participated in the retreat showed changes in emotional functioning (depressive symptoms, gratitude, positive affect), self-regulation (self-control), and working memory. The average effect size estimate across all outcomes was small-to-moderate, Cohen's  $d = 0.38$  (range = 0.00 to 0.88). Improvements in self-compassion mediated the associations between meditation training and enhanced emotional functioning. The current field study suggests that residential meditation retreats can support psychological and cognitive functioning during adolescence, a critical period of social-emotional development.

“It will help me realize that I am always safe in my own mind.”

“At this moment I feel I have learned more lessons about myself and others in the past five days than I did in the last year of school.”

~Retreat participants

## 1. Introduction

Adolescence is a developmental period characterized by profound change, learning, and growth (Lerner & Steinberg, 2009). It is also a precarious time, when numerous problems emerge, sometimes with lasting consequences. For example, increases in risky behaviors—having unprotected sex, committing crimes, smoking cigarettes—can snare adolescents into harmful lifestyles, leading to health problems and economic insecurity well into adulthood (Moffitt et al., 2011). Likewise, mood disorders, including depression, spike during the high school years (Hankin et al., 1998), with prevalence rates nearly doubling from 14 to 18 years of age (Merikangas et al., 2010). More generally, increases in unmanaged stress (American Psychological Association, 2014) and declines in positive self-views (Robins, Trzesniewski, Tracy, Gosling, & Potter, 2002) suggest that adolescents may be suffering in more subtle ways—getting a bad grade on a test, feeling excluded—that cumulate across time (Fulgini et al., 2009).

Yet, adolescence is increasingly seen as a window of opportunity to

help young people *thrive*, not simply *survive* (Steinberg, 2014). The developmental plasticity of adolescence suggests that attitudes and skills underlying healthy development (e.g., positive identity, self-regulation) are still malleable, and possibly, subject to modification (Roeser & Pinela, 2014). Beyond preventing “bad” outcomes then, social scientists are also interested in developing programs that support executive function and self-regulation (Steinberg, 2015), train emotion regulation (Broderick, 2013), affirm positive self-views (Cohen, Garcia, Purdie-Vaughns, Apfel, & Brzustoski, 2009), and encourage prosocial behaviors (Roeser & Pinela, 2014).

One approach that holds promise for supporting positive adolescent development is meditation training. The current field study used a quasi-experimental, between-groups design to test the effectiveness of a weeklong intensive, residential meditation retreat for adolescents on emotional functioning, self-regulation, and executive functioning. The current study also sought to better understand why meditation training programs may benefit youth. Unpacking the explanatory mechanisms of meditation training may provide clues about how to shape programs that lead to improved mental and behavioral health. This study explored mindfulness and self-compassion as two possible mechanisms linking meditation training to positive outcomes.

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### 1.1. Meditation training with adolescents

Meditation refers to a set of mental and physical exercises designed to cultivate different mental qualities (Vago & Silbersweig, 2012). A central feature of most meditation exercises is the voluntary regulation of attention to specific sensory (e.g., breath) or mental (e.g., emotions, thoughts) processes (Davidson et al., 2012). Some forms of meditation practice involve monitoring the moment-to-moment flow of mental activity to become more aware of reactive mental habits that exacerbate psychological suffering (Lutz, Slagter, Dunne, & Davidson, 2008), while other forms of practice involve becoming sensitive to the well-being and suffering of others (Dahl, Lutz, & Davidson, 2015). Though the specific styles of meditation practice vary, most are thought to engage and strengthen facets of executive functioning, including working memory (Dreyfus, 2011; Jha, Stanley, & Baime, 2010). They are also thought to support self-regulatory and stress reduction processes that can lead to emotional and behavioral health (Creswell & Lindsay, 2014; Galla, Kaiser-Greenland, & Black, 2016).

The current appeal of meditation training with adolescents stems in part from research showing that it may support a wide range of skills and outcomes crucial for healthy development (Black, 2015). For example, meditation training with adolescents has been shown to support effective *self-regulation* of maladaptive behavioral impulses, and emotional and stress reactions—skills that predict long-term success in life (Moffitt et al., 2011). For example, one study tested whether meditation training could improve self-regulation of stress reactivity in a sample of urban, economically disadvantaged fourth and fifth grade students (Mendelson et al., 2010). Over the course of 12 weeks, students received meditation and yoga training for 45 min, 4 days per week. Relative to a wait-list control condition, meditation training was associated with significant reductions in reactive responses to stress, including less rumination and fewer intrusive thoughts (see also, Sibinga, Webb, Ghazarain, & Ellen, 2016). Relatedly, meditation training has been shown to reduce behavioral impulsivity, measured via preferences for smaller, sooner rewards, over larger, later rewards (Hendrickson & Rasmussen, 2017), and questionnaire measures (Ghahremani et al., 2013; Terjestam, Bengtsson, & Jansson, 2016).

Numerous studies have also found that adolescents who participated in multi-month, school or clinic-based meditation programs reported enhanced *emotional functioning*, which broadly covers reductions in depression and other internalizing symptoms (Biegel, Brown, Shapiro, & Schubert, 2009; Bluth, Gaylord, Campo, Mullarkey, & Hobbs, 2016; Raes, Griffith, Van der Gucht, & Williams, 2014; Sibinga et al., 2016), reductions in psychological distress and negative emotions (Broderick & Metz, 2009; Sibinga et al., 2016), and increases in positive affect, gratitude, and optimism (Bluth & Eisenlohr-Moul, 2017; Broderick & Metz, 2009; Schonert-Reichl et al., 2015), compared to those who did not receive the programs. And given its conceptual relation to *executive cognitive processes* (Dreyfus, 2011; Lutz et al., 2008), training in meditation has also been shown to support improvements in working memory (Quach, Jastrowski Mano, & Alexander, 2016) and executive attention (Zylowska et al., 2007).

The overall evidence to date suggests a small, but reliable effect of meditation training to support youth functioning. Meta-analytically derived effect size estimates across outcomes typically fall in the small-to-moderate range, Becker's  $d = 0.23$  (Zoogman, Goldberg, Hoyt, & Miller, 2014), Hedge's  $g = 0.40$  (Zenner, Herrnleben-Kurz, & Walach, 2014), and Hedge's  $g = 0.32$  (Klingbeil et al., 2017). There is some evidence to suggest that meditation training supports emotional functioning more strongly than other outcome domains (including aspects of self-regulation) ( $d = 0.37$  vs.  $0.21$ ,  $p = 0.028$ ), and for studies using clinical samples compared to non-clinical samples ( $d = 0.50$  vs.  $0.20$ ,  $p = 0.024$ ) (Zoogman et al., 2014). There is also evidence that effects of meditation training are sustained across follow-up assessments (Klingbeil et al., 2017). It is important to note that many of the studies to date have involved younger adolescents (roughly ages

9 to 13). Fewer studies have been conducted with middle and late adolescents (roughly ages 14 to 19); research that does involve these age groups tends to select adolescents with pre-specified health issues (Black, 2015), including mixed anxiety and depression (Biegel et al., 2009), externalizing disorders (Bögels, Hoogstad, van Dun, de Schutter, & Restifo, 2008), and elevated blood pressure (Barnes, Pendergrast, Harshfield, & Treiber, 2008). So, more field research is required to understand how meditation training may influence well-being during middle and late adolescence in samples who are not selected on the basis of preexisting health conditions.

### 1.2. From schools and clinics to retreat centers

The current study examines meditation training in the context of an intensive, residential retreat (Black, Belzer, Semple, & Galla, 2015). During a retreat, individuals voluntarily commit to a period of introspection, setting aside normal daily routines (e.g., work, leisure) and luxuries (e.g., smartphones) to focus exclusively on meditation training. Whereas programs delivered in schools and clinics may encourage several minutes of formal daily meditation practice, retreats enable teens to engage in *hours* of uninterrupted practice, across multiple days. Retreats therefore offer an unprecedented opportunity for adolescents to train their minds in skills that support self-awareness, self-regulation, compassion, and empathy. And given that adolescents report far greater autonomy, engagement, and intrinsic motivation in structured out-of-school programs compared to being in school (Larson, 2000; Shernoff & Vandell, 2007), retreats may be an especially powerful and supportive context for teens learning to meditate.

The question largely remains, however, whether intensive meditation training (historically reserved for adults) that occurs over a period of days can produce meaningful changes in cognitive, emotional, and psychosocial processes underlying mental and behavioral health. Preliminary studies do suggest meditation training in the context of intensive, residential retreats can be beneficial for teenagers. Two studies, conducted two decades ago with Thai adolescents, found improvements in self-esteem, emotional maturity, and sympathetic warmth following 3-day or 7-day retreats (Emavardhana & Tori, 1997; Tori, 1999). A more recent 3-month longitudinal study tracked the effects of a weeklong meditation retreat in a sample of 132 North American adolescents (Galla, 2016). Results showed improvement on multiple indices of emotional functioning (e.g., depression) and self-regulation (e.g., rumination) immediately following the retreat (Cohen's  $d = 0.39$  to  $1.19$ ), many of which were maintained three months later ( $d = 0.04$  to  $0.68$ ). Yet, the study by Galla (2016) did not include a control group, so it is impossible to know whether changes in outcomes were attributable to the retreat or extraneous factors unrelated to meditation. And like most studies of meditation training with adolescents, it relied exclusively on self-report questionnaires which have well-known limitations (Lucas & Baird, 2005).

### 1.3. The role of mindfulness and self-compassion

Because retreats act as “incubators” for developing meditative expertise, they also provide unique opportunities to address key theoretical questions concerning the psychological mechanisms underlying meditation training. For example, why should sitting with eyes closed, focusing on the breath matter for self-regulation and emotional functioning? Why should observing the moment-to-moment flow of experience reduce reactivity to impulses and increase positive emotion? Surprisingly little research has examined the psychological mechanisms linking meditation training to beneficial outcomes for adolescents (Black, 2015). Given that the focus of many meditation programs, especially retreats, is on the cultivation of mindfulness and self-compassion, it seems reasonable to consider changes in these mental qualities as key therapeutic ingredients.

Mindfulness is defined as an awareness of subjective experience that

is characterized by an attitude of nonreactivity, openness, and acceptance (Bishop et al., 2004). When an experience is observed mindfully, there are no attempts to control, suppress, or alter it; mindfulness simply reveals what is happening so that the experience can be investigated and understood (Grabovac, Lau, & Willett, 2011). Through the cultivation of mindfulness, teens may begin to observe negative thoughts about themselves and their perceived limitations as simply *thoughts*—temporary, objective mental events—as opposed to true and absolute reflections of themselves (Fresco et al., 2007). Such a shift in perspective may also reduce reactivity to difficult (or pleasurable) emotional experiences, enabling more thoughtful—and less impulsive—responses (Teper, Segal, & Inzlicht, 2013).

Self-compassion, on the other hand, is defined as a kind-hearted awareness of and nonjudgmental caring toward one's own suffering (Neff, 2003). It can be understood as a countervailing force to the negative and distorted self-evaluations triggered by failure and perceived imperfections (Neff & Dahm, 2015). And whereas mindfulness involves maintaining a nonreactive awareness to all experiences—good, bad, neutral—self-compassion specifically involves awareness of and sympathy toward suffering (Baer, Lykins, & Peters, 2012). Self-compassion is also distinct insofar as it motivates a heartfelt desire to alleviate suffering, as opposed to the more dispassionate observation of experience implied by mindfulness. Through a sustained and sympathetic connection to suffering, self-compassion also enables the development of the insight that suffering is a shared human experience—that one's own personal suffering, no matter how unique or profound, is a doorway to connection with all other humans. For teens, learning to bring a kindhearted and compassionate mindset to the “inner critic” may help them disengage from the self-absorbed ruminative thought patterns that perpetuate misery (Bluth, Campo, Futch, & Gaylord, 2016; Galla, 2016). The insight into the shared reality of human suffering may also help reduce feelings of isolation and shame that can accompany difficult experiences.

Mindfulness and self-compassion are interrelated, but distinct qualities of mind (Neff & Dahm, 2015), both of which support psychological functioning in adolescents. For example, adolescents with higher self-reported mindfulness and self-compassion ruminate less often in response to stressful events (Ciesla, Reilly, Dickson, Emanuel, & Updegraff, 2012), are less stressed and more satisfied with their lives (Bluth, Campo, et al., 2016; Bluth & Blanton, 2015; Brown, West, Loverich, & Biegel, 2011), have higher self-control (Black, Sussman, Johnson, & Milam, 2012), and have less anxiety and depression (Neff & McGhee, 2010). More importantly, adolescents' self-reported mindfulness and self-compassion do seem to increase after a period of meditation training (Bluth, Gaylord, et al., 2016; Bluth & Eisenlohr-Moul, 2017; Brown et al., 2011; Galla, 2016). And at least two studies have found that changes in mindfulness were associated with improvements in self-esteem, anxiety, stress, and broad-based internalizing and externalizing problems (Bögels et al., 2008; Brown et al., 2011). However, when examining both mindfulness and self-compassion simultaneously, one study found that changes in self-compassion were more predictive of certain outcomes—including depressive symptoms, life satisfaction, and negative affect—compared to changes in mindfulness (Galla, 2016); others found that both contributed to improvements in anxiety and perceived stress (Bluth, Gaylord, et al., 2016; Bluth & Eisenlohr-Moul, 2017).

#### 1.4. Exploring gender differences

Despite the rapid increase in meditation training research with adolescents, few studies have investigated gender differences in outcomes of meditation training (Bluth, Roberson, & Girdler, 2017). The lack of research is surprising, especially when considering that adolescent girls and boys differ both in terms of emotional functioning (girls have higher rates of depression, Hankin et al., 1998; Mojtabai, Olfson, & Han, 2016) and self-regulation (boys often demonstrate lower self-regulation, Moffitt, Poulton, & Caspi, 2013). Likewise, girls and

boys are socialized from a young age to express and regulate emotions in different ways (Chaplin, Cole, & Zahn-Waxler, 2005), with girls being more likely to display sadness and anxiety and ruminate in response to stress, and boys being more likely to express anger and joy and distract themselves when coping with stress (Broderick, 1998; Chaplin et al., 2005). In light of these developmental differences, it is possible meditation training—that (arguably) encourages more emotion-focused coping strategies, including nonreactive awareness, lovingkindness, and self-compassion—may align more closely with emotion regulation practices for girls (Laurent, Laurent, Hertz, Egan-Wright, & Granger, 2013; Rojiani, Santoyo, Rahrig, Roth, & Britton, 2017). In fact, there is some preliminary, exploratory data to suggest boys and girls may respond differently to meditation training. In the aforementioned study of intensive meditation retreats, Galla (2016) found that changes in self-compassion were more predictive of reductions in perceived stress among girls, but not boys. Likewise, changes in mindful non-reactivity predicted improvements in life satisfaction among girls but not boys. Another exploratory study found that girls engaged in more out-of-class meditation practice than boys (Bluth et al., 2017), and that girls and boys showed differential responses to a laboratory stressor following a 6-week meditation training program. These two studies suggest there may be differential responses to meditation training based on gender, but more research is required to explore and better understand these potential differences.

#### 1.5. The current study

The current field study used a quasi-experimental, between-groups design to estimate the effectiveness of intensive meditation training on adolescents' overall psychological functioning. It built on prior research (Galla, 2016) by including both an experimental condition and a no-treatment (wait-list) control condition drawn from the same population of adolescents who were interested in meditation retreats. Thus, this study included a strong control sample with whom to compare changes related to meditation training.

Based on findings reported in Galla (2016), it was also assumed that adolescents in this study would show elevated stress and depressive symptoms. Though adolescents were not selected to participate in this research on the basis of any pre-existing mental health condition, the available data suggest that adolescents who choose to attend retreats may be dealing with (or be more aware of) higher stress burdens than other typically-developing adolescent samples. Insofar as meditation training has historically been a way for people to gain insight into the sources of psychological suffering in their everyday lives (Grabovac et al., 2011), it may not be that surprising that teens who feel stressed would gravitate toward intensive meditation training. But, this is also theoretically important since current thinking suggests meditation training may be especially helpful for individuals dealing with psychological distress compared to those who are not (Creswell & Lindsay, 2014).

Because so little research on intensive meditation retreats with adolescents exists, the current study included a broad range of theoretically-informed measures. Specifically, this study took a multi-method, multi-informant measurement approach, incorporating self-report and parent-report questionnaires assessing indices of emotional functioning and self-regulation, and a performance measure of working memory. The hypothesis was that adolescents who participated in a meditation retreat would show greater improvement in emotional functioning, self-regulation, and cognitive functioning compared to adolescents who did not.

A second aim of this study was to clarify the psychological mechanisms linking meditation training to enhanced psychological functioning. Specifically, this study tested whether improvements in mindfulness or self-compassion following the retreat predicted related improvements in emotional functioning and self-regulation. Based on prior research (Galla, 2016), it was hypothesized that changes in both mindfulness and self-compassion would mediate the relationship

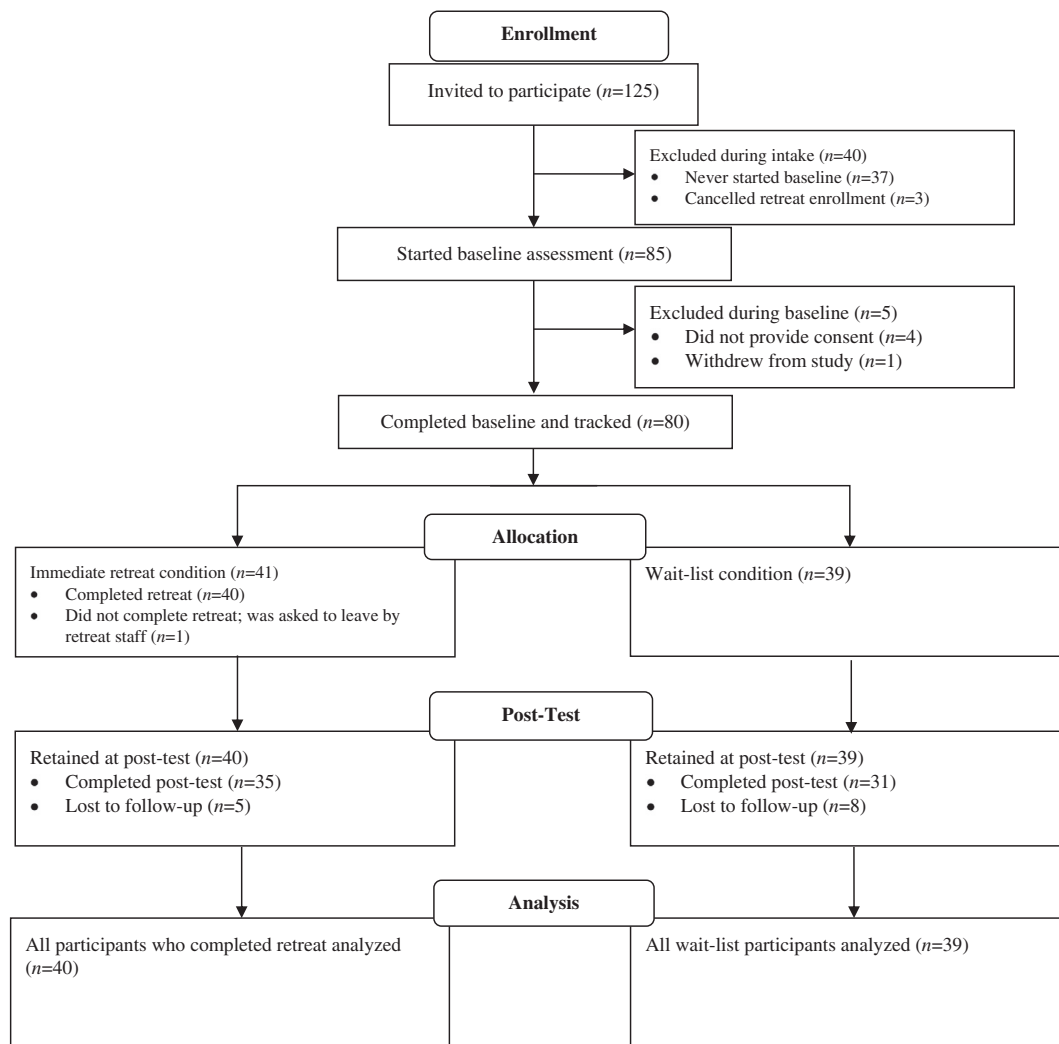


Fig. 1. Participant flow through the study.

between retreat participation and enhanced emotional functioning and self-regulation.

Finally, this study explored gender differences in response to meditation training. Given the lack of definitive research on gender differences, no specific hypotheses were made about the potential differential responses between girls and boys.

## 2. Method

### 2.1. Participants

The final sample included  $N = 79$  youth ( $M_{\text{age}} = 17.02$  years,  $SD = 1.36$ , range = 14.25 to 19.58; 77% of participants were under 18 years of age at baseline; 61% female, 34% male, 5% non-binary) who participated in one of 5, weeklong (five or six-day) meditation retreats offered during summer 2016. Fig. 1 depicts the flow of participants through each phase of the study. Study participants were a self-selected group of adolescents interested in meditation practice; they were not recruited for the study on the basis of any preexisting health conditions nor were the meditation retreats intended as treatment for emotional or behavioral problems.

Detailed information about the meditation retreat format has been published elsewhere (Black et al., 2015; Galla, 2016). Briefly, the retreat is designed to help adolescents intentionally cultivate mindfulness, self-compassion, and other positive mental qualities (empathy, loving-kindness). Toward that end, adolescents are introduced to the principles of

mindfulness, loving-kindness, and compassion through a variety of daily activities, including silent meditation, yoga, creative workshops, and small group exercises. Meditation instructions are often drawn from traditional Buddhist practices, but are presented using secular language that does not assume any religious affiliation. They are structured like retreats for adults, and involve the acceptance of ethical precepts (e.g., to be respectful in speech, refrain from intoxicants) and the renunciation of typical daily diversions (e.g., smartphones, Internet). The retreats differ in that adolescents enter into and out of silence throughout the day, although adolescents engage in roughly 5 h of silent meditation per day.

Based on parent-reported demographic information, 65% of participants were White, 13% were African American, 9% were Latino, 6% were Asian, 5% were of mixed racial backgrounds, and 1% were Middle Eastern. Household income ranged from \$24,999 or less to \$150,000 or higher, with a median reported income range of \$50,000 to \$74,999 (a value that is comparable to the 2015 national average of about \$56,000; United States Census Bureau, 2015, Table 1).<sup>1</sup> According to participants' self-reports, a majority ( $n = 63$ , 80%) had practiced meditation prior to start of their retreat; just under half ( $n = 35$ , 44%)

<sup>1</sup> Aggregate data retrieved from the retreat organization indicated that approximately 30% of all families across all five retreats paid the full retreat price (which varied slightly by location). Approximately 35% of all families allocated to the retreat condition (see below for more details) paid the full price, whereas approximately 28% of families allocated to the wait-list condition paid full price, a non-significant difference ( $\chi^2(1) = 0.95$ ,  $p = 0.331$ ).

**Table 1**  
Linear mixed models for parent-reported self-regulation and emotional functioning.

Variable	Wait-list condition										Retreat condition										Condition-by-time interaction			
	Baseline					Post-test					Baseline					Post-test					b	SE	p	d
	N	M	SE	LCI	UCI	N	M	SE	LCI	UCI	N	M	SE	LCI	UCI	N	M	SE	LCI	UCI				
<i>Self-regulation</i>																								
Self-control	39	3.67	0.12	3.43	3.91	31	3.69	0.13	3.43	3.95	39	3.68	0.12	3.44	3.92	34	4.00	0.13	3.74	4.24	0.29	0.17	0.085	0.41
<i>Emotional functioning</i>																								
Gratitude (behaviors)	39	3.98	0.11	3.75	4.20	31	4.03	0.12	3.78	4.27	39	4.08	0.11	3.85	4.30	34	4.05	0.12	3.81	4.28	-0.08	0.17	0.626	-0.12
Gratitude (emotions)	39	3.44	0.12	3.19	3.69	31	3.53	0.14	3.26	3.80	39	3.55	0.13	3.30	3.80	34	3.83	0.13	3.57	4.09	0.19	0.19	0.320	0.24
Negative affect	39	2.35	0.13	2.10	2.61	31	2.08	0.14	1.80	2.36	39	2.02	0.13	1.77	2.28	34	1.62	0.14	1.35	1.89	-0.13	0.21	0.544	-0.14
Positive affect	39	3.26	0.13	3.00	3.51	31	3.23	0.14	2.96	3.50	39	3.37	0.13	3.12	3.63	34	3.55	0.13	3.28	3.81	0.20	0.16	0.205	0.30

Notes: Means (M), standard errors (SE), within-condition change scores, and condition-by-time interaction effects are adjusted for covariates (female vs. other, prior meditation experience, baseline gratitude child-report).

†p < 0.10, \*p < 0.05, \*\*p < 0.01.

had previously attended a meditation retreat.

2.2. Measures

Except where noted, scale scores for each questionnaire were calculated as the average of item scores, such that higher scores indicated more agreement with the construct. Item order within each questionnaire was randomized across participants, although the order of the questionnaires was held constant. Every dependent variable collected for this study is described here, and none were excluded from analysis. Scales had acceptable internal reliability consistency estimates at baseline (αs = 0.79 to 0.91) and post-test (αs = 0.77 to 0.92).

2.2.1. Parent-report questionnaires

2.2.1.1. Self-regulation measures

2.2.1.1.1. *Self-control.* Parents reported on their child's self-control in the past week using 14 items adapted from the Domain-Specific Self-Control Scale for Children (Tsukayama, Duckworth, & Kim, 2013) and the Behavior Rating Inventory of Executive Function (Gioia, Isquith, Guy, & Kenworthy, 2000). Items captured children's behavioral and emotional reactivity (e.g., "My child stayed calm even when others bothered or criticized them"). Items were endorsed from 1 = not at all like my child to 5 = very much like my child.

2.2.1.2. Emotional functioning measures

2.2.1.2.1. *Positive and negative affect.* Parents reported on their child's positive and negative affect in the past week using the 10-item Positive and Negative Affectivity Schedule, Short Form (Mackinnon et al., 1999). Five items were used to capture positive affect (i.e., alert, excited, enthusiastic, inspired, determined) and five items were used to capture negative affect (i.e., distressed, upset, scared, nervous, afraid). Items were rated from 1 = not at all to 5 = extremely.

2.2.1.2.2. *Gratitude (emotions).* Parents also reported on their child's expression of gratitude-related emotions in the past week using two items, grateful and thankful. Items were endorsed from 1 = not at all to 5 = extremely.

2.2.1.2.3. *Gratitude (behaviors).* Behavioral expressions of gratitude in the past week were measured using 4 items (e.g., "My child appreciated when others helped them"). Items were rated from 1 = not at all like my child to 5 = very much like my child.

2.2.2. Self-report questionnaires

2.2.2.1. Process measures

2.2.2.1.1. *Mindfulness.* Participants completed the 14-item Mindful Attention Awareness Scale for Adolescents (Brown et al., 2011). This is among the most commonly used self-report measures of mindfulness,

and taps the general tendency to be attentive to and aware of present-moment experience in daily life (e.g., "It seems I am 'running on automatic' without much awareness of what I'm doing"). Items were endorsed from 1 = almost always to 6 = almost never.

2.2.2.1.2. *Self-compassion.* Participants completed the 12-item Self-Compassion Scale, Short Form (Raes, Pommier, Neff, & Van Gucht, 2011). This scale taps facets related to self-compassion, including self-kindness, self-judgment, common humanity, balanced awareness, isolation, and over-identification. Items were endorsed from 1 = never to 5 = very often.

2.2.2.2. Self-regulation measures

2.2.2.2.1. *Reflexive reaction to feelings.* Participants reported on the degree to which they impulsively react to their emotions using the 7-item Reflexive Reaction to Feelings scale (Webb Hooper & Carver, 2016). Items (e.g., "When I feel a desire, I act on it immediately") were rated from 1 = I disagree a lot to 5 = I agree a lot.

2.2.2.2.2. *Temporal discounting.* Participants' tendency to discount (i.e., devalue) future rewards was measured using the 27-item monetary-choice questionnaire (Kirby, Petry, & Bickel, 1999). For each item, participants chose between a smaller, immediate sum of money versus a larger, delayed sum of money (e.g., "Would you prefer \$54 today or \$55 in 117 days?"). Discount rate was calculated as the proportion of delayed monetary choices, with higher scores indicating a greater preference for larger, delayed rewards (Myerson, Baumann, & Green, 2014).

2.2.2.3. Emotional functioning measures

2.2.2.3.1. *Positive and negative affect.* Participants reported their own positive and negative affect in the past week using the same 10-item scale described in the parent-report measures section.

2.2.2.3.2. *Gratitude (emotions).* Participants reported their own experience of gratitude in the past week using the same two items described above, grateful and thankful.

2.2.2.3.3. *Depressive symptoms.* Participants reported their depressive feelings in the past week using 19 items from the Center for Epidemiological Studies Depression Scale for Children (Faulstich, Carey, Ruggiero, Enyart, & Gresham, 1986). Items (e.g., "I felt down and unhappy") were rated from 0 = not at all to 3 = a lot. The item, "I was more quiet than usual," was not administered because several hours per day were devoted to silent meditation.

2.2.2.3.4. *Perceived stress.* Participants reported the degree to which their life demands in the past week were overwhelming and uncontrollable using the 10-item Perceived Stress Scale (e.g., "In the last week, how often have you felt difficulties were piling up so high that you could not overcome them?"; Cohen, Kamarck, & Mermelstein,

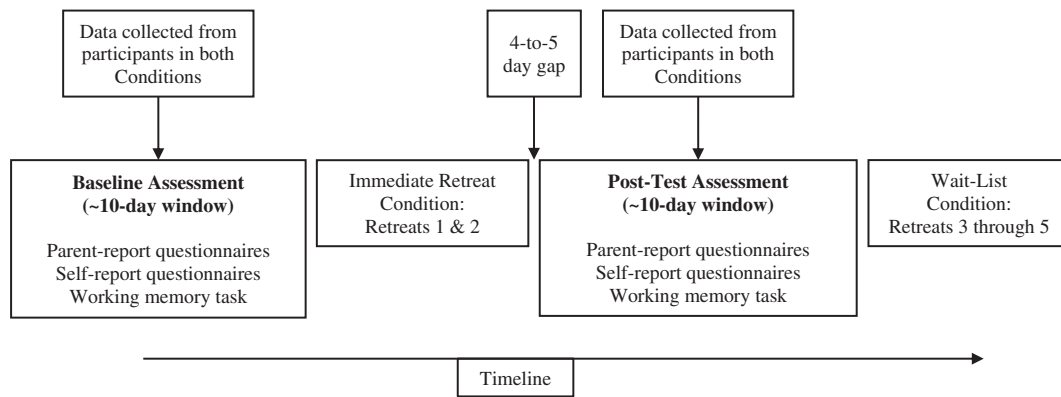


Fig. 2. Study design and timeline.

1983). Items were endorsed from 1 = *never* to 5 = *very often*.

### 2.2.3. Cognitive functioning measure

**2.2.3.1. Working memory capacity.** Working memory was assessed using the automated Operation Span task (Unsworth, Heitz, Schrock, & Engle, 2005). The task requires participants to solve math problems while also trying to memorize a sequence of letters. The length of the letter sequence varies from three to seven letters, with a total of 75 letters dispersed across 15 blocks. The primary performance outcome was the sum of all letters recalled in the appropriate order.

### 2.3. Procedure

This study used a 2 (Condition: retreat vs. wait-list) by 2 (Time: baseline vs. post-test) quasi-experimental design. See Fig. 2 for a depiction of study design and timeline. All youth enrolled in any of five summer meditation retreats were invited to participate. Youth were allocated into different study conditions based on their retreat start date. The retreat condition included youth enrolled in either of two retreats offered in early July. The wait-list control condition<sup>2</sup> included youth enrolled in any of three retreats offered in late July or early August. The cutoff to participate in the study was completion of the baseline survey prior to the start of the very first retreat in early July.<sup>3</sup> This study therefore capitalized on variations in the existing summer retreat schedule to “create” different experimental conditions, and to test for changes in adolescents who participated in earlier retreats versus those who were enrolled (and thus intending to participate) in later retreats.

During the baseline assessment, parents first provided permission (for children under 18 years of age) and demographic information (e.g., family income), and then completed several questionnaires about their child. After, participants provided consent/assent and then completed the remainder of the survey, which included several demographic questions (e.g., gender), a battery of self-report questionnaires, and a performance measure of working memory. The post-test assessment was identical to the baseline, minus demographic questions.

Participants had roughly 10 days to complete each assessment wave. The baseline assessment was completed by all participants (and

their parents) before the start of the first two retreats that comprised the retreat condition, and the post-test assessment was completed *after* the first two retreats but *before* the wait-list condition retreats. The post-test assessment was made available for completion four or five days after the end of the first two retreats. The gap between the end of the first two retreats and the start of the post-test assessment was included to reduce demand characteristics on the parent-report and self-report questionnaires, and to better capture the enduring changes following meditation training. Although somewhat arbitrary in length, this four-to-five day gap was also the maximum period that still permitted a 10-day window to complete the post-test assessment before the start of wait-list retreats. Everything was completed online. Participants earned \$25 for completing each assessment, and a bonus of \$10 for completing both assessments (for a maximum of \$60).

### 2.4. Analytic plan

A combination of formal significance testing and effect size interpretation was used (Wilkinson, 1999). Following intent-to-treat principles, mixed linear models tested condition (retreat vs. wait-list) × time (baseline vs. post-test) interactions using SPSS, version 24 (IBM Corp, 2016). Intent-to-treat analyses included the full sample ( $N = 79$ ) regardless of missing data. Because participants were not randomly assigned to condition, models were estimated with covariates to account for the few statistically significant ( $p < 0.05$ ) baseline differences across condition (see Results below). Cohen's  $d$  (Cohen, 1988) effect size estimates were calculated to represent the standard difference in change scores across condition. Following conventional guidelines,  $d = 0.20$  was considered a small effect,  $d = 0.50$  was considered a medium effect, and  $d = 0.80$  was considered a large effect (Cohen, 1988); effects larger than  $d = 0.20$  are often considered practically meaningful (Cohen, 1988). Given the exploratory nature of this study and the relatively small sample size, adjustments were not made for multiple comparisons as these can increase Type II error (see also, Biegel et al., 2009; Butzer, LoRusso, Shin, & Khalsa, 2016).

Indirect effects with 5000 bootstrapped samples tested whether changes in mindfulness or self-compassion mediated the relationship between condition and emotional functioning or self-regulation using *Mplus* Version 7.2 (Muthén & Muthén, 1998–2012). A stylized mediation model is depicted in Fig. 3. Missing data were handled using full information maximum likelihood which has been shown to produce less biased and more efficient results than other methods, such as listwise deletion (Baraldi & Enders, 2010; Schafer & Graham, 2002). Difference scores were calculated for both mindfulness and self-compassion by subtracting post-test scores from baseline scores. The difference scores were then used as mediators between condition and outcomes. In each model, difference scores (post-test minus baseline) on the outcome served as the dependent variable. Covariates (described below) were also included to account for baseline differences in condition.

<sup>2</sup> For ease of exposition, the term “wait-list” control condition is used here, even though these adolescents were not technically assigned to a wait-list condition. The wait-list designation was given to adolescents who were enrolled in one of three retreats that started *after* the completion of the post-test assessment. The summer schedule for the various retreats provided a roughly two-week window between the end of the first two retreats (active condition) and the remaining three (wait-list condition) in which to administer the post-test assessment.

<sup>3</sup> Five participants completed the baseline survey one or two days after the start of the very first retreat. Three participants were in the wait-list condition, and two were in the second of the two immediate retreats, a non-significant difference,  $\chi^2(1) = 0.24$ ,  $p = 0.623$ . To maximize sample size, these participants were included in analyses.

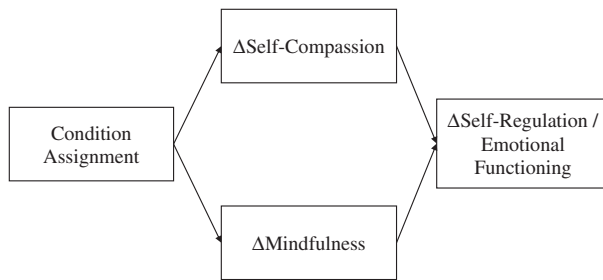


Fig. 3. Hypothesized model in which changes in self-compassion and mindfulness mediate the associations between condition (retreat vs. wait-list) and changes in self-regulation and emotional functioning.

Mediation was inferred when the 95% confidence interval for the crucial indirect effect parameter (i.e., retreat condition on outcomes through the mediator) did not include zero.

Finally, two sets of exploratory analyses were conducted. First, gender was tested as a moderator of the condition-by-time interaction effect for all outcomes. For these analyses, participants who identified as non-binary ( $n = 4$ ) were removed from analyses. Given the exploratory nature of these analyses, interactions that reached statistical significance of  $p < 0.10$  were interpreted. Second, and based on descriptive data at baseline, condition differences in clinical thresholds for depressive symptoms were examined at baseline and post-test.

### 3. Results

#### 3.1. Attrition

A total of 66 out of 79 (84%) participants had baseline and (at least some) post-test data (data for working memory task were available for  $n = 67$  participants at baseline and  $n = 57$  at post-test). No significant baseline differences ( $p < 0.05$ ) were found between those who completed the post-test assessment versus those who did not. Importantly, attrition did not vary by condition:  $\chi^2(1) = 0.92, p = 0.337$ .

#### 3.2. Baseline equivalence across condition

Overall, the two conditions were mostly equivalent. Nonetheless, there were two demographic characteristics that differed at baseline. The wait-list condition had more participants with prior meditation experience compared to the retreat condition,  $\chi^2(1) = 4.77, p = 0.029$ . And though the overall gender percentages did not vary by condition,  $\chi^2(2) = 3.25, p = 0.197$ , there was a marginally significant difference in the percentage of females in the immediate retreat condition,  $\chi^2(1) = 2.90, p = 0.088$ . No other significant differences across condition were observed for the remaining demographic characteristics, including age, household income, and race/ethnicity, or study characteristics, including the number of days between completion of the baseline and post-test assessments. Importantly, the two groups did not differ in their participation in prior meditation retreats,  $\chi^2(1) = 0.11, p = 0.744$ .<sup>4</sup>

Of the 15 dependent variables assessed, only one was significantly different at baseline: Participants in the wait-list condition self-reported more gratitude-related emotions compared to participants in the retreat condition,  $t(77) = 2.83, p = 0.006$ .

To control for baseline differences across condition, gender (female vs. male/non-binary), prior meditation experience (yes vs. no), and self-reported gratitude were included as covariates in follow-up models reported below.

<sup>4</sup> The online supplemental material contains more descriptive information and analyses pertaining to baseline equivalency across conditions.

#### 3.3. Descriptive statistics

Bivariate correlations for all dependent variables (across baseline and post-test) are presented in Table S1, but a brief summary is offered here. Consistent with prior research (Galla, 2016), mindfulness and self-compassion were positively correlated at baseline ( $r = 0.57$ ) and post-test ( $r = 0.61$ ). Likewise, at each assessment wave, participants with higher mindfulness and self-compassion reported lower self-reported depression ( $r_s = -0.46$  to  $-0.65$ ), perceived stress ( $r_s = -0.40$  to  $-0.62$ ), and negative mood ( $r_s = -0.31$  to  $-0.40$ ), and higher positive affect ( $r_s = 0.23$  to  $0.54$ ) and gratitude ( $r_s = 0.20$  to  $0.43$ ). Mindfulness and self-compassion were also correlated in the expected positive direction with self-reported self-regulation, and parent-reported emotional functioning and self-regulation, but not all of the correlations reached conventional levels of statistical significance ( $p < 0.05$ ).

#### 3.4. Contribution of meditation training to self-regulation and emotional functioning

##### 3.4.1. Parent-reported outcomes

Parent-report data for one participant was removed since this participant noted that they had completed the parent measures themselves, leaving  $n = 78$  for linear mixed model analysis. The vast majority of parent-report data came from mothers (91%), while the remaining 9% of respondents were fathers.<sup>5</sup>

After controlling for baseline differences, linear mixed models showed that none of the condition-by-time interaction effects were statistically significant at conventional levels ( $p < 0.05$ ). See Table 1 for full results. Nevertheless, participants within the retreat group showed statistically significant covariate-adjusted improvements in self-control, gratitude-related emotions, and negative affect ( $p_s < 0.05$ ). In contrast, participants within the wait-list condition showed no significant improvement in outcomes across time.

Effect size estimates for change scores indicated a small-to-medium-sized effect favoring the retreat condition on self-control ( $d = 0.41$ ), and small-sized effects favoring the retreat condition on changes in gratitude-related emotions and behaviors, and positive and negative affect ( $d_s = 0.12$  to  $0.30$ ).

##### 3.4.2. Self-reported outcomes

After controlling for baseline differences, linear mixed models showed significant condition-by-time interactions for self-compassion ( $b = 0.27, SE = 0.13, p = 0.039$ ), depression ( $b = -7.78, SE = 2.73, p = 0.006$ ), positive affect ( $b = 0.66, SE = 0.19, p = 0.001$ ), and gratitude-related emotions ( $b = 0.79, SE = 0.21, p < 0.001$ ). The remaining time-by-condition interaction effects did not reach statistical significance at  $p < 0.05$ . See Table 2 for full results.

Effect size estimates for change scores between conditions ranged from large ( $d > 0.80$ ) for positive affect and gratitude-related emotions, medium ( $d > 0.50$ ) for self-compassion and depression, and small ( $d < 0.50$ ) for remaining variables, including mindfulness, perceived stress, and temporal discounting. All change scores suggested improvement in the retreat condition compared to the wait-list condition.

Looking within conditions, participants who went on retreat showed a statistically significant ( $p < 0.05$ ) covariate-adjusted improvement on every outcome, except measures of self-regulation (reflexive reactivity to feelings, temporal discounting). In contrast, participants in the wait-list condition showed no significant improvement in any outcome across time, and actually showed significant ( $p < 0.05$ ) declines

<sup>5</sup> During the post-test assessment, one adult respondent indicated they were the participant's aunt/uncle—the parent (mother) who completed the baseline was presumably unavailable to complete the post-test assessment.

**Table 2**  
Linear mixed models for self-reported process measures, self-regulation, emotional functioning, and performance measure of working memory.

Variable	Wait-list condition						Retreat condition						Condition-by-time interaction							
	Baseline			Post-test			Baseline			Post-test			Retreat			Condition-by-time interaction				
	N	M	SE	LCI	UCI	SE	M	SE	LCI	UCI	N	M	SE	LCI	UCI	b	SE	p	d	
<i>Process measures</i>																				
Mindfulness	39	3.79	0.12	3.56	4.03	0.13	3.80	0.13	3.55	4.06	40	3.93	0.12	3.70	4.16	4.41	0.22	0.17	0.184	0.32
Self-compassion	39	2.78	0.11	2.56	3.00	0.12	2.75	0.12	2.51	2.98	40	3.12	0.11	2.91	3.34	3.58	0.27	0.13	0.039	0.50
<i>Emotional functioning</i>																				
Depression	39	23.77	1.74	20.31	27.22	1.93	25.42	1.93	21.59	29.25	40	19.74	1.72	16.33	23.14	17.24	-7.78	2.73	0.006	-0.67
Negative affect	39	2.57	0.15	2.27	2.86	0.16	2.35	0.16	2.02	2.67	40	2.40	0.15	2.11	2.69	2.15	-0.35	0.23	0.145	-0.35
Positive affect	39	3.20	0.12	2.95	3.44	0.13	2.89	0.13	2.62	3.15	40	3.29	0.12	3.06	3.53	3.90	0.66	0.19	0.001	0.83
Gratitude (emotions)	39	3.64	0.10	3.45	3.83	0.11	3.31	0.11	3.09	3.52	40	3.64	0.09	3.45	3.82	4.30	0.79	0.21	< 0.001	0.88
Perceived stress	39	2.99	0.12	2.75	3.22	0.13	2.81	0.13	2.55	3.07	40	2.72	0.12	2.48	2.95	2.54	-0.24	0.18	0.193	-0.31
<i>Self-regulation</i>																				
Reactivity to feelings	39	3.17	0.15	2.88	3.46	0.16	3.13	0.16	2.82	3.44	40	2.96	0.14	2.67	3.24	3.21	0.00	0.17	0.991	0.00
Temporal discounting	39	0.53	0.03	0.47	0.60	0.03	0.50	0.03	0.43	0.57	40	0.47	0.03	0.41	0.53	0.54	0.03	0.04	0.391	0.20
<i>Cognitive functioning</i>																				
Working memory	32	44.88	3.28	38.37	51.39	3.48	46.80	3.48	39.89	53.71	35	42.79	3.10	36.63	48.94	59.27	8.17	4.44	0.071	0.47

Notes: Means (M), standard errors (SE), within-condition change scores, and condition-by-time interaction effects are adjusted for covariates (female vs. other, prior meditation experience, baseline gratitude child-report). \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

in positive affect and gratitude-related emotions.

3.5. Contribution of meditation training to working memory

After controlling for baseline differences, the condition-by-time interaction effect for working memory did not reach conventional levels of statistical significance ( $b = 8.17$ ,  $SE = 4.44$ ,  $p = 0.071$ ). Nonetheless, Cohen's  $d$  estimates suggested a medium-sized effect ( $d = 0.47$ ) of the retreat condition on changes in working memory. Participants in the wait-list condition showed an adjusted mean change of 1.92 points, a non-significant improvement ( $p = 0.540$ ), whereas participants in the retreat condition showed a statistically significant adjusted mean change of 10.09 points,  $p = 0.001$ . See Table 2.

3.6. Mediation via changes in mindfulness or self-compassion

As a preliminary step, linear regression analyses were fit to test whether condition assignment (0 = wait-list, 1 = retreat) predicted changes in the proposed mediators: mindfulness and self-compassion (using difference scores). Consistent with results described above, the retreat condition predicted significant changes in self-compassion ( $b = 0.28$ ,  $SE = 0.12$ ,  $p = 0.024$ ), but not mindfulness ( $b = 0.23$ ,  $SE = 0.16$ ,  $p = 0.157$ ). Given that the conditions did not differ on one of the proposed mediators (mindfulness), the models presented below only examined whether changes in self-compassion mediated the relationship between condition and changes in emotional functioning and self-regulation.

Controlling for baseline differences, indirect effect analyses with 5000 bootstrapped samples indicated that changes in self-compassion mediated the association between condition and changes in emotional functioning. Specifically, participants in the retreat condition reported improvements in self-compassion that in turn predicted reductions in self-reported depression and perceived stress, and increases in positive affect and gratitude-related emotions. Changes in self-compassion also mediated the association between condition and changes in parent-reported positive affect. See Table 3 for full results.

3.7. Exploratory analysis: gender differences

In this first set of exploratory analyses, gender was tested as a moderator of the condition-by-time interaction effect. In total, 2 of a possible 15 interaction effects reached significance levels of  $p < 0.10$ . Gender moderated the condition-by-time interaction effect for parent-reported gratitude behaviors,  $F(2, 64) = 3.51$ ,  $p = 0.036$ . For boys in the retreat condition, there was a reduction in gratitude behaviors ( $-0.40$ ), whereas for boys in the wait-list condition, there was almost no change across time (0.04). For girls in the retreat condition, there was a slight increase in gratitude behaviors (0.13), whereas for girls in the wait-list condition, there was slight decrease ( $-0.14$ ).

Gender also moderated the condition-by-time interaction effect for self-reported positive affect,  $F(2, 64) = 3.02$ ,  $p = 0.056$ . For boys in the retreat condition, there was a substantial increase in positive affect (0.62), whereas for boys in the wait-list condition, there was a substantial decrease ( $-0.62$ ). On the other hand, girls in the retreat condition showed smaller increases in positive affect (0.29), whereas girls in the wait-list condition showed no change ( $-0.01$ ).

The three-way gender-by-condition-by-time interaction effect did not reach  $p < 0.10$  for any other outcome.

3.8. Exploratory analysis: changes in depression status

Though the current sample was not selected on the basis of pre-existing health conditions, baseline data suggest participants had elevated depressive symptoms prior to the retreat (see also Galla, 2016). Approximately 48% ( $n = 38$ ) of all participants scored 24 or higher on the depressive symptoms scale at baseline (observed range = 1 to 47,



**Table 3**  
Mediation via changes in self-reported self-compassion.

Outcome variables	Indirect effect	LCI	UCI
<b>Parent-report outcomes</b>			
Condition → self-compassion → self-control	0.03	− 0.063	0.196
Condition → self-compassion → negative affect	0.01	− 0.142	0.157
Condition → self-compassion → positive affect	<b>0.11</b>	<b>0.003</b>	<b>0.310</b>
Condition → self-compassion → gratitude (emotions)	0.03	− 0.102	0.239
Condition → self-compassion → gratitude (behaviors)	− 0.04	− 0.231	0.034
<b>Self-report outcomes</b>			
Condition → self-compassion → depression	− 2.11	− 5.589	− 0.240
Condition → self-compassion → negative affect	− 0.09	− 0.314	0.031
Condition → self-compassion → positive affect	<b>0.13</b>	<b>0.004</b>	<b>0.335</b>
Condition → self-compassion → gratitude	<b>0.17</b>	<b>0.023</b>	<b>0.446</b>
Condition → self-compassion → perceived stress	− 0.17	− 0.419	− 0.023
Condition → self-compassion → reactivity to feelings	− 0.08	− 0.259	0.006
Condition → self-compassion → temporal discounting	0.01	− 0.001	0.043

Notes:  $N_{\text{parent-report}} = 78$ ;  $N_{\text{self-report}} = 79$ . LCI and UCI = lower and upper 95% confidence intervals. Bolded indirect effects and confidence intervals are statistically significant (i.e., confidence intervals do not include zero). Models controlled for prior meditation experience, gender, and baseline self-reported gratitude.

possible range = 0 to 57). This cutoff value has sometimes been used to screen for depression in adolescents (Stockings et al., 2015). It is crucial to mention here that cutoff values can have high false positive rates in nonclinical settings (Stockings et al., 2015), so these values should not be taken as proof that participants in the study had clinical depression.

But, given these elevated levels of depressive symptoms, condition differences in the number of participants who scored 24 or higher both before and after the retreat were explored. To ensure comparable proportions across time, only participants with full data on depressive symptoms ( $n = 64$ ) were included in this analysis. At baseline, the two conditions did not differ on the percentage of participants scoring 24 or higher (retreat = 47%, wait-list = 50%),  $\chi^2(1) = 0.06$ ,  $p = 0.814$ . However, at post-test, the retreat condition had fewer participants with scores of 24 or higher compared to participants in the wait-list condition (retreat = 18%, wait-list = 43%),  $\chi^2(1) = 5.04$ ,  $p = 0.025$ .

#### 4. Discussion

Meditation training with early adolescents is linked to a variety of positive outcomes, from enhanced emotional functioning to increased self-regulation (Black, 2015). Yet far fewer studies have examined meditation training with middle and older adolescents, and in contexts other than schools and clinics. The current results indicate that a weeklong intensive, residential meditation retreat predicted emotional functioning, self-regulation, and cognitive functioning. Compared to a wait-list condition, adolescents who participated in a retreat showed greater improvement on emotional functioning (self-reported depressive symptoms, positive affect, gratitude), self-regulation (parent-reported self-control), and a performance measure of working memory. The current results also provide important theoretical clarity on the mechanisms underlying meditation training: Improvements in self-compassion partially accounted for the beneficial effects of the retreat on emotional functioning. Exploratory moderation analyses showed that, for the most part, girls and boys both benefited from the retreat. And compared to those in the wait-list condition, fewer adolescents in the retreat condition had depression scores possibly indicating clinical significance at post-test.

##### 4.1. Implications for meditation training research with adolescents

This study advances theory and research on meditation training for adolescents in several ways. First, this research suggests that residential retreats offer another context in which to investigate whether and how different styles of meditation training influence adolescent development. Though schools are major contexts for development (Eccles & Roeser, 2011), they are not the only ones. And given that

many adolescents report low autonomy and intrinsic motivation while in school (Larson, 2000), it is imperative to consider meditation training in other contexts that may be more supportive of these desires (Roeser & Eccles, 2015; Steinberg, 2015). Retreats may be especially promising for improving well-being in stressed adolescents who are not necessarily seeking treatment for mental illness in clinics, but who are interested in more rigorous meditation training outside of school settings.

Second, results showed that a weeklong, intensive meditation retreat produced effect size estimates comparable to other meditation programs that can span several months (Klingbeil et al., 2017; Zenner et al., 2014; Zoogman et al., 2014). Across all outcome measures, the current data showed a small-to-medium effect size estimate,  $d = 0.38$ . Within the specific outcome domains, a small-to-medium effect was observed for changes in mindfulness and self-compassion ( $d = 0.41$ ), emotional functioning ( $d = 0.43$ ), and working memory ( $d = 0.47$ ), and a small effect for self-regulation ( $d = 0.21$ ). Apart from self-regulation, these effect size estimates suggest practically meaningful changes in mindfulness, self-compassion, emotional functioning, and working memory were observed for adolescents who participated in a retreat (Cohen, 1988).

Third, the current study advances our understanding of the mechanisms linking meditation training to enhanced emotional functioning. Specifically, adolescents who participated in a retreat showed increases in self-compassion, which in turn resulted in decreases in depression and perceived stress, and increases in positive affect and gratitude. Though it may run counter to conventional notions of “mindfulness” training, adolescents in the retreat condition did not show improvements in mindfulness relative to adolescents in the wait-list condition. This study thus replicates results from a prior study of intensive meditation training for adolescents in which changes in self-compassion predicted well-being more consistently than changes in mindfulness (Galla, 2016). But, these results run counter to several other studies suggesting that changes in mindfulness may be an important factor linking meditation training with positive outcomes (Bluth, Gaylord, et al., 2016; Bluth & Eisenlohr-Moul, 2017; Bögels et al., 2008; Brown et al., 2011).

Why would changes in self-compassion predict improvement in such a variety of outcomes? It is possible that the positive mindsets instilled through self-compassion, including self-kindness, emotional equanimity, and a sense of common humanity, are more direct remedies for the major pressures middle adolescents face (e.g., negative social evaluation) and the suffering tied to those pressures (e.g., depression). For example, teens who silently worry they are the only ones who struggle with doubts about themselves or with social exclusion may benefit from the realization that most people their age suffer in similar ways, that

they are not alone. Likewise, for teens inclined to participate in a meditation retreat—who appear more depressed and stressed than the typical adolescent (Galla, 2016)—learning to bring kindhearted attitudes and a sense of shared humanity to everyday difficulties may be especially helpful for instilling an inner sense of resilience and well-being. Of course, this is not to dismiss the value of cultivating mindfulness. But, the results suggest that a reliance on mindfulness measures as a mechanism of change may miss information about other mental qualities targeted during meditation training that enhance well-being.

#### 4.2. Gender differences

Exploratory moderation analyses indicated that the association between retreat participation and beneficial outcomes varied minimally by gender. First, the retreat was more beneficial for girls with regard to parent-reported gratitude-related behaviors (e.g., saying “thank you”). Among boys who participated in the retreat, there was a decrease in behavioral expressions of gratitude, whereas for girls in the retreat there was a slight increase. Second, the retreat predicted more substantial improvements in self-reported positive affect for boys compared to girls. Despite these two differential responses, a majority of moderation tests (13 of 15) revealed no statistically reliable differences in the effectiveness of the retreat for boys versus girls. These data therefore largely replicate results of a prior retreat study (Galla, 2016), and suggest further that both boys and girls can benefit from participating in intensive periods of meditation practice. Of course, it is possible that the study was underpowered to detect statistically reliable three-way interactions, so future research is required to confirm these exploratory results before generalizing beyond the current sample.

#### 4.3. Differential effectiveness of the retreat on outcome measures

The dependent measures used in this study were selected based on their theoretical relations to meditation training and on prior research. Though gains were observed across a range of parent-report and self-report measures (e.g., depression, self-compassion, self-control) and working memory, improvement was not observed on all measures. The lack of improvement on self-reported self-regulation (temporal discounting, reflexive reaction to feelings) was surprising, especially in light of other studies with adolescents demonstrating a positive effect of meditation training on impulsivity and effortful control (Ghahremani et al., 2013; Terjestam et al., 2016). This is likely not just a measurement issue: Galla (2016) documented sustained improvement on a measure of mindful non-reactivity (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), which shares features of the reflexive reactivity to feelings scale used in the current study. Moreover, improvements for teens in the retreat condition were observed on parent-reported measures of self-control, so it appears that meditation training did have some impact on self-regulation.

One explanation for the null results on temporal discounting may have to do with measurement specificity. In one recent study, participating in a short (50-minute) mindful-eating workshop reduced impulsive food choices among obese adolescents, but had no effect on impulsive money choices (Hendrickson & Rasmussen, 2017). Insofar as most impulsive choices are domain-specific (Tsukayama, Duckworth, & Kim, 2012), it is possible that meditation training may need to be adapted for specific self-regulatory problems (e.g., cigarette smoking, Elwafi, Witkiewitz, Mallik, Thornhill, & Brewer, 2012). Future research is needed to clarify what aspects of self-regulation are influenced through intensive meditation retreats.

Another unexpected finding was the lack of a significant condition difference in mindfulness (despite a meaningful condition-by-time effect size,  $d = 0.32$ ). Given that a majority of the sample had some type of prior meditation experience, it is possible that ceiling effects prevented further increases in mindfulness. The data, however, do not

entirely support this hypothesis. First, the current sample's baseline mean (3.86, range = 1 to 6) and standard deviation (0.75) were comparable to the means and standard deviations in other samples of non-meditating adolescents (e.g., Brown et al., 2011). Second, mindfulness *did* increase significantly from baseline to post-test within the retreat condition, whereas it did not in the wait-list condition, suggesting that sample size, not ceiling effects contributed to the lack of statistically reliable group differences.

#### 4.4. Strengths, limitations, and future directions

This field study represents a methodological advance over a prior study of meditation retreats for adolescents (Galla, 2016). The inclusion of a comparison group from the same population of adolescents interested in meditation retreats provides confidence in the conclusion that the retreat—and not extraneous factors unrelated to meditation—contributed to improvements in outcomes. Observed gains on parent-report questionnaires and working memory also show that the benefits of the retreat can extend beyond self-report assessments.

Despite its strengths, the current study has limitations that suggest directions for future research. Randomly assigning adolescents to condition (retreat vs. wait-list) was not feasible, so threats to internal validity remain. Likewise, the lack of randomization precludes causal inferences regarding the effect of the retreat on different outcomes. The fact that the two conditions were mostly equivalent at baseline helps rule out obvious threats to validity, although of course, conditions may have differed in consequential, but unobserved ways. Limitations of these methods notwithstanding, it is important to note here that quasi-experimental designs are the norm for research examining the benefits of long-term and intensive meditation training with adult samples (e.g., Jha, Krompinger, & Baime, 2007; Perlman, Salomons, Davidson, & Lutz, 2010; Slagter et al., 2007), and for many studies involving meditation training programs for adolescents (Black, 2015). And consistent with other early-phase trials of meditation training with adolescents (Biegel et al., 2009; Butzer et al., 2016), no corrections were made for multiple comparisons. This decision was made because the purpose of this study was to test general hypotheses about the potential benefits of intensive meditation training for adolescents across a range of outcomes. Future research might focus more narrowly on outcomes related to emotional functioning, including depression, gratitude, and positive affect, since the retreat had a particularly robust contribution to improvement on these measures.

Because this study operated under a relatively narrow summer-schedule window, follow-up assessments were not possible. Consequently, no conclusions about the enduring benefit of the retreat can be determined. Though one prior study suggests benefits can last at least three months after a retreat (Galla, 2016), where feasible, future research should include follow-up assessments.

And finally, many adolescents who participated in this study had prior meditation and retreat experience (and presumably, an interest in meditation) and elevated levels of depression. As with many studies of meditation training with adolescents, caution is therefore warranted in generalizing these findings to all adolescents. Future studies are required to determine whether similar results would be obtained in samples of adolescents without any meditation experience or elevated depressive symptoms. Despite limits to broad generalizability, it is important to weigh these limitations against the important theoretical advances that are possible by studying intensive meditation retreats. For example, this study showed that a weeklong training produced comparable effect sizes to those observed after months of training in schools and clinics (Zenner et al., 2014; Zoogman et al., 2014). Given the intensive nature of the meditation training, retreats provide additional opportunities to probe *how* (not just *whether*) meditation training can support psychological well-being in adolescents.

## 5. Conclusion

Whereas many adolescents might look to the outside world for happiness, meaning, and support, it is clear that adolescents can also voluntarily turn inward to find such experiences within themselves. The current field study provides an unprecedented look into one context—residential meditation retreats—that may support these efforts during adolescence, a critical period of social-emotional development.

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## Appendix A. Supplemental Analyses

Supplementary analyses to this article can be found online at <https://doi.org/10.1016/j.appdev.2017.09.006>.

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