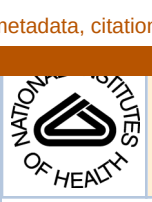

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Open Hearts Build Lives: Positive Emotions, Induced Through Loving-Kindness Meditation, Build Consequential Personal Resources

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Abstract

B. L. Fredrickson's (1998, 2001) broaden-and-build theory of positive emotions asserts that people's daily experiences of positive emotions compound over time to build a variety of consequential personal resources. The authors tested this *build hypothesis* in a field experiment with working adults (n = 139), half of whom were randomly-assigned to begin a practice of loving-kindness meditation. Results showed that this meditation practice produced increases over time in daily experiences of positive emotions, which, in turn, produced increases in a wide range of personal resources (e.g., increased mindfulness, purpose in life, social support, decreased illness symptoms). In turn, these increments in personal resources predicted increased life satisfaction and reduced depressive symptoms. Discussion centers on how positive emotions are the mechanism of change for the type of mind-training practice studied here and how loving-kindness meditation is an intervention strategy that produces positive emotions in a way that outpaces the *hedonic treadmill* effect.

Keywords

emotions; meditation; positive psychology; broaden-and-build; mindfulness

A paradox surrounds positive emotions. On one hand, they are fleeting: Like any emotional state, feelings of joy, gratitude, interest, and contentment typically last only a matter of minutes. Moreover, positive emotions are less intense and less attention-grabbing than negative emotions (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001) and are more diffuse (Ellsworth & Smith, 1988). Yet on the other hand, research indicates that positive emotions contribute to important downstream life outcomes, including friendship development (Waugh & Fredrickson, 2006), marital satisfaction (Harker & Keltner, 2001),

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higher incomes (Diener, Nickerson, Lucus, & Sandvik, 2002), and better physical health (Doyle, Gentile, & Cohen, 2006; Richman et al., 2005). People who experience frequent positive emotions have even been shown to live longer (Danner, Snowdon, & Friesen, 2001; Moskowitz, 2003; Ostir, Markides, Black, & Goodwin, 2000). Indeed, a recent meta-analysis of nearly 300 findings concluded that positive emotions produce success and health as much as they reflect these good outcomes (Lyubomirsky, King, & Diener, 2005).

How do they do this? How do people's fleeting and subtle pleasant states pave the way to their later success, health, and longevity? Fredrickson's (1998) broaden-and-build theory of positive emotions outlines a possible path: Because positive emotions arise in response to diffuse opportunities, rather than narrowly-focused threats, positive emotions momentarily broaden people's attention and thinking, enabling them to draw on higher-level connections and a wider-than-usual range of percepts or ideas. In turn, these broadened outlooks often help people to discover and build consequential personal resources. These resources can be *cognitive*, like the ability to mindfully attend to the present moment; *psychological*, like the ability to maintain a sense of mastery over environmental challenges; *social*, like the ability to give and receive emotional support; or *physical*, like the ability to ward off the common cold. People with these resources are more likely to effectively meet life's challenges and take advantage of its opportunities, becoming successful, healthy, and happy in the months and years to come. Thus, the personal resources accrued, often unintentionally, through frequent experiences of positive emotions are posited to be keys to later increases in well-being. Put simply, the broaden-and-build theory states that positive emotions widen people's outlooks in ways that, little by little, reshape who they are.

The key hypotheses of the broaden-and-build theory have received empirical support from multiple laboratories. First, the *broaden hypothesis* holds that positive emotions broaden people's attention and thinking. Experiments have shown that, relative to neutral and negative states, induced positive emotions widen the scope of people's visual attention (Fredrickson & Branigan, 2005; Rowe, Hirsh, & Anderson, 2007; Wadlinger & Isaacowitz, 2006), broaden their repertoires of desired actions (Fredrickson & Branigan, 2005), and increase their openness to new experiences (Kahn & Isen, 1993) and critical feedback (Raghunathan & Trope, 2002). At the interpersonal level, induced positive emotions increase people's sense of "oneness" with close others (Hejmadi, Waugh, Otake, & Fredrickson, 2008), their trust in acquaintances (Dunn & Schweitzer, 2005), and their ability to accurately recognize individuals of another race (Johnson & Fredrickson, 2005). The empirical evidence is mounting, then, that positive emotions broaden people's attention and thinking in both personal and interpersonal domains.

The second part of the theory, the *build hypothesis*, holds that positive emotions set people on trajectories of growth that, over time, build consequential personal resources. To date, the empirical evidence for the build hypothesis has been largely indirect. Prospective correlational studies have shown that people who, for whatever reasons, experience or express positive emotions more than others show increases over time in optimism and tranquility (Fredrickson, Tugade, Waugh, & Larkin, 2003), ego-resilience (Cohn, Fredrickson, Brown, Mikels, & Conway, 2008), mental health (Stein, Folkman, Trabasso, & Richards, 1997), and the quality of their close relationships (Gable, Gonzaga, & Strachman, 2006; Waugh & Fredrickson, 2006).

Here we present the first experimental evidence that directly tests the build hypothesis. Such research has been virtually nonexistent (but see Emmons & McCullough, 2003; King, 2001), largely because resources are expected to accrue only after many experiences of positive emotions over separate occasions, which necessitates a longitudinal design as well as a reliable, repeatable method for evoking positive emotions. The well-documented *hedonic*

treadmill effect (Diener, Lucas, & Scollon, 2006) assures that emotion-elicitation techniques used with success in the laboratory (e.g., film clips, gifts of candy) would likely become inert if repeated daily. As the novelty of an experience subsides, people's emotions tend to revert to a trait-like baseline. In this study, we sought to overcome this challenge by using an induction based on meditation.

We suspected that meditation would outpace the hedonic treadmill for several reasons. First, it incorporates mindful attention, which has been shown to undo hedonic adaptation (Schwarz, Kahneman, & Xu, in press). Second, unlike watching a film or receiving a gift, meditation practice is active and personalized. Participants can lengthen the meditation, alter their focus, or otherwise try to get more out of their practice, keeping it within a range that is feasible but not boring. Most important, participants can use the insights and psychological skills developed during meditation practice in many situations and life domains. Meditation, then, offers opportunities for enhanced emotions throughout the day, not simply during meditations, per se.

Meditation and mindfulness, which are perhaps best known as elements of Buddhist spiritual practice, have also proven to be fruitful topics within empirical research on well-being (Baer, 2003; Kabat-Zinn, 2003; Segal, Williams, & Teasdale, 2002; Wallace & Shapiro, 2006). For instance, for more than 2 decades, Kabat-Zinn and colleagues have reported evidence that meditation helps people self-regulate stress, anxiety, chronic pain, and various illnesses (for a review, see Kabat-Zinn, 2003). Building on the observation that when formerly depressed individuals see their thoughts and emotions from a wider perspective, they are more resistant to relapse, Teasdale et al. (2000) developed a successful therapy that combines mindfulness meditation with cognitive therapy.

More recently, Kabat-Zinn collaborated with Davidson et al. (2003) to examine the affective, brain, and immunological effects of beginning a meditation practice. Volunteers were randomly assigned to either a waitlist control group ($n = 16$) or an 8-week mindfulness-based stress-reduction workshop ($n = 25$), which required a daily practice of guided meditation lasting about 1 hr. As in past studies, trait anxiety was significantly reduced in the meditation group. Both immediately after the training period and 4 months later, electroencephalogram monitoring revealed that meditators showed increases in left-sided anterior brain activation, which has been repeatedly linked to greater positive, approach-related emotions (for a review, see Davidson, 2000). Meditators also showed a more robust and effective immune response to an influenza vaccine administered at the end of the training period, and the strength of this response was correlated with the magnitude of left-sided anterior brain activation. The suggestion that meditation practice increases positive affect is also supported by at least one experience sampling study (Easterlin & Cardeña, 1998).

Most empirical work on meditation has centered on mindfulness meditation (e.g., Davidson et al., 2003; Teasdale et al., 2000). Because we were particularly interested in evoking positive emotions, we employed a related mind-training practice, loving-kindness meditation (LKM). LKM is a technique used to increase feelings of warmth and caring for self and others (Salzberg, 1995). Like other meditation practices, LKM involves quiet contemplation in a seated posture, often with eyes closed and an initial focus on the breath. Yet whereas mindfulness meditation involves training one's attention toward the present moment in an open-minded (nonjudgmental) way, LKM involves directing one's emotions toward warm and tender feelings in an open-hearted way. Individuals are first asked to focus on their heart region and contemplate a person for whom they already feel warm and tender feelings (e.g., their child, a close loved one). They are then asked to extend these warm feelings first to themselves and then to an ever-widening circle of others. Thus, LKM may well cultivate

broadened attention in addition to positive emotions. According to the broaden-and-build theory, these two experiential consequences go hand in hand.

In LKM, people cultivate the intention to experience positive emotions during the meditation itself, as well as in their life more generally. Moreover, mind-training practices like LKM are thought to not only shift people's fleeting emotional states but also reshape their enduring personality traits (Davidson et al., 2003), a coupling of momentary with long-term gains fully compatible with the broaden-and-build theory. We acknowledge that mind-training practices, including LKM, are not simply vehicles for improving emotion experiences. The primary goal within contemplative traditions is, instead, to learn about the nature of one's mind and dispel false assumptions about the sources of one's happiness (Dalai Lama & Cutler, 1998). These insights can, in turn, shift people's basic outlooks on themselves in relation to others, increasing empathy and compassion. Approaching daily life with the new insights and outlooks developed through mind-training practice is what is thought to enhance people's emotion experiences. That said, the goal of the present study was to test the build hypothesis, which required a means of reliably eliciting positive emotions over the span of months. We saw LKM as a suitable vehicle to meet this goal. Future empirical work is needed to test whether the cognitive shifts outlined by scholars of contemplative practices are indeed responsible for any success LKM has in enhancing positive emotions.

LKM involves a range of thoughts and visualizations, and it directly evokes only select positive emotions (i.e., love, contentment, and compassion) and carries some potential to evoke negative emotions. Moreover, given the possibility of gradual shifts in people's outlooks and personality traits, we expected the positive emotions generated by LKM to increase over time. Our study involved daily assessments of time spent meditating and of a wide range of discrete positive and negative emotions. This strategy allowed us to determine whether (a) positive emotions, measured directly, are responsible for any changes produced by LKM; (b) different classes of positive emotions (low- vs. high-arousal, e.g., contentment vs. amusement; or self- vs. other-focused, e.g., pride vs. love) are differentially induced by this practice; and (c) the effects of LKM on positive emotions increase (because of practice) or decrease (because of adaptation) over time.

We are aware of only one other field experiment that has tested the effects of LKM. Carson et al. (2005) compared a group of chronic pain patients who were taught LKM (n = 18) with a group receiving standard care (n = 25). Results from this pilot trial indicated that LKM reduced pain, anger, and psychological distress. The present study tests LKM in a larger sample, with a wider variety of outcome measures. Most critically, it gathers detailed data on positive emotions as a potential mediator of the benefits of this form of meditation.

Overview of Empirical Strategy

We conducted a randomized, longitudinal field experiment to test whether positive emotions, induced through LKM, build consequential personal resources. In designing our experiment, we grappled with selecting the most appropriate comparison condition. In laboratory research, we have used sham meditation (i.e., sitting with eyes closed) to achieve precise experimental control. For a 7-week intervention that asked participants for a substantial investment of time and effort, both ethical and face-validity concerns led us away from this sort of placebo meditation. Another approach is to choose a comparison condition that best addresses the current state of knowledge in a given area. Our review of the scientific literature had uncovered no published evidence that LKM could produce sustained increases in positive emotions and only limited and indirect evidence that positive emotions could build personal resources. Given this embryonic state of evidence, an appropriate initial

comparison group would reflect treatment as usual, which, outside the clinical literature, is perhaps better phrased as life as usual. Thus, we chose a waitlist control design, which can assess treatment efficacy while controlling for self-selection, history, maturation, regression to the mean, and the effects of repeated testing (Chambless & Hollon, 1998; Kazdin, 2003). Although the groups differ in terms of experimenter demand, delivery format, and expectation of improvement, we address these limitations procedurally and analytically to the extent possible (see Discussion).

In the context of a workplace wellness program, we offered a 7-week meditation workshop to employees interested in stress reduction and willing to respond to questionnaires and provide daily, web-based reports of their emotions. All volunteers completed an initial survey that assessed their life satisfaction, depressive symptoms, and status on a range of personal resources. Volunteers were then randomly assigned to either our meditation workshop or a waitlist control group (which received the same workshop after the study ended). Over the next 9 weeks (including 1 week before and after the workshop), participants in both groups completed daily reports of their emotion experiences and meditation practice. About 2 weeks after the workshop ended, participants completed a final survey that reassessed their life satisfaction, depressive symptoms, and status on the same personal resources measured previously.

In addition to daily reports of emotion experiences, which may well underestimate the frequency of emotion experiences, at the time of the final survey, participants also completed a detailed account of the emotions they experienced that particular day using the day reconstruction method (DRM; Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). The DRM is a survey method that builds on the strengths of two older methods: time-use assessment and momentary data capture (i.e., experience sampling). Like each of these earlier methods, the DRM minimizes recall biases and provides a comprehensive picture of daily experience. Participants first reconstruct a detailed diary of “this morning” by dividing it into sequences of episodes. Next, they complete a series of questions, including emotion reports, for each episode of their morning.

We predicted that participation in the 7-week LKM workshop would increase individuals’ daily experiences of positive emotions, over time across the 9 weeks of daily reporting and within the specific morning targeted by the DRM. Drawing from the broaden-and-build theory, we further predicted that increases in positive emotions, produced by LKM, would, in turn, build participants’ personal resources. To test the generality of the build effect of positive emotions, we targeted a wide range of personal resources, including cognitive resources (e.g., mindfulness, the ability to savor positive experiences), psychological resources (e.g., ego-resilience, environmental mastery), social resources (e.g., positive relations with others, social support given and received), and physical resources (e.g., illness symptoms, duration of sleep). Finally, we investigated whether these resources actually made a difference in participants’ lives. To do so, we tested whether any increments in resources, in turn, contributed to changes in overall life satisfaction, a judgment of fulfillment and well-being that differs from positive affectivity in its global focus and cognitive emphasis (Lucas, Diener, & Suh, 1996). As a secondary way to assess whether newly built resources were consequential, we tested whether they led to decreases in depressive symptoms. We distill this series of predictions into the following overarching mediational hypothesis:

> *Hypothesis:* Becoming skilled in LKM will, over time, increase people’s daily experiences of positive emotions, which, in turn, build a variety of personal resources that hold positive consequences for the person’s mental health and overall life satisfaction.

Figure 1 portrays the conceptual model that underlies the build hypothesis as we tested it here. Note that this study does not directly assess momentary changes in broadened cognition, because of the lack of valid measures that could be used repeatedly and in the field, nor does it directly assess the cognitive shifts produced by LKM that trigger positive emotions. As such, this study evaluates positive emotions as a mechanism for the effects of LKM but does not further decompose the mechanisms by which LKM and positive emotions exert their influence.

Method

Participants

The study was conducted at the Compuware Corporation, a large business software and information technology services company in Detroit, Michigan. All full-time employees working at Compuware's Detroit headquarters (approximately 1,800 individuals, 38% female, 34% ethnic minorities) received an e-mail message from Compuware executives inviting them to participate in the study.[1] The study was described as a scientific investigation of "the benefits of meditation… [to] reduce stress." The e-mail included a link to a website where employees could learn more about the project. The information made clear that the study was being conducted by university researchers, that the results would be confidential, and that the choice of whether to participate would not affect their standing with their employer.

Two hundred two Compuware employees attended the study orientation, gave their consent, and completed the initial survey. Of these, 102 were assigned to the LKM group and 100 were assigned to the waitlist control group. Participants were excluded from analyses for the following reasons: (a) They violated random assignment ($n = 7$), (b) they failed to complete Time 2 measures ($n = 27$), (c) they were assigned to the meditation condition but attended fewer than three of the six weekly classes ($n = 5$), or (d) they completed fewer than 30 of the 61 daily reports ($n = 24$). In total, 63 participants were excluded, 34 from the LKM group and 29 from the waitlist group. Attrition and disqualification affected the LKM and waitlist groups equally, $\chi^2(1, N = 202) = 0.4$, $p = .51$, and was comparable with other studies on meditation (Carson et al., 2005; Davidson et al., 2003; Teasdale et al., 2000). The final sample, then, consisted of 139 participants, 67 of whom were in the LKM group and 72 of whom were in the waitlist control group.

Demographic information is presented in Table 1. The compositions of the initial and completer samples were similar: Most participants were female, most had bachelor's or master's degrees, and the average age was 41 years ($SD = 9.6$). The completer sample was 65.5% female, 73.7% White, 9.5% Black, 8.8% South Asian, 6.6% East Asian, 0.7% Hawaiian/Pacific Islander, and 0.7% Hispanic. Male participants were disproportionately lost to attrition and disqualification, $\chi^2(1, N = 180) = 10.9$, $p = .001$. There was also a trend towards loss of married participants, $\chi^2(1, N = 178) = 3.2$, $p = .07$. These groups, however, were lost equally between conditions (waitlist = 64% female, meditators = 67% female), $\chi^2(1, N = 139) = .17$, $p = .69$, (waitlist = 56% married, meditators = 60% married), $\chi^2(1, N = 137) = .22$, $p = .67$, implying that married and male participant attrition related to the study in general and not to LKM. Otherwise, the initial and completer samples did not differ on demographic characteristics, condition assignment, or depression and life-satisfaction scores ($p > .24$). Four participants in the completer sample had a meditation practice at the start of

[1]The population was limited to those Compuware employees with a Compuware e-mail address. This included executives, developers, and administrators, but not maintenance workers or cleaning staff.

the study. Although these participants were higher than others on positive emotions throughout the study, removing their data did not alter the pattern of findings reported here.

In addition to providing access to the participant pool, Compuware supported this study in multiple ways. All study orientation meetings and meditation workshop sessions were held during business hours at Compuware's Detroit office. The meditation workshops were offered free of charge to all interested employees. Compuware also provided employee release time so that participants could attend a study orientation meeting, six meditation workshop sessions, and complete all web surveys during work time, without loss of compensation.

Participants received monetary compensation for time spent on study measures. They received $10 for completing the initial survey, $20 for completing the final survey, and $1 for each daily report. In addition, participants who completed daily reports for at least 40 of the 61 days received a $10 bonus and a copy of a popular book on meditation by Jon Kabat-Zinn (valued at $24.95). The total possible payment for the study was $101, plus the book.

Procedure

All study orientation sessions were held during employees' lunch hour, in a large auditorium on Compuware premises. At orientation, Barbara L. Fredrickson or Michael A. Cohn introduced interested employees to the rationale for investigating the effects of meditation on health and well-being. We sought to enhance prospective participants' investment in the study by describing benefits of meditation already featured in the popular press and regularly used to draw attendees to comparable workplace wellness courses, specifically, the potential to reduce stress and improve health and well-being. We also described the timeline of the study and the details of compensation and explained the value of gathering data from a waitlist control group. We did not describe LKM, the broaden-and-build theory, our hypotheses regarding mediation by daily positive emotions, or other information that might have created detailed expectancy or demand effects. Those who could not attend an orientation session received information by phone.

Within the week following orientation, interested employees logged on to a secure website, gave consent to participate in the study, and responded to the initial (T1) survey (described below). Participants learned their group assignment (meditation workshop or waitlist control) only after completing the T1 survey.

The daily reporting phase of the study began 1 week following orientation and continued for approximately 9 weeks. Each day, participants visited our secure website to complete a short report on their emotions and time spent in "meditation, prayer, or solo spiritual activity" over the past day. After approximately 1 week of baseline reporting, workshop classes and daily practice began for the meditation group (described below). Daily reporting continued for approximately 1 week after the meditation workshop ended.

After the daily reporting phase ended, the final (T2) survey became available online. Participants visited our website a final time and completed the same measures as at T1, followed by a day reconstruction (described below) and a demographics questionnaire. After data collection was completed, participants received debriefing information explaining more about the details of the study.[2] Approximately 2 months later, meditation classes began for the waitlist control group. No further data were collected at that time.

[2]We contacted participants who did not complete the T2 survey to request demographic information and to make the debriefing information available.

The websites for the initial questionnaires and the daily reports were available around the clock. The final survey was available only between noon and 2:00 a.m., because of the specifics of the DRM. Although participants were encouraged to complete the surveys at work, they were asked to practice meditation at home. Participants who missed more than three consecutive weekday report forms, or who did not fill out the final survey, received an automated e-mail reminder asking them to visit our website. The study team did not otherwise initiate contact with participants.

LKM Workshops—The meditation training involved six 60-minute group sessions (held over 7 weeks, because of religious holidays) with 20–30 participants per group. All sessions were led by a stress-management specialist (Sandra M. Finkel) with extensive experience practicing and teaching LKM. The median number of sessions attended was five (M = 4.3, SD = 1.8). At the first session, participants were given a CD that included three guided meditations of increasing scope, led by the workshop instructor. During Week 1, participants practiced a meditation directing love and compassion toward themselves. During Week 2, the meditation added loved ones. During subsequent weeks, the meditation built from self, to loved ones, to acquaintances, to strangers, and finally, to all living beings. The first meditation lasted 15 min, and the final one lasted 22 min.

Each workshop session included 15–20 min for a group meditation, 20 min to check on participants' progress and answer questions, and 20 min for a didactic presentation about features of the meditation and how to integrate concepts from the workshop into one's daily life. Participants were assigned to practice LKM at home, at least 5 days per week, with the guided recordings. The text of the guided meditations and week-by-week content outlines are available by request from Sandra M. Finkel.[3]

Measures

Cognitive Resources: T1 and T2

Mindfulness and Awareness Scale: The Mindfulness and Awareness Scale (Brown & Ryan, 2003) assesses awareness of one's circumstances, as well as tendencies towards automated, "mindless" behavior or acting on "autopilot." Participants indicate the frequency of 15 behaviors on a 6-point scale (1 = *almost always*, 6 = *almost never*). Items include "I snack without being aware of what I am eating" and "I could be experiencing some emotion and not be conscious of it until some time later." All items are reverse-scored. (α_{T1} = .86, α_{T2} = .89).

Agency thinking and pathways thinking: We used the Trait Hope Scale (Snyder et al., 1991; Snyder, Rand, & Sigmon, 2002) to assess these two cognitive components of Snyder's hope theory. Participants use a 4-point scale to indicate agreement or disagreement (1 = *definitely false*, 4 = *definitely true*) with 10 items divided between two subscales: agency thinking (belief that one has been/will be personally able to achieve one's goals), including "I meet the goals I set for myself" (α_{T1} = .84, α_{T2} = .81), and pathways thinking (belief that there are multiple ways to achieve one's goals), including "There are lots of ways around any problem" (α_{T1} = .84, α_{T2} = .83).

Savoring Beliefs Inventory: The Savoring Beliefs Inventory (Bryant, 2003) assesses one's tendency to enjoy pleasant experiences in the moment (savoring the present), pleasurably anticipate them beforehand (savoring the future), and pleasurably recall them afterward (savoring the past). Participants indicate agreement on a 7-point scale with 24 items, including "It's easy for me to rekindle the joy from pleasant memories" and "When I think

[3]Sandra M. Finkel can be reached by e-mail at smfinkel@med.umich.edu

about a pleasant event before it happens, I often start to feel uneasy or uncomfortable" (reverse scored; savoring the past, $\alpha_{T1} = .88$, $\alpha_{T2} = .92$; savoring the present, $\alpha_{T1} = .88$, $\alpha_{T2} = .89$; savoring the future, $\alpha_{T1} = .87$, $\alpha_{T2} = .91$).

Psychological Resources: T1 and T2

Life Orientation Test: The Life Orientation Test—Revised (Scheier, Carver, & Bridges, 1994) is a 6-item scale that assesses generalized *optimism* as the belief that positive things are possible in the future. Participants indicate agreement or disagreement on a 5-point scale (1 = *I agree a lot*, 5 = *I disagree a lot*) with 10 statements (4 items are fillers), including "In uncertain times, I usually expect the best" and "If something can go wrong for me, it will" (reverse scored; $\alpha_{T1} = .82$, $\alpha_{T2} = .79$).

Ego-resilience: The ego-resilience measure (Block & Kremen, 1996) assesses the ability to bounce back from adversity and flexibly adapt to shifting demands. Participants indicate agreement or disagreement on a 4-point scale with 14 items, including "I quickly get over and recover from being startled" and "I like to do new and different things" ($\alpha_{T1} = .73$, $\alpha_{T2} = .74$).

Psychological well-being: We measured five additional psychological resources using subscales of Ryff's (1989) broader psychological well-being measure. Participants indicate agreement on a 6-point scale (1 = *strongly disagree*, 6 = *strongly agree*) with seven to eight items for each of the following five subscales: personal growth, with items like "For me, life has been a continuous process of learning, changing, and growth" ($\alpha_{T1} = .76$, $\alpha_{T2} = .80$); environmental mastery, with items like "I often feel overwhelmed by my responsibilities" (reverse scored; $\alpha_{T1} = .78$, $\alpha_{T2} = .80$); autonomy, with items like "I am not afraid to voice my opinions, even when they are in opposition to the opinions of most people" ($\alpha_{T1} = .72$, $\alpha_{T2} = .77$); self-acceptance, with items like "I like most parts of my personality" ($\alpha_{T1} = .88$, $\alpha_{T2} = .86$); and purpose in life, with items like "My daily activities often seem trivial and unimportant to me" (reverse scored; $\alpha_{T1} = .80$, $\alpha_{T2} = .80$).

Social Resources: T1 and T2

Dyadic Adjustment Scale: The Dyadic Adjustment Scale (Spanier, 1976) measures social support as the amount of emotional support the participant provides to and receives from close others. Using a 5-point scale (0 = *not at all*, 4 = *an extreme amount*), participants respond to questions, including "On the whole, how much do your friends and relatives make you feel loved and cared for?" and "If one of your close friends got sick or were injured in a car accident, how much could they count on you to take care of them?" Items are divided into subscales for social support given ($\alpha_{T1} = .81$, $\alpha_{T2} = .81$) and social support received ($\alpha_{T1} = .83$, $\alpha_{T2} = .83$).

Positive relations with others: Our third index of social resources was drawn from Ryff's (1989) psychological well-being scale (see above). The 7-item subscale includes items like, "I know that I can trust my friends, and they know they can trust me" and "I often feel lonely because I have few close friends with whom to share my concerns" (reverse scored; $\alpha_{T1} = .81$, $\alpha_{T2} = .81$).

Physical Resources: T1 and T2

Illness symptoms: This self-report measure assesses 13 common symptoms of illness or poor health, including headaches, chest pain, congestion, and weakness (Elliot & Sheldon, 1998). Participants use a 7-point scale to rate the frequency of each symptom over the past month (1 = *not at all*, 7 = *very frequently*; $\alpha_{T1} = .82$, $\alpha_{T2} = .84$).

Sleep duration: This single item, extracted from the Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989), asks participants to respond to the question "During the past month, how many hours of actual sleep did you get at night?"

Outcome Measures: T1 and T2

Satisfaction with life scale: We assessed cognitive evaluations of life satisfaction with this five-item scale (Diener, Emmons, Larsen, & Griffin, 1985). It assesses participants' global satisfaction with their lives and circumstances. Participants indicate agreement with each item on a 7-point scale, including "So far I have gotten the important things I want in life" ($\alpha_{T1} = .88$, $\alpha_{T2} = .90$).

Center for Epidemiological Studies—Depression Measure: We assessed depressive symptoms with the Center for Epidemiological Studies—Depression Measure (Radloff, 1977). We excluded the four positively worded items to minimize conceptual overlap with positive emotions (see Moskowitz, 2003; Ostir et al., 2000). On a 5-point scale, participants indicated how often they had felt symptoms of depression in the past week (0 = *never*, 4 = *most of the time*), including "I felt that I could not shake off the blues even with help from my family or friends" ($\alpha_{T1} = .86$, $\alpha_{T2} = .88$).

Emotions and Meditation Practice: Daily Assessments—During daily reports, participants completed the Modified Differential Emotions Scale (mDES; Fredrickson et al., 2003). The mDES asks participants to recall the past 24 hr and rate their strongest experience of each of 19 specific emotions on a 4-point scale (0 = *not at all*, 4 = *extremely*). The emotions listed were amusement, anger, awe, compassion, contempt, contentment, disgust, embarrassment, gratitude, hope, joy, interest, love, pride, guilt, sadness, shame, fear, and surprise. Participants also reported whether they had engaged in "meditation, prayer, or solo spiritual activity" since the last time they filled out the survey (not necessarily the same 24-hr time span as mDES responses). Both meditation and waitlist participants responded to these questions.

DRM: T2—We used the DRM (Kahneman et al., 2004) to assess participants' time-varying emotion experiences during a specific day. Because of time constraints, we limited our assessment to the morning of the targeted day. We asked participants to divide their morning —from the time they awoke until they completed lunch—into a continuous series of episodes and to provide a descriptive label for each episode. We allowed a maximum of 10 episodes. Thereafter, participants revisited each labeled episode to provide ratings from 0 (*not at all*) to 4 (*extremely*) for the emotion adjectives from the mDES, as described above (Fredrickson et al., 2003). For each episode, participants were also asked "What were you doing?" followed by a checklist of several activities that included "praying/worshiping/ meditating." They also responded "yes" or "no" to the question, "Were you interacting with anyone (including on the phone, in a teleconference, etc)?"

Results

Overview of Data Analytic Strategy

Given the complexity of the data set, we performed a range of analyses, which we forecast here.[4] As a manipulation check, we used *t* tests to confirm that participants in the LKM

[4]Preliminary analyses incorporated sex of participant as a predictor. It did not significantly predict positive emotions, the impact of experimental condition on positive emotions, or the impact of experimental condition on positive emotions over time. In addition, it was not related to the constructs we examine in subsequent models. For this reason, all reported analyses collapse across male and female participants, and we do not consider the impact of participant sex further.

condition were, in fact, meditating and were meditating more than the control participants. A series of hierarchical linear models, with time nested within individual—also known as growth models— investigated the impact of experimental condition, passage of time, and time spent meditating on self-reported emotions. An additional set of analyses examined participants' emotions within a single morning, incorporating information about the amount of time that participants had meditated over the course of the study and whether they had meditated on the particular morning in question.

We then tested the build hypothesis in a combined latent growth curve and path-analysis structural equation model (SEM). The growth curve for positive emotions from the hierarchical linear model analyses was reparameterized as a SEM-based latent trajectory model. In the path-analysis portion of the model, baseline positive emotions and slope of change in positive emotions predicted change in the targeted resource, which then predicted change in life satisfaction or depression. Each of the 18 resources we measured was tested in a separate model.[5]

Results were analyzed separately in three samples:

1. individuals who adhered to the study requirements described above (our "complete data" sample, $n = 139$);
2. an intent-to-treat sample ($n = 195$), comprising all of the participants who were successfully randomly assigned to experimental condition; and
3. a per-protocol sample ($n = 175$), comprising (a) all of the participants successfully randomly assigned to the waitlist control condition ($n = 98$) and (b) those participants assigned to LKM who received a predetermined "minimum effective dose" of LKM training (at least three of the six weekly loving-kindness sessions; $n = 77$).

Analyses with the complete data sample are described below. At the end of the section, analyses with the other samples are discussed.

Manipulation Check

Did Participants in the Meditation Condition Comply With Instructions to Meditate?—Time spent in "meditation, prayer, or solo spiritual activity" was assessed each day. As expected, during the baseline period, meditators and control participants did not differ in duration of meditative activity, $t(135) = -0.25$, $p = .80$ (Ms = 13 and 12 min/week, respectively). Beginning with Week 1 of the study, and for each subsequent week, participants in the LKM group engaged in significantly more meditative activity than did those in the control group, averaging about 80 min/week, although this dropped to about 60 min/week after the workshop ended.

Effects of LKM on Emotions

Did LKM Impact Positive Emotions Over the Course of the Study?—We averaged measurements for nine positive emotions—amusement, awe, contentment, joy, gratitude, hope, interest, love, and pride—within each day, and then we averaged these daily means over the week to create a composite positive emotions variable for each week of the

[5]We explored whether we might reduce the number of models tested by considering the 18 different resources assessed as indicators of either one latent "resources" factor, or four latent factors distinguished by type of resource (e.g., cognitive, psychological, social, and physical resources). However, confirmatory and exploratory factor analyses suggested that no such reduction was warranted. The correlation matrix is available on request.

study. Across weeks, this index score had an average alpha coefficient of .94 (range = .94–.95).

The impact of LKM on positive emotions over time was tested using hierarchical linear modeling, with time nested within individual. Experimental condition, week in the study, and their interaction were included as predictors. The model also included random effects for the intercept, which represented each participant's level of positive emotions at baseline, and for the impact of week in the study, which represented each participant's change in positive emotions over time. Both random effects were significant (intercept variance = 0.34, $SE = 0.05$, $p < .0001$; week variance = 0.002, $SE = 0.0006$, $p = .0002$), indicating that participants varied in their baseline levels of positive emotions and showed differing rates of change over time. The fixed effects for experimental condition and week were not significant, but their interaction was ($b = 0.041$, $SE = 0.011$, $p = .0004$). Thus, neither time nor condition alone predicted positive emotions, but over time, a difference between conditions emerged (see Figure 2). We probed the interaction by treating time as the focal predictor and experimental condition as the moderating variable (Preacher, Curran, & Bauer, 2006). These analyses revealed that time did not significantly predict positive emotions for control participants ($b = -0.008$, $SE = 0.0079$, $p = .31$) but did significantly predict positive emotions for participants in the LKM condition ($b = 0.03$, $SE = 0.008$, $p = .0001$). Thus, these results confirm that LKM increased participants' positive emotions over the course of the study.

We then tested similar growth models for each of the nine positive emotions included in the composite. In all cases, neither main effect was significant, but their interaction was significant. (The sole exception to this was that interest also showed both main effects; see Table 2.) These results suggest that the findings for the composite positive emotions variable were not determined by any single positive emotion and that it is appropriate to consider the positive emotions collectively.

We tested an additional growth model that examined compassion over the duration of the study. Neither the main effects for experimental condition and week, nor their interaction ($b = 0.021$, $SE = 0.016$, $p = .21$), was significant. Visual inspection revealed the same pattern for compassion as for the positive emotions, but the increase over time for meditators was not statistically significant.

What Role Did Individual Effort Play in the Impact of the Intervention on Positive Emotions?—The impact of LKM on positive emotions might be expected to be a function not only of experimental condition but also of individual effort put into daily practice. We tested a growth model for positive emotions that included the number of hours of meditation practice each week as a fixed effect, time-varying predictor, along with time and experimental condition. To allow us to examine any changes in the impact of meditation practice on positive emotions over the course of the study, we entered meditation practice for each week of the study as a separate variable. We deliberately left experimental condition in the model to test the unique contribution of time spent meditating each week, above and beyond the impact of participation in the workshop or interaction with the meditation instructor. Unexpectedly, time spent in "meditation, prayer, or solo spiritual activity" significantly predicted positive emotions during the baseline week before the workshops began ($p = .05$), even when we excluded the participants who reported a preexisting meditation practice. After the first week of meditation instruction, time spent in meditative activity predicted positive emotions for all time points except Week 4 ($p = .08$), even after we controlled for the other predictors in the model. These results are presented in Table 3.[6]

To estimate the impact of LKM instruction and practice on positive emotions, we tested a separate model with the meditators alone. By excluding the control participants, who were not receiving LKM instruction, we avoided diluting the estimate for the impact of "meditation, prayer, or solo spiritual activity" on positive emotions with non-LKM forms of spiritual practice. In this model, 1 hr of meditation practice during Week 2 was associated with a 0.06-unit increase in positive emotions ($SE = 0.03$, $p = .06$) on the 5-point Likert scale described above. This value increased steadily during Weeks 3–7 of the study. By Week 7, each hour of meditation practice was associated with a 0.17-unit increase in positive emotions ($SE = 0.03$, $p < .0001$). These data suggest that the dose-response relationship between the practice of LKM and the experience of positive emotions tripled over the course of the study. Furthermore, even though meditation practice dropped after the workshop ended in Week 7, 1 hr of meditation practice in Week 8 still exerted approximately the same influence on positive emotions as it had in Week 7 ($b = 0.18$, $SE = 0.05$, $p = .0004$).

Did LKM Influence Negative Emotions Over the Course of the Study?—We also examined the impact of LKM on negative emotions over the course of the study. Negative emotions were indexed by a composite of daily ratings for anger, shame, contempt, disgust, embarrassment, guilt, sadness, and fear. Across weeks, this index score had an average alpha coefficient of .85 (range = .81–.90). As described above for positive emotions, the model included experimental condition, week in the study, Time × Condition interaction, and hours of meditation practice each week. None of the predictors were significant. Thus, neither experimental condition, week in the study, their interaction ($b = -0.011$, $SE = 0.011$, $p = .28$), nor time spent meditating during any weeks of the study (range $p = .11$–$.74$) significantly influenced the negative emotions sampled in this study.

Did LKM Influence Emotions Within a Targeted Morning?—The DRM provided data on participants' emotional experiences within the episodes of an ordinary morning. This offered a window into the impact of our intervention on emotional experiences in response to specific daily events, rather than emotions summarized over an entire day. Five participants did not provide DRM data, leaving 134 for analysis. There were 918 episodes recorded in total, with each participant reporting a mean of about seven episodes ($M = 6.85$, $SD = 2.38$). As with the daily reports, composite scores of positive and negative emotions were computed by taking the mean of positive items and negative items, respectively. Consistent with the daily reports, participants reported higher positive emotions ($M = 1.16$, $SD = 0.15$) than negative emotions ($M = 0.15$, $SD = 0.28$). Positive and negative emotions were largely uncorrelated ($r = -.06$, $p = .09$).

Multilevel random-coefficient regression modeling has been recommended for analyzing DRM data (Stone et al., 2006). We estimated a series of models predicting positive or negative emotions for a given episode from experimental condition, total number of hours engaged in meditative activity over the course of the study, the time of day of the episode, whether the episode included meditation, whether the episode included social interaction, and the interaction between social interaction and total hours of meditative activity. This interaction term was included to explore whether LKM—which focused on kindness and compassion toward others—had a specific influence on the participant's response to interactions with others. All quantitative predictors were mean centered.

[6]To address concerns about multicollinearity between experimental condition and time spent meditating, we tested a separate model in which number of hours of meditation practice was group mean-centered. The pattern of significant findings was identical, except that the impact of time spent meditating became nonsignificant for Week 3, as well as Week 4. Table 3 reports the uncentered meditation time values, for ease of interpretation.

We established that the best fitting unconditional models for positive and negative emotions had significant random intercepts (*p*s < .0001) and autoregressive covariance structures (*p*s < .0001), indicating that participants began the day with significant variability in their levels of positive and negative emotions and that temporally close measures of emotion were more highly correlated than more distant measures. Time of day positively predicted positive emotions ($b = 0.065$, $SE = 0.009$, $p < .0001$), whereas no time trend emerged for negative emotions ($b = 0.002$, $SE = 0.003$, $p = .54$). These findings are consistent with diurnal rhythms of positive emotions, which have been found to peak at noon (Stone et al., 2006). Experimental condition was not significant for either positive or negative emotions ($b = 0.067$, $SE = 0.118$, *ns*, and $b = -0.082$, $SE = 0.048$, *ns*, respectively).

We next tested the total number of hours spent in meditative activity (over the previous 9 weeks) as a predictor of emotional experiences during the episodes of the targeted morning.[7] A positive effect of time spent meditating on positive emotions emerged, above and beyond the effect of time ($b = 0.033$, $SE = 0.010$, $p = .0008$). This was not true for negative emotions ($b = -0.005$, $SE = 0.004$, $p = .2064$). Hence, time spent in meditative activity over the previous 9 weeks was associated with more frequent positive emotions and no change in negative emotions across episodes within the targeted morning. We do not consider negative emotions further.

A small number of participants ($n = 9$) indicated in their DRM responses that they had engaged in meditative activity that morning. To assess whether the target day's meditative activity alone could account for the significant effects on positive emotions reported above, we reran the models in two ways. First, we added meditation at episode as a time-varying predictor to test the effects of engaging in meditative activity on positive emotions experienced during that same episode. Second, in place of the episode-level predictor, we added a dummy variable indicating whether or not participants meditated that day to test the effects of engaging in meditative activity on positive emotions experienced that day. Meditating during an episode predicted higher positive emotions during that episode ($b = 0.39$, $SE = 0.17$, $p = .0207$) but did not change the effect of hours engaged in meditative activity over the previous 9 weeks on positive emotions experienced that morning ($b = 0.033$, $SE = 0.010$, $p = .0008$). Meditating any time that morning also predicted positive emotions experienced that morning ($b = 0.52$, $SE = 0.23$, $p = .0247$) but also did not change the effect of total hours meditated throughout the study ($b = 0.029$, $SE = 0.010$, $p = .0031$). Thus, we can attribute much of the increase in positive emotions on this particular day to the time participants had spent meditating over the last several weeks.

Taken together, these DRM findings indicate that (a) meditation produces positive emotions during meditation practice; (b) these positive emotions persist after the meditation session has ended; and (c) over time, repeated LKM practice produces a cumulative increase in positive emotions that appears on subsequent days, whether or not the individual meditates on that day.

Previous research has shown that, in general, people experience more intense positive emotions when interacting with others than when alone (McIntyre, Watson, Clark, & Cross, 1991). We explored whether time spent meditating over the previous 9 weeks differentially influenced participants' experiences of positive emotions, depending on whether they were interacting with others or not. We tested a model with time of day, social interaction, time spent meditating over the previous 9 weeks, and the interaction of social interaction and time spent meditating as predictors. The slope for social interaction was allowed to vary (Var_{slope}

[7] It is not surprising that experimental condition and time spent meditating were highly correlated, $r(139) = 0.71$, $p < .0001$. Thus, we examined them separately as predictors of emotions within the morning targeted by the DRM.

= 0.052, *SE* = 0.25, *p* = .0187), confirming that interacting with others predicted positive emotions differentially across individuals. Beyond the effects of time and hours spent in meditation, episode-level social interactions (*b* = 0.232, *SE* = 0.059, *p* = .0001) and the interaction between time spent meditating and social interactions (*b* = 0.014, *SE* = 0.006, *p* = .0363) predicted positive emotions in that morning. That is, more time spent meditating was associated with higher positive emotions, and this effect was stronger during social interactions.

Testing the Build Hypothesis

We tested the full build hypothesis by combining a growth model for positive emotions with an SEM path analysis. This combined model used the strengths of growth modeling, which considers individual trajectories of change over time, and path analyses, which can examine direct and indirect effects in mediational models. The growth model for positive emotions was reparameterized as a latent trajectory model in an SEM framework (Curran & Hussong, 2003). Experimental condition and time spent meditating during the week predicted positive emotions for each week of the study. Time spent meditating was entered as a time-varying predictor. An intercept and slope for positive emotions over the course of the study were created by allowing the indicators for positive emotions, representing positive emotions during each week of the study, to cross-load on both intercept and slope latent variables. The latent variable that reflected the intercept of positive emotions, at baseline, was created by fixing factor loadings for the indicators to 1.0. The latent variable that reflected change in positive emotions over the course of the study was then created by specifying factor loadings that reflected week in the study (0.0 = baseline, 1.0 = Week 1, 2.0 = Week 2, etc.).

In the path-analysis portion of the model, the intercept, representing each participant's initial level of positive emotions during the baseline week, and slope, representing each participant's rate of change in positive emotions over time, predicted change in his or her resources between T1 and T2, which then predicted change in life satisfaction between T1 and T2. In other words, each participant's baseline level of positive emotions and individual rate of change in positive emotions over the course of the study, calculated within the latent trajectory portion of the model, became predictors in the path-analysis portion of the models we tested. Given our experimental design, only change in positive emotions (i.e., slope) was predicted to build participants' resources. Thus, we predicted that the path from slope of positive emotions to resources would be significant, but the path from baseline positive emotions to change in resources would not. The resource variable was a difference score that represented change between T1 and T2 in the specific resource featured within each model. We tested the model for each resource assessed, and this was the only variable that changed across models. Last, the life-satisfaction variable was also a difference score, representing change in life satisfaction between T1 and T2. Thus, the model examined whether initial positive emotions and changes in positive emotions over the course of the study predicted changes in resources over the course of the study, which, in turn, predicted changes in life satisfaction over the course of the study. Participants with greater increases in positive emotions were hypothesized to exhibit greater increases in resources and, in turn, life satisfaction. A diagram of the model tested is depicted in Figure 3.

The model was tested for each of the 18 resources identified in Table 4, using LISREL 8.80 (Jöreskog & Sörbom, 1996). A multitude of factors may be associated with individual trajectories of change over time, therefore, it is rare for growth models or combined growth and path-analysis models to fit well when assessed using standard SEM fit indices, such as root-mean-square error of approximation (Widaman & Thompson, 2003). For this reason, it is noteworthy that each of the models we tested produced an estimated root-mean-square error of approximation of less than 0.08 (range = 0.068–0.076), indicating an acceptable fit to the data. Given that all of the models tested were acceptable fits to the data, and that

overall model fit was influenced by the fit of the latent trajectory portion of the model (which was the same for each resource), we examined the significance of the individual path coefficients in the models for each resource to test the build hypothesis.

As predicted, the path from baseline positive emotions to change in resources (Path A) was not significant for any of the resources, indicating that change in resources over the course of the study was not significantly affected by participants' initial levels of positive emotions (see Table 4). The paths from change in positive emotions (i.e., slope) to change in resources (Path B) and from change in resources to change in life satisfaction (Path C) are central to the build hypothesis. These paths were significant for 9 of the 18 resources tested: mindfulness, pathways thinking, savoring the future, environmental mastery, self-acceptance, purpose in life, social support received, positive relations with others, and illness symptoms. In other words, increases in positive emotions over the course of the study were associated with significant increases in these resources, which were, in turn, associated with significant increases in life satisfaction. Table 4 presents the parameter estimates for all path coefficients tested. The first two columns of Table 5 present the amount of variance explained in the changes in resource and life satisfaction variables when the predicted build paths were significant.

Six of the nine remaining resources showed significant paths influencing life satisfaction (Path C) but were not significantly influenced by change in positive emotions (Path B). These resources were agency thinking, savoring the past, savoring the present, optimism, personal growth, and autonomy. This suggests that these six measures are indeed consequential resources, even though increases in positive emotions did not significantly augment them.

Did Changes in Positive Emotions Directly Influence Life Satisfaction, in Addition to Their Indirect Influence Through Built Resources?—We examined the possibility that changes in positive emotions could exert a direct effect on increases in life satisfaction (Path D), in addition to the indirect effects via built resources (Paths B and C). To examine this, we tested a series of models that included a direct effect from change in positive emotions to change in life satisfaction. The "Path D" column in Table 4 presents the results for this path coefficient. (In Table 4, the columns for Paths A, B, and C report values for these path coefficients when Path D is *not* in the model.) The direct effect from change in positive emotions to change in life satisfaction was not significant for any of the models tested, nor did the model fit significantly improve when this path was included. For the nine resources that were found in previous analyses to exhibit the predicted pattern of significant build paths, these path coefficients remained significant when the direct effect of change in positive emotions on change in life satisfaction was included in the model. These results indicate that changes in positive emotions only produced changes in life satisfaction to the extent that they built personal resources. This further underscores the conceptual distinction between transient experiences of positive emotions and global judgments of life quality (Cohn et al., 2008; Diener et al., 2006).

Did Experimental Condition and Time Spent Meditating Directly Impact Resources and Life Satisfaction, in Addition to the Impact They Exerted Via Their Influence on Changes in Positive Emotion?—We also examined the possibility that experimental condition and amount of time spent meditating directly influenced changes in resources and life satisfaction, in addition to their indirect influence via positive emotions. We tested this possibility in a new series of models. For purposes of clarity, these paths are not represented in Figure 3, but they entail direct effects from experimental condition and from each week's variable for time spent meditating to both change in resource and change in life satisfaction. These effects were generally

nonsignificant, with values that varied depending upon the path and the resource being tested. There was one exception: The direct effect from time spent meditating in Week 2 to change in life satisfaction was significant for each of the 18 resources tested (e.g., mindfulness, $b = 0.49$, $z = 2.47$). Excluding this direct effect, there were other, isolated significant effects, which represented a total of 4% of the 360 path coefficients estimated, but there was no pattern to these effects, and they did not exceed the percentage of path coefficients that would be expected on the basis of chance alone. These results suggest that experimental condition and time spent meditating exerted their influence on resources and life satisfaction because of their impact on positive emotions.

Do Positive Emotions Influence Depressive Symptoms Through the Same Mechanism (i.e., Built Resources) by Which They Influence Life Satisfaction?

—To explore whether positive emotions might beneficially influence measures of negative psychological adjustment through the same mechanisms by which they influence life satisfaction, we tested a series of models for which depressive symptoms was the ultimate variable in the model, replacing life satisfaction. In these models, change in positive emotions predicted change in the resource, which, in turn, predicted change in depressive symptoms. Model fit, as determined by root-mean-square error of approximation, remained acceptable. In addition, the predicted build paths were significant for the same nine resources for which these paths were significant when life satisfaction was the ultimate variable in the models. These findings suggest that increases in positive emotions decrease depressive symptoms through the same mechanisms by which they increase life satisfaction: built resources.

We also examined the possibility that positive emotion directly influenced depressive symptoms, in addition to its indirect impact via built resources. In the first set of models, we examined the significance of the direct effect from change in positive emotions to change in depressive symptoms (Path D). Unlike the results for life satisfaction, this path was significant for all models tested. In addition, the overall fit of the models significantly improved for all 18 resources when this path was included in the model ($p < .0025$). Even so, the predicted build paths remained significant for eight of the nine previously significant resources. This pattern of results suggests that increases in positive emotions influenced the decline in depressive symptoms via both built resources and a direct impact on depressive symptoms. The one resource for which this was not the case was social support received, for which the mediated build paths were not significant when Path D was included. Table 6 presents the parameter estimates for these models. The last two columns of Table 5 present the amount of variance explained in the changes in resource and depressive symptoms variables when the predicted build paths were significant. In a second set of models, we examined the direct effects from experimental condition and time spent meditating each week to the changes in resources and depressive symptoms, for each of the resources tested. Although isolated paths were significant, these represented only 2.8% of the paths tested, and there was no discernible pattern to which paths were significant.

Intent-to-Treat Analyses

To test for possible effects of differential participant completion on our results, we repeated the analyses above using our intent-to- treat and per-protocol samples. The impact of experimental condition over time on positive emotions was not significant in either the intent-to-treat, $t(1380) = 1.37$, $p = .17$, or per-protocol samples, $t(1380) = 1.58$, $p = .11$, whereas it was significant in our completer sample (discussed above). The impact of time spent meditating on positive emotions remained significant in both samples, starting with the first week of instruction. The resources for which we found significant build paths (paths from positive emotion change to resource to life satisfaction; shown as Paths B and C in

Figure 3) generally showed the same significant paths in the intent-to-treat and per-protocol samples. Positive emotions significantly predicted savoring the future only in the completer sample, and change in ego resilience significantly predicted change in life satisfaction and depression in the intent-to-treat and per-protocol samples, even though it did not do so in the completer sample. Overall, the hypothesis that positive emotions help people build consequential personal resources was supported in the intent-to-treat analysis. However, these analyses suggest that conclusions about the efficacy of LKM may need to be restricted to individuals who invest adequate effort in training and practice (approximately 70% in this sample).

Discussion

The broaden-and-build theory (Fredrickson, 1998, 2001) states that, over time, recurrent experiences of positive emotions allow people to build consequential personal resources. The data reported here provide the first experimental test of the build hypothesis. The findings are clear cut: The practice of LKM led to shifts in people's daily experiences of a wide range of positive emotions, including love, joy, gratitude, contentment, hope, pride, interest, amusement, and awe. These increases in positive emotions were evident both within the trajectories of change in daily emotions over the span of 9 weeks and within a detailed analysis of a given morning 2 weeks after formal training ended. These shifts in positive emotions took time to appear and were not large in magnitude, but over the course of 9 weeks, they were linked to increases in a variety of personal resources, including mindful attention, self-acceptance, positive relations with others, and good physical health. Moreover, these gains in personal resources were consequential: They enabled people to become more satisfied with their lives and to experience fewer symptoms of depression. Simply put, by elevating daily experiences of positive emotions, the practice of LKM led to long-term gains that made genuine differences in people's lives.

The conceptual model—drawn from the broaden-and-build theory and depicted in Figure 1—is unambiguously supported by the evidence reported here. Most important, positive emotions emerge as the clear centerpiece of the model. LKM was beneficial precisely because it helped people experience positive emotions; direct effects of LKM, circumventing the hypothesized build paths, were virtually nonexistent. Positive emotions emerged as the mechanism through which people build the resources that make their lives more fulfilling and help keep their depressive symptoms at bay.

These data also echo a message from our recent work that unpacks the relationship between positive emotions and life satisfaction (Cohn et al., 2008). Although both can be considered facets of happiness or subjective well-being (Lucas et al., 1996), we found positive emotions, and not life satisfaction, to predict change in resources. Furthermore, the association between increased positive emotions and increased life satisfaction was fully mediated by resource building. This suggests that people judge their lives to be more satisfying and fulfilling, not because they feel more positive emotions per se, but because their greater positive emotions help them build resources for living successfully.

Nine of the eighteen resources we tested fit the hypothesized build paths. Of the remaining nine, six showed changes in the expected direction on the build paths (see Table 4). We speculate that these six resources may be affected by positive emotions, albeit less strongly or more slowly than other resources, and not that the build hypothesis is categorically inapplicable to them.

The resources that did show significant build effects might be loosely grouped into two categories. The first involves having a loving attitude toward oneself and others and includes

self-acceptance, social support received, and positive relations with others. The second involves a feeling of competence about one's life and includes pathways thinking, environmental mastery, purpose in life, and ego-resilience (which was influenced by positive emotions, although just shy of significantly influencing life satisfaction). We speculate that increases in positive emotions may impact these resources more rapidly and to a greater extent than others.

This study confirms yet again that positive emotions are more than momentary good feelings. Laboratory experiments have documented that positive emotions broaden cognition (for a review, see Fredrickson & Cohn, 2008). Now we have evidence from a field experiment to document that positive emotions also place people on trajectories of growth, leaving them better able to ward off depressive symptoms and become ever more satisfied with life. This experiment also carries the inspiring implication that people can take deliberate action to cultivate meaningful experiences of positive emotion and reap these benefits as a result.

This field experiment also further documents the benefits of meditation. When people initiated a practice of LKM, they enjoyed payoffs both immediately, in terms of self-generated positive emotions, and over time, in terms of increased resources and overall well-being. Meditators even experienced enhanced positive emotions in ordinary life situations, especially those involving other people. This substantiates the claim that this type of meditation changes the way people approach life.

We found that the effects of LKM were specific to positive emotions, without a comparable decrease in negative emotions. This resembles the work of Teasdale et al. (2000), who anecdotally reported that their mindfulness-based protocol does not reduce negative emotions but, instead, alters responses to negative emotions that can lead to depression (Segal et al., 2002). In contrast, Carson et al. (2005) uncovered a marginal decrease in trait anger in their pilot study of LKM. They also observed reductions in anxiety and distress, but these may have been due to the study's central outcome of pain amelioration. Davidson et al. (2003) also found a decrease in trait anxiety with mindfulness-based stress reduction but only weak support for changes in negative emotion. Future work will need to resolve these inconsistencies.

Another curious finding was the null effect of LKM on self-ratings of compassion. In hindsight, we speculate that our sole daily item for compassion ("In the past 24 hours, what is the most sympathy, concern or compassion you have felt?") may have oriented respondents toward compassion felt in response to the suffering of others, rather than kindness or equanimity per se. If the suffering of others was not directly salient to participants on a daily basis, increases on this particular item may have been limited. We suggest that future work tailor measures of compassion to more directly reflect the teachings of contemplative traditions.

A final puzzling finding was the initially lower level of positive emotions in the meditation group. We speculate that this difference reflects the difficulties of initiating any self-change effort, even if those changes are self-chosen. Consider the parallel to the perennial New Year's resolution to lose weight to be healthier. At the peak of a person's motivation to shed pounds, he or she might join a local gym. Then, days later, the person realizes that he or she must actually go to the gym and exercise. Starting a meditation practice may similarly involve a period of doing something unfamiliar, difficult, and draining without immediate rewards. Contemplative traditions have articulated five obstacles facing novice meditators, including craving, anger, boredom, restlessness, and doubt (Kabat-Zinn, 2005). These obstacles are thought to result from increased awareness of challenging inner states that may

be commonly present, although not noticed during one's typical busy and outward-directed focus. Indeed, nearly all attrition occurred during the initial weeks, when participants may not have been sufficiently "in shape" to feel competent at meditation or derive benefits from it. Yet if people can endure these first difficult weeks, meditation becomes more effective, and positive emotions begin to accumulate and compound, changing people for the better.

Because we set out to develop a durable method of inducing positive emotions, the dose-response results we documented are particularly inspiring. We found that the amount of positive emotions participants gained per hour spent meditating increased over the course of the study, tripling from the first week to the last. Rather than becoming bored with or jaded to the effects of meditation, our participants seemed to be building a dependable skill for self-generating positive emotions again and again. These findings are especially noteworthy given that most of our participants were novice meditators and our meditation workshop lasted only 7 weeks.

Limitations and Future Directions

This study breaks new ground in several ways, which leaves ample room for future research to probe or refine its findings. First, the sample was predominantly White, educated, and motivated for self-change. Mindfulness-based programs have shown widespread emotional and medical benefits in diverse populations and for individuals without prior interest in meditation (Kabat-Zinn, 1990), and it will be important to determine whether the same holds true for LKM. Second, the duration of the experiment was just over 10 weeks. In the future, it will be important to investigate the extent to which the resources endure beyond the end of the intervention or into periods of heightened stress or negative emotions. We found that after the formal workshop ended, time spent meditating and positive emotions decreased in tandem, even though meditation remained effective at evoking positive emotions. Lyubomirsky, Sheldon, and Schkade (2005) have argued that intentional activity is required to sustain gains in happiness. Future research will benefit from assessing the duration of gains or determinants of continued, independent practice. Finally, the current experiment did not include daily measures of broadened cognition, which would have allowed a more precise test of the proposed links between positive emotions, broadened thinking, and resources. Currently, no measures of broadening are valid, repeatable, and administrable outside the lab, but once one has been developed and validated, it will be an important contribution to this research program.

Another necessity in future work will be to move beyond self-report data to eliminate concerns of shared method variance. Implicit or behavioral measures, observer reports, and physiological markers will be especially useful. Specifically, researchers can track changes in emotions over time with implicit or behavioral measures of affect (Payne, Cheng, Govorun, & Stewart, 2005) or positivity bias (Carstensen & Mikels, 2005). In a more recent study of LKM, we obtained observer reports from peers identified by study participants. Preliminary analyses suggest that, as expected, observers judge meditators to be more helpful than control participants (Fredrickson, 2008). Romantic partners, supervisors and physicians would also be fruitful informants in future research. Finally, in current and planned work, we are investigating whether LKM produces changes in respiratory sinus arrhythmia, progesterone, and oxytocin, each of which has been linked to positive social relations (e.g., Brown et al., 2008; Eisenberg et al., 1995; Holt-Lunstad, Birmingham, & Light, in press).

The comparison condition within this experiment was a waitlist control group. Although typical for initial tests of psychological interventions (e.g., Davidson et al., 2003; Teasdale et al., 2000), this experimental design can inadvertently create experimenter demand, expectation of improvement, or nonspecific effects related to delivery format. We address

each possibility in turn: First, the explicit focus on love and kindness may have created demand to elevate self-reports of these emotions. However, our data indicated that (a) LKM was associated with changes in many positive emotions, not just the ones explicitly discussed; (b) guided meditations featured the terms “love” and “compassion” beginning in Week 1, yet the profile of changes in self-reported positive emotions (see Figure 2) shows that positive emotions did not significantly increase until Week 3; and (c) self-reported positive emotions fit into a full set of mediational pathways (see Figure 3), which participants were unlikely to intuit and use to shape their responses.[8] Second, simply participating in a meditation workshop might create the expectation of improvement. These expectations might give rise to positive emotions, such as hope and confidence, a legitimate, though nonspecific, effect of the intervention. We underscore that the increase in positive emotions evident in the current study did not appear until Week 3 (see Figure 2), whereas placebo responses typically emerge rapidly (Scott et al., 2007). Third, nonspecific effects of delivery format, including contact with a caring instructor, group interaction, and weekly work-release time might also have contributed to increases in positive emotions. However, we found that when controlling for group assignment, time spent meditating still predicted increases in positive emotions. Even among participants who received the nonspecific benefits, meditation itself—the proposed core of the intervention— predicted positive change. We also examined whether participants reported a boost in positive emotions on the day of workshop sessions or the day after, comparing waitlist participants, LKM participants who did not attend that week’s workshop, and LKM participants who did. The results did not differ from chance, suggesting that the higher positive emotions reported by LKM participants reflected a continuous upward trend, rather than a temporary response to the one day each week that involved time off of work, social support, and contact with the instructor. Overall, patterns in our data argue against spurious results arising from our use of a waitlist control group. Now that LKM has shown efficacy in increasing positive emotions and building personal resources, future work will be able to directly control for nonspecific effects and expectancies by comparing LKM with other meditative or self-change techniques.

Another alternative explanation for our findings is that whatever positive emotions our participants were feeling at T2 cast a rosy glow over all their self-reports and artificially produced the appearance of growth in resources. The reports from the DRM provided an estimate of positive emotions for the day the T2 measures were completed. We regressed that day’s positive emotions on aggregate positive emotions over the 9 weeks of daily reports (R = .69) and created a residual term, representing positive emotions that were present at T2 and could have cast a rosy glow over responses but that were not present during the time resources were being built. We tested the residual variable in our mediational models, in place of change in positive emotions over time. It did not predict change in any of the resources. This suggests that positive emotions experienced over time exerted a gradual, cumulative effect, rather than simply biasing responding at the moment participants were responding to T2 questionnaires.

[8]Another way experimenter demand might have produced the results is if meditation participants gradually began to skip responding on days low in positive emotions. Meditation participants did respond less frequently over time (dropping from 5.2 to 4.6 responses per week), whereas waitlist participants did not, $F(7, 132) = 3.75$, $p = .002$. However, the week-by-week correlations between positive emotions and response frequency were very low in both groups. The sole significant correlation suggested that, if anything, the highest positive emotions were reported by participants who responded most frequently (i.e., least selectively). Also, recall that emotion measures were analyzed using per-participant means for each week, meaning that frequent responders did not contribute disproportionately to the data.

Conclusion

One of the most deflating concepts facing positive psychology is the hedonic treadmill (Brickman, Coates, & Janoff-Bulman, 1978): Even though positive and negative events (e.g., winning the lottery, becoming paraplegic) temporarily alter levels of happiness, people quickly adapt to them and return to a fixed emotional set-point. The hedonic treadmill, as classically stated, implies that all efforts to improve happiness are doomed to failure. Yet more nuanced research (Diener et al., 2006) indicates that adaptation is not necessarily inevitable and may be strongest for negative affect and weaker for positive affect and life satisfaction. The evidence reported here reveals that one way to outpace the hedonic treadmill is to begin a practice of LKM. Participants who invested an hour or so each week practicing this form of meditation enhanced a wide range of positive emotions in a wide range of situations, especially when interacting with others. We find these data especially promising. LKM appears to be one positive emotion induction that keeps on giving, long after the identifiable “event” of meditation practice.

Positive emotions feel good, and feelings like love, joy, and contentment can be valuable in and of themselves. Yet the broaden-and-build theory posits that natural selection sculpted our ancestors’ positive emotions to be useful in more far-reaching ways as well. These desirable states built resources that gave our ancestors’ an edge in circumstances that impinged on their survival. To our knowledge, this is the first experiment to provide clear support for the build hypothesis. By random assignment, one group of individuals began a mind-training practice that increased their positive emotions and, in turn, their personal resources and well-being. Just as the broaden-and-build theory predicts, then, when people open their hearts to positive emotions, they seed their own growth in ways that transform them for the better.

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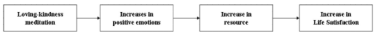

Figure 1.
Conceptual model depicting predicted causal paths between loving-kindness meditation, change in positive emotions, change in resources, and change in life satisfaction.

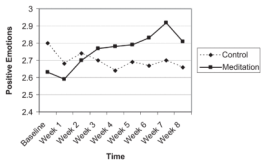

Figure 2.
Positive emotions by experimental condition.

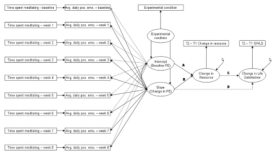

Figure 3.
Combined latent trajectory and path-analysis model. Avg. daily pos. emo. = average daily positive emotion; PE = positive emotion; SWLS = Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985).

Table 1

Participant Demographics

Participant characteristic	Intent-to-treat	Per-protocol	Completers[a]
N	195	175	139
% providing demographic information[b]	88.2	93.9	100.0
% in meditation group	49.2	43.4	48.2
% female	59.8	60.8	65.5
Age[c]	41	41	41
Education level[c]	Bachelor's degree	Bachelor's degree	Bachelor's degree
% married	60.5	59.8	57.7
Income[c] ($)	>85,000	>85,000	>85,000
Depression[d] (CES–D, full scale)			
Baseline	16.1	15.4	15.9
Posttest	12.7	12.4	12.8
Life satisfaction (SWLS)			
Baseline	4.12	4.17	4.10
Posttest	4.42	4.46	4.50
% White (non-Hispanic)	73.7	73.3	72.6

Note. CES–D = Center for Epidemiological Studies—Depression Measure (Radloff, 1977). SWLS = Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985).

[a] For exclusion criteria, see Methods section.

[b] Twenty-three participants declined to provide demographic information. Median and percentage calculations use only participants who provided data. Group-assignment data were available for all participants.

[c] Value reported is median.

[d] To facilitate comparison with previously published work, we report values that represent scores based on the full CES–D scale, including both positively and negatively worded items. In subsequent analyses, we omit the positively worded items to minimize conceptual overlap with positive emotions.

Table 2

Impact of Loving-Kindness Meditation on Specific Positive Emotions

	Experimental condition			Week			Experimental condition × week		
Emotion	**Estimate**	***SE***	***p***	**Estimate**	***SE***	***p***	**Estimate**	***SE***	***p***
Amusement	−0.112	0.125	.37	−0.012	0.009	.20	0.040	0.014	.003
Awe	−0.163	0.123	.19	−0.0003	0.010	.97	0.046	0.014	.001
Contentment	0.036	0.120	.76	−0.002	0.011	.83	0.043	0.016	.006
Gratitude	−0.010	0.141	.94	0.0006	0.010	.96	0.035	0.014	.01
Hope	−0.139	0.127	.28	−0.006	0.010	.55	0.044	0.015	.003
Interest	−0.421	0.136	.002	−0.022	0.011	.05	0.060	0.016	.0002
Joy	0.0005	0.124	.997	−0.013	0.010	.21	0.037	0.014	.01
Love	0.060	0.134	.66	−0.009	0.010	.33	0.036	0.014	.009
Pride	−0.249	0.1369	.07	−0.016	0.010	.15	0.048	0.014	.0008

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Table 3

Impact of Experimental Condition, Week, and Time Spent Meditating on Positive Emotions

Predictor	Estimate	*SE*	*p*
Intercept	2.717	0.075	<.0001
Experimental condition	−0.124	0.110	.26
Week	−0.010	0.008	.20
Experimental Condition × Week	0.026	0.013	.04
Time Spent Meditating – Baseline	0.167	0.086	.05
Time Spent Meditating – Week 1	0.006	0.039	.88
Time Spent Meditating – Week 2	0.083	0.032	.01
Time Spent Meditating – Week 3	0.068	0.031	.03
Time Spent Meditating – Week 4	0.045	0.026	.08
Time Spent Meditating – Week 5	0.093	0.029	.002
Time Spent Meditating – Week 6	0.107	0.028	.0001
Time Spent Meditating – Week 7	0.144	0.029	<.0001
Time Spent Meditating – Week 8	0.130	0.048	.007

Table 4

Resource Models Tested With Life Satisfaction as Outcome Variable

Resource tested	RMSEA (90% CI)	$\chi^2(137, N = 139)$	Path A	Path B	Path C	Path D
			Cognitive resources			
Mindfulness[a]	0.068 (0.051–0.083)	224.58 (p = .00)	−0.10 (z = −1.17)	0.20 (z = 2.04)	0.25 (z = 3.04)	0.12 (z = 1.24)
Agency thinking	0.074 (0.058–0.089)	241.15 (p = .00)	−0.03 (z = −0.38)	0.17 (z = 1.74)	0.36 (z = 4.46)	0.11 (z = 1.15)
Pathways thinking[a]	0.071 (0.056–0.087)	234.24 (p = .00)	−0.03 (z = −0.32)	0.22 (z = 2.25)	0.24 (z = 2.94)	0.12 (z = 1.19)
Savoring the past	0.070 (0.053–0.085)	228.99 (p = .00)	0.05 (z = 0.51)	0.15 (z = 1.52)	0.18 (z = 2.17)	0.15 (z = 1.49)
Savoring the present	0.071 (0.055–0.086)	232.88 (p = .00)	−0.13 (z = −1.45)	0.18 (z = 1.87)	0.30 (z = 3.72)	0.12 (z = 1.19)
Savoring the future[a]	0.072 (.056–0.087)	235.94 (p = .00)	−0.06 (z = −0.74)	0.20 (z = 2.08)	0.28 (z = 3.38)	0.12 (z = 1.22)
			Psychological resources			
Optimism	0.075 (0.059–0.090)	243.70 (p = .00)	−0.06 (z = −0.70)	0.04 (z = 0.38)	0.26 (z = 3.10)	0.16 (z = 1.64)
Ego-resilience	0.075 (0.059–0.090)	243.13 (p = .00)	−0.07 (z = −0.83)	0.25 (z = 2.53)	0.14 (z = 1.65)	0.14 (z = 1.42)
Personal growth	0.073 (0.057–0.088)	237.88 (p = .00)	0.00 (z = −0.05)	0.14 (z = 1.42)	0.30 (z = 3.75)	0.13 (z = 1.37)
Environmental mastery[a]	0.070 (0.054–0.086)	231.02 (p = .00)	0.06 (z = 0.66)	0.33 (z = 3.37)	0.38 (z = 4.86)	0.06 (z = 0.64)
Autonomy	0.075 (0.059–0.090)	243.87 (p = .00)	−0.08 (z = −0.94)	−0.01 (z = −0.07)	0.18 (z = 2.15)	0.17 (z = 1.72)
Self-acceptance[a]	0.072 (0.056–0.088)	236.21 (p = .00)	−0.08 (z = −0.92)	0.27 (z = 2.77)	0.42 (z = 5.45)	0.05 (z = 0.58)
Purpose in life[a]	0.076 (0.060–0.091)	245.55 (p = .00)	0.11 (z = 1.30)	0.29 (z = 2.95)	0.40 (z = 5.09)	0.07 (z = 0.71)
			Social resources			
Social support given	0.071 (0.055–0.087)	233.63 (p = .00)	0.16 (z = 1.82)	0.15 (z = 1.49)	0.15 (z = 1.77)	0.15 (z = 1.57)
Social support received[a]	0.072 (0.056–0.087)	235.84 (p = .00)	−0.09 (z = −0.98)	0.25 (z = 2.54)	0.21 (z = 2.54)	0.13 (z = 1.28)
Positive relations with others[a]	0.071 (0.055–0.086)	232.06 (p = .00)	−0.01 (z = −0.10)	0.29 (z = 2.97)	0.36 (z = 4.54)	0.08 (z = 0.79)
			Physical resources			
Illness symptoms[a]	0.071 (0.055–0.086)	232.82 (p = .00)	−0.09 (z = −1.01)	−0.24 (z = −2.47)	−0.20 (z = −2.37)	0.13 (z = 1.27)
Duration of sleep	0.072 (0.057–0.088)	236.80 (p = .00)	−0.11 (z = −1.22)	−0.14 (z = −1.35)	0.01 (z = 0.14)	0.18 (z = 1.78)

Note. RMSEA = root-mean-square error of approximation; CI = confidence interval. Parameter estimates are reported in standardized units. Path D was tested in a separate set of models, for which the RMSEA values and parameter estimates for Paths A, B, and C were slightly different than those listed above. For purposes of brevity, we have not presented these slightly different values when Path D was incorporated in the model.

[a]Model was a good fit for the data, and the predicted build-hypothesis paths (Paths B and C) were significant.

Table 5

Variance Explained in Change in Resources and Change in Life Satisfaction and Depression for Significant Resources

	Life-satisfaction models		Depression models (negative symptoms only)	
Resource	**Δ resource R^2**	**Δ life satisfaction R^2**	**Δ resource R^2**	**Δ depression R^2**
		Cognitive resources		
Mindfulness	0.06	0.06	0.06	0.22
Pathways thinking	0.05	0.06	0.05	0.15
Savoring the future	0.05	0.08	0.05	0.16
		Psychological resources		
Environmental mastery	0.10	0.15	0.10	0.25
Self-acceptance	0.09	0.18	0.09	0.24
Purpose in life	0.08	0.16	0.08	0.29
		Social resources		
Social support received	0.08	0.04	0.08	0.15
Positive relations with others	0.08	0.13	0.09	0.24
		Physical resources		
Illness symptoms	0.06	0.04	0.05	0.18

Note. The variance estimates reported for the life-satisfaction models is for models that include Paths A, B, and C, but not D, because this path was not significant for any of the life-satisfaction models tested. The variance reported for the depression models is for models that include Paths A, B, C, and D, because path D was significant for each of the depression models tested. Direct effects from experimental condition and time spent meditating to resource and life satisfaction/depression were not included in any of the models.

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Table 6

Resource Models Tested With Depressive Symptoms (Negative Symptoms Only) as Outcome Variable

Resource tested	RMSEA (90% CI)	$\chi^2(136, N = 139)$	Path A	Path B	Path C	Path D
			Cognitive resources			
Mindfulness[a]	0.070 (0.053–0.085)	227.53 (p = .00)	−0.10 (z = −1.18)	0.20 (z = 2.06)	−0.28 (z = −3.88)	−0.31 (z = −3.06)
Agency thinking	0.074 (0.059–0.090)	240.88 (p = .00)	−0.03 (z = −0.39)	0.18 (z = 1.77)	−0.27 (z = −3.41)	−0.30 (z = −3.25)
Pathways thinking[a]	0.072 (0.056–0.087)	233.37 (p = .00)	−0.03 (z = −0.31)	0.22 (z = 2.23)	−0.17 (z = −2.02)	−0.31 (z = −3.22)
Savoring the past	0.069 (0.053–0.085)	226.33 (p = .00)	0.05 (z = 0.52)	0.16 (z = 1.59)	−0.23 (z = −2.81)	−0.32 (z = −3.39)
Savoring the present	0.073 (0.057–0.088)	237.09 (p = .00)	−0.13 (z = −1.46)	0.19 (z = 1.89)	−0.42 (z = −5.62)	−0.27 (z = −3.04)
Savoring the future[a]	0.072 (0.056–0.087)	233.93 (p = .00)	−0.07 (z = −0.75)	0.21 (z = 2.15)	−0.19 (z = −2.37)	−0.31 (z = −3.24)
			Psychological resources			
Optimism	0.075 (0.059–0.090)	241.11 (p = .00)	−0.06 (z = −0.70)	0.04 (z = 0.40)	−0.10 (z = −1.27)	−0.35 (z = −3.63)
Ego-resilience	0.075 (0.059–0.090)	242.45 (p = .00)	−0.07 (z = −0.83)	0.25 (z = 2.53)	−0.02 (z = −0.25)	−0.35 (z = −3.45)
Personal growth	0.075 (0.059–0.090)	241.56 (p = .00)	0.00 (z = −0.04)	0.14 (z = 1.45)	−0.35 (z = −4.58)	−0.30 (z = −3.35)
Environmental mastery[a]	0.071 (0.056–0.087)	232.54 (p = .00)	0.06 (z = 0.69)	0.33 (z = 3.39)	−0.37 (z = −4.61)	−0.24 (z = −2.57)
Autonomy	0.072 (0.057–0.087)	243.07 (p = .00)	−0.08 (z = −0.94)	−0.01 (z = 0.07)	−0.08 (z = −0.98)	−0.35 (z = −3.66)
Self-acceptance[a]	0.073 (0.058–0.089)	237.81 (p = .00)	−0.08 (z = −0.93)	0.27 (z = 2.78)	−0.35 (z = −4.36)	−0.25 (z = −2.71)
Purpose in life[a]	0.076 (0.061–0.091)	246.05 (p = .00)	0.12 (z = 1.33)	0.29 (z = 2.97)	−0.43 (z = −5.65)	−0.24 (z = −2.66)
			Social resources			
Social support given	0.071 (0.055–0.087)	231.87 (p = .00)	0.16 (z = 1.81)	0.16 (z = 1.59)	−0.06 (z = −0.69)	−0.35 (z = −3.58)
Social support received	0.072 (0.056–0.088)	234.70 (p = .00)	−0.08 (z = −0.98)	0.25 (z = 2.60)	−0.15 (z = −1.80)	−0.32 (z = −3.21)
Positive relations with others[a]	0.071 (0.055–0.086)	230.43 (p = .00)	−0.01 (z = −0.08)	0.30 (z = 3.02)	−0.35 (z = −4.33)	−0.25 (z = −2.71)
			Physical resources			
Illness symptomsa	0.072 (0.056–0.088)	234.74 (p = .00)	−0.09 (z = −1.02)	−0.24 (z = −2.40)	0.26 (z = 3.17)	−0.29 (z = −3.09)
Duration of sleep	0.073 (0.057–0.088)	235.69 (p = .00)	−0.10 (z = −1.11)	−0.15 (z = −1.48)	−0.13 (z = −1.50)	−0.37 (z = −3.87)

Note. RMSEA = root-mean-square error of approximation; CI = confidence interval. Parameter estimates are reported in standardized units.

[a]Model was a good fit for the data, and all predicted build-hypothesis paths (Paths B and C) were significant.