I Think Therefore I Om: Cognitive Distortions and Coping Style as Mediators for the Effects of Mindfulness Meditation on Anxiety, Positive and Negative Affect, and Hope

Sharon Sears and Sue Kraus
Fort Lewis College

This study examined cognitive distortions and coping styles as potential mediators for the effects of mindfulness meditation on anxiety, negative affect, positive affect, and hope in college students. Our pre- and postintervention design had four conditions: control, brief meditation focused on attention, brief meditation focused on loving kindness, and longer meditation combining both attentional and loving kindness aspects of mindfulness. Each group met weekly over the course of a semester. Longer combined meditation significantly reduced anxiety and negative affect and increased hope. Changes in cognitive distortions mediated intervention effects for anxiety, negative affect, and hope. Further research is needed to determine differential effects of types of meditation. © 2009 Wiley Periodicals, Inc. J Clin Psychol 65: 561–573, 2009.

Keywords: mindfulness; meditation; anxiety; coping; cognitive distortions; mediators

> Work with your mind, and you'll be surprised how it changes the outer world.
>
> Chödrön, 2006, 2:14:00

One of the most widely cited definitions of mindfulness is "Paying attention in a particular way: on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 1994, p. 4). The growing scientific, clinical, and secular interest in mindfulness

We wish to thank Erin Treat for her expertise and wisdom in helping to develop and deliver the interventions for this project.
Correspondence concerning this article should be addressed to: Sharon Sears, 1000 Rim Drive, Durango, CO 81301; e-mail: Sears_s@fortlewis.edu

Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/jclp.20543

meditation has produced many excellent intervention studies substantiating its benefits for pain management (Kabat-Zinn, Lipworth, & Burney, 1985); immune function (Davidson et al., 2003); promoting brain activity in areas associated with positive emotion (Davidson et al., 2003), and ruminative thoughts (Jain et al., 2007; Shapiro, Brown, & Biegel, 2007); preventing relapse of depression (Teasdale et al., 2000), anxiety and negative affect (Shapiro et al., 2007); and decreasing perceived stress and promoting self-compassion (Shapiro, Astin, Bishop, & Cordova, 2005). A meta-analysis of mindfulness-based stress-reduction programs concluded that this type of intervention is efficacious for individuals coping with a variety of physical and mental health issues including pain, cancer, heart disease, depression, and anxiety (Grossman, Niemann, & Stefan, 2004).

In a recent theoretical article, Shapiro, Carlson, Astin, and Freedman (2006) propose that with the efficaciousness of mindfulness fairly well established, a next line of inquiry is to determine mediators and moderators of these beneficial effects. In other words, mindfulness works—but how, for whom, and under what circumstances? They call for future longitudinal dismantling research designs as well as statistical tests of mediation.

Thus, the goal of the present study was to examine potential mechanisms for the effects of mindfulness using a dismantling design and statistical tests of mediation. We were particularly interested in examining cognitive distortions and coping style as possible mediators of the effects of mindfulness. In addition, we were interested in teasing out the effective ingredients of mindfulness. Specifically, we developed two different interventions with a focus on either mindful attention or loving kindness. The mindful attention sessions emphasized developing awareness of the breath, sounds, and bodily sensations with a stance of accepting whatever arises. The loving kindness sessions emphasized the practice of "metta," or extending friendliness, compassion, joy, and peacefulness to the self and others. Finally, as Folkman (2008) encouraged in a review of the case for positive emotions in the stress process, we examined outcomes reflecting both positive and negative psychological phenomena, namely positive and negative affect, anxiety, and hope.

Previous studies have examined the effects of mindfulness on thought processes including rumination (Jain et al., 2007; Shapiro et al., 2007), and have integrated cognitive–behavioral components into mindfulness interventions in studying relapse in major depression (Teasdale et al., 2000). Furthermore, Jain et al. found that rumination partially mediated effects of mindfulness meditation on distress. In addition to rumination, another important cognitive mediator to test may be cognitive distortions. In contemporary rational–emotive behavior therapy (REBT), four irrational belief patterns are deemed critical: demandingness, awfulizing, low frustration tolerance, and self-other damnation (Boelen & Baars, 2007). If a key aspect of mindfulness is paying attention in a kind, open, and nonjudgmental way, then one mechanism for its action may be through mitigating these cognitive distortions.

Regarding coping style as a potential mediator, only two pilot studies to our knowledge have examined the effects of mindfulness on coping. One study of employees in a personnel development context found that mindfulness-based stress reduction increased positive strategies for coping using the 120-item German-language Coping with Stress Questionnaire (SVF-120; Walach et al., 2007). A second study of women with heart disease found that mindfulness-based stress reduction decreased the use of a reactive coping style using the 18-item Problem-Focused Styles of Coping measure (PF-SOC; Tacön, McComb, Caldera, & Randolph, 2003).

However, no studies to our knowledge have tested coping as a mediator of effects on other outcomes. By focusing on the present moment with an attitude of acceptance, mindfulness may exert some of its beneficial effects by increasing approach coping and decreasing avoidance coping. Consistent with Shapiro et al.'s (2006) notion of ''reperceiving,'' mindfulness may intersect with traditional stress and coping theory by modifying either primary appraisals (i.e., threat, harm, challenge) or secondary appraisals (i.e., assessment of one's coping resources).

Previous studies have demonstrated the effects of meditation on positive and negative affect as well as anxiety (Shapiro et al., 2007; Tacön et al., 2003). Shapiro and colleagues found that changes in mindfulness as measured by the Mindful Attention Awareness Scale (MAAS) were associated with changes in rumination and anxiety.

No studies to our knowledge have examined the effects of meditation on the positive psychological construct of hope. According to Snyder et al. (1991), hopeful individuals have a sense of goal-directed determination and ability to generate plans to achieve goals (Snyder et al., 1991). Although mindfulness meditation is not goal-orientated in itself, the clarity and acceptance it cultivates may, in turn, increase the likelihood of identifying and pursing tenable goals and effective pathways to achieve them.

The aim of the present study was to investigate changes in cognitive distortions and coping styles as mechanisms for the effects of mindfulness meditation on positive and negative affect, anxiety, and hope. In addition, we attempted to examine the effective ingredients of mindfulness meditation using a dismantling design. To our knowledge, this is the first study of its kind to deliver an intervention focusing on different aspects of mindfulness meditation. We examined these questions in a pre- and postintervention design with four conditions: (a) a control group who received no meditation, (b) a weekly brief meditation group who focused on the attentional aspects of mindfulness, (c) a weekly brief meditation group who focused on the loving kindness aspects of mindfulness, and (d) a weekly longer meditation group who focused on both attentional and loving kindness aspects of mindfulness.

We tested four specific hypotheses: (a) All meditation interventions would significantly impact anxiety, positive and negative affect, cognitive distortions, coping style, and hope. (b) The brief loving kindness group may have greater decreases in cognitive distortions compared to the brief mindful awareness group. Although both groups emphasized acceptance of whatever sensations, thoughts, or feelings may arise, the lovingkindness group additionally emphasized qualities of friendliness, compassion, and joy. We speculated that this focus may have additional impact in decreasing cognitive distortions such as demandingness, awfulizing, low frustration tolerance, and self-other damnation. (c) Cognitive distortions and coping style would mediate the effects of the interventions on anxiety, positive and negative affect, and hope. (d) The longer combined meditation group would have the greatest impact on all outcomes (i.e., anxiety, positive and negative affect, cognitive distortions, coping style, and hope).

Method

Participants

The 57 participants were students at a small liberal arts college who voluntarily completed surveys and participated in varying types and amounts of meditation in a

classroom setting. All participants provided written informed consent. Of participants, 41% were men and 59% women with an average age of 22.80 ($SD = 6.86$). Self-identified ethnic backgrounds for participants were White/non-Hispanic (73%), Native American (20%), and other ethnicities (Hispanic/Latino/a, African American, 7%). Socioeconomic background was varied with 16% reporting fathers with a high school education or less, and 27% reporting fathers with an advanced degree. Mother's education level was reported as 14% with high school education or less, and 11% with advanced degrees.

Design and Procedure

All components of our research design and protocol were approved by our institutional review board (IRB). We used a 4×2 nonrandomized cohort-controlled mixed design (Between Groups: Control, Brief Meditation Focused on Attention, Brief Meditation Focused on Loving Kindness, Longer Meditation Combining Both Attentional and Loving Kindness Aspects of Mindfulness) $\times$ (Within Group Repeated Measures: Preintervention, Postintervention). A similar nonrandomized cohort-controlled approach was recently used by Shapiro et al. (2007). Ten students in an upper division psychology course served as a nonmeditating control group. This group completed pretest surveys early in the semester, and posttest surveys a week prior to the end of class.

Two statistics courses taught by the same instructor were utilized to examine differences between brief mindful attention and loving kindness-focused meditation practice. The instructor was blind to condition and was not present during study recruitment, survey administration, or meditation sessions. This article's first author (S.S.) introduced the study to students in the course at the beginning of a class session during the second week of classes. Participants were aware from the informed consent that they would receive one of two types of meditation, but were not explicitly told which one they were receiving. The type of meditation the two groups received was randomized by cohort. Participation rates for each course were as follows: 19 of 24 (79%) of students in mindful attention, and 17 of 20 (85%) of students in loving kindness. Participants completed 10- to 15-minute guided meditation once a week for 12 weeks in addition to filling out pre- and posttest surveys during the 2nd and 15th week of classes, respectively.

A one-credit meditation class served as the longer combined intensive mediation group. S.S. (who was not the course instructor) introduced the study to students in the course. These students met for 2 hours for seven sessions in addition to filling out pre- and posttest surveys during the 5th and 15th week of the semester, respectively. Of students in the course, 15 of 20 (75%) completed pretest questionnaires, and 11 of 20 (55%) attended the majority of sessions and also completed posttest questionnaires.

Meditation Interventions

All meditation sessions were developed and delivered by the same meditation teacher. The instructor was from a community meditation center who completed Spirit Rock Meditation Center's Community Dharma Leader Program in Woodacre, California. The brief mindful attention sessions focused on developing awareness of the breath, sounds, and bodily sensations with a stance of accepting whatever arises. The brief loving kindness sessions focused on the practice of metta, or extending friendliness, compassion, joy, and peacefulness to the self and others.

The longer intensive meditation sessions included both of these practices, as well as more extensive discussion of the traditional teachings surrounding them. Each session typically included at least two meditation practices. Each practice session was 15–30 minutes in length, with longer practices occurring as the semester progressed and participants gained comfort and experience.

Participants in all of the meditation interventions were encouraged, but not required to practice meditation techniques at home. Participants in the control group were neither encouraged nor prohibited from meditating. In posttest surveys, we asked all participants to estimate, ''This semester, approximately how many minutes per week have you meditated outside of class?'' The number of reported minutes ranged from 0 to 200 ($M = 25$, $SD = 39$). A one-way ANOVA found no significant differences between the four groups on number of reported minutes, df (3, 53) $F = 1.86$, $p = 0.15$.

Measures

The following scales were used as both pre- and posttest measures.

Beck Anxiety Inventory. The Beck Anxiety Inventory (BAI) is a 21-item self-report inventory for measuring anxiety that has demonstrated high internal consistency, test–retest reliability, and discriminant validity (Beck, Epstein, Brown, & Steer, 1988). In particular, it is designed to distinguish anxious from depressive symptoms. Participants rated the extent to which they were bothered by symptoms during the past week. Responses were scored on a 4-point scale (0 = *not at all*; 3 = *severely, I could barely stand it*), with higher scores indicated more anxiety. Cronbach's alphas for internal consistency reliabilities for our sample were .88 (pre) and .91 (post).

Positive and Negative Affect Scale. The Positive and Negative Affect Scale (PANAS) is a 20-item scale, with 10 positive and 10 negative affective descriptors, which has demonstrated sound internal consistency and convergent and discriminant validity (Watson, Clark, & Tellegen, 1988). Participants rated their feelings concerning the affective descriptors during the past week. Responses were scored on a 5-point scale ranging from *very slightly or not at all* to *extremely*. Higher scores indicate higher affect. Cronbach's alphas for internal consistency reliabilities for our sample were as follows: negative affect .85 (pre) and .89 (post); positive affect .84 (pre) and .89 (post).

Irrational Beliefs Scale. The Irrational Beliefs Scale (IBS) is a 20-item measure of cognitive distortions (Malouff & Schutte, 1986). Boelen and Baars (2007) describe specific items and psychometric properties. Participants rated their level of agreement with each belief on a 5-point scale (1 = *strongly disagree*; 5 = *strongly agree*) with higher scores indicating more irrational beliefs. Cronbach's alphas for internal consistency reliabilities were .85 (pre) and .86 (post).

Coping style. Carver (1997) demonstrated validity of the Brief COPE, a 28-item inventory tapping 14 coping styles. As have other researchers (e.g., Sears, Woodward, & Twillman, 2007; Stanton et al., 2000), we collapsed active coping and planning subscales to form an approach coping subscale, and collapsed behavioral disengagement, mental disengagement, and denial subscales to form an avoidance subscale. Participants rated items referring to what they generally do and feel when experiencing stressful events. Cronbach's alphas for internal consistency

reliabilities for our sample were as follows: approach .79 (pre) and .85 (post); avoidance .46 (pre) and .55 (post). The internal consistencies for avoidance coping were similar to that found by Sears et al. (.53), but lower than that found by Stanton et al. (.77).

Hope Scale. Participants completed the Hope Scale (Snyder et al., 1991) to assess perceived successful goal-directed energy (i.e., agency) and the ability to generate plans to achieve goals (i.e., pathways). The scale has eight items plus four fillers rated on 4-point scales, with high scores indicating high hope. Snyder et al. (1991) documented the scale's high reliability and convergent, discriminant, and predictive validities. Cronbach's alphas for internal consistency reliabilities were .80 (pre) and .78 (post).

Results

Preliminary analyses using one-way ANOVAs suggested that participants in the four intervention conditions were not significantly different prior to the intervention in demographics, prior meditation experience, or any of our outcome variables (i.e., cognitive distortions, coping style, anxiety, hope, positive or negative affect).

Intervention Effects

We assessed effects of the intervention using 4×2 mixed design ANOVAs (Between Groups: Control, Brief Meditation Focused on Attention, Brief Meditation Focused on Loving Kindness, Longer Meditation Combining Both Attentional and Loving Kindness Aspects of Mindfulness) $\times$ (Within Group Repeated Measures: Preintervention, Postintervention) with alpha set at .05. We included partial η^2 as an indicator of effect size whenever possible to reflect the proportion of variance that the independent variable accounted for in the dependent variable. We used values of .010, .059, and .138 as indicators of small, medium, and large effect sizes (these are approximately equivalent to Cohen's *d*s of 0.2, 0.5, and 0.8, respectively).

No main effects emerged for groups or time (all $ps > .10$). The lack of main effects allows a clear examination of our research questions in that the interactions between treatment group and time were most relevant to our hypotheses. Table 1 shows descriptive statistics and Table 2 shows ANOVA interaction results. Figures 1 and 2 display pre- and postintervention means by intervention group for BAI and PANAS negative outcomes, respectively.

Consistent with hypotheses, interactions between groups and pre- and postassessments were significant for the BAI, PANAS negative, Irrational Beliefs Scale, and Hope Scale. As indicated by the partial η^2s, effect sizes for the interactions were medium to large. Although the interactions were not statistically significant for PANAS positive, approach coping, or avoidance coping, the effect sizes for the interactions were nonetheless medium, suggesting potentially meaningful impact of the intervention on these outcomes.

As the patterns in Figures 1 and 2 suggest, longer meditation may mitigate anxiety and negative affect over the course of a semester. Similarly, longer meditation increased hope. As reported above, there were no preexisting differences between groups on any outcomes. To identify where the differences occurred between groups for changes in outcome variables as a result of the intervention, we conducted follow-up one-way ANOVAs using Bonferroni corrections for multiple comparisons (i.e., dividing $p < .05$ by the number of follow-up comparisons for each analysis as

Table 1
Descriptive Statistics for Effects of Intervention on Anxiety, Positive and Negative Affect, Cognitive Distortions, Coping, and Hope

Outcome	Group	*n*	Pre *M* (*SD*)	Post *M* (*SD*)
BAI				
	Control	10	10.49 (8.39)	14.91 (10.79)
	Loving kindness	17	12.53 (9.24)	10.85 (10.35)
	Attention	19	8.19 (6.52)	7.90 (5.93)
	Combined	11	12.00 (6.57)	5.55 (4.55)
	Total	57	10.67 (7.80)	9.58 (8.64)
PANAS Negative				
	Control	10	20.92 (8.71)	26.20 (11.20)
	Loving kindness	17	22.23 (7.45)	22.47 (7.90)
	Attention	19	19.89 (6.94)	19.89 (5.37)
	Combined	11	22.50 (4.58)	17.50 (6.72)
	Total	57	21.25 (7.00)	21.38 (7.98)
PANAS Positive				
	Control	10	37.30 (4.50)	34.30 (10.81)
	Loving kindness	17	33.53 (5.80)	33.32 (6.49)
	Attention	19	37.37 (6.95)	36.05 (7.88)
	Combined	11	33.50 (8.33)	37.11 (5.69)
	Total	57	35.50 (6.63)	35.10 (7.69)
Irrational Beliefs Scale				
	Control	10	47.95 (12.93)	49.30 (10.75)
	Loving kindness	17	54.53 (13.05)	56.06 (10.50)
	Attention	19	53.11 (9.71)	52.37 (12.19)
	Combined	11	53.36 (10.29)	48.00 (13.01)
	Total	57	52.68 (11.40)	52.09 (11.73)
Approach coping				
	Control	10	13.20 (2.25)	13.40 (2.37)
	Loving kindness	17	12.35 (2.40)	11.82 (2.65)
	Attention	19	12.89 (2.51)	12.42 (2.71)
	Combined	11	12.18 (2.99)	13.91 (2.26)
	Total	57	12.65 (2.50)	12.70 (2.61)
Avoidance coping				
	Control	10	10.80 (1.93)	10.70 (2.79)
	Loving kindness	17	11.24 (2.54)	11.35 (2.03)
	Attention	19	11.16 (2.22)	11.11 (2.38)
	Combined	11	11.55 (3.08)	9.77 (2.58)
	Total	57	11.19 (2.40)	10.85 (2.40)
Hope				
	Control	10	53.45 (7.09)	53.35 (5.84)
	Loving kindness	17	49.66 (6.57)	48.18 (7.46)
	Attention	19	51.34 (5.36)	53.11 (5.11)
	Combined	11	51.82 (8.95)	55.00 (5.35)
	Total	57	51.30 (6.76)	52.04 (6.47)

Note. BAI = Beck Anxiety Inventory; PANAS = Positive and Negative Affect Scale; Control = control group; Attention = brief meditation focused on attention; Loving kindness = brief meditation focused on loving kindness; Combined = longer meditation combining both attentional and loving kindness aspects of mindfulness.

recommended by Green, Salkind, & Akey, 2000). Although not statistically significant using this very conservative approach, the most pronounced differences appeared between the control group and the longer combined meditation

Table 2
4 × 2 ANOVA Interactions for Effects of Intervention on Pre- and Postintervention Changes in Anxiety, Positive and Negative Affect, Cognitive Distortions, Coping, and Hope

Outcome	*df*	*F*	*p*	Partial η^2
BAI	3, 52	3.35	.03*	.162
PANAS Negative	3, 52	3.04	.04*	.149
PANAS Positive	3, 53	1.36	.27	.073
Hope	3, 53	3.22	.03*	.154
Irrational Beliefs Scale	3, 53	2.71	.05*	.133
Approach coping	3, 53	1.64	.19	.086
Avoidance coping	3, 53	1.66	.19	.086

Note. We used partial η^2 values of .010, .059, and .138 as indicators of small, medium, and large effect sizes (these are approximately equivalent to Cohen's *d*s of 0.2, 0.5, and 0.8, respectively). BAI = Beck Anxiety Inventory, PANAS = Positive and Negative Affect Scale.
*$p < .05$.

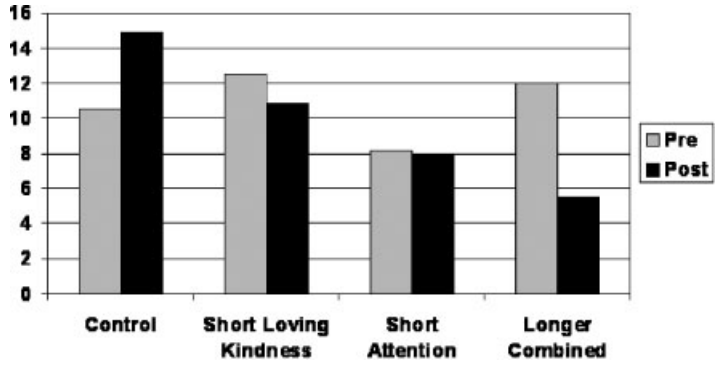

Figure 1. Beck Anxiety Inventory averages for pre- and postintervention and condition. Preliminary analyses using one-way ANOVAs suggested that participants in the four intervention conditions were not significantly different prior to the intervention in anxiety.

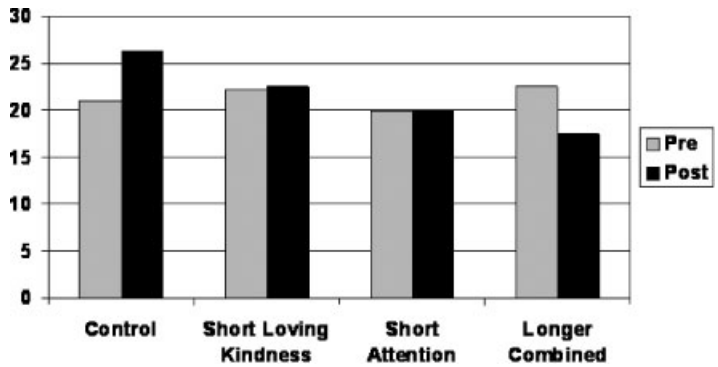

Figure 2. Positive and Negative Affect Scale negative averages for pre- and postintervention and condition. Preliminary analyses using one-way ANOVAs suggested that participants in the four intervention conditions were not significantly different prior to the intervention in negative affect.

Table 3
Zero-Order Correlations Between Changes in Cognitive Distortions, Coping, Hope, Anxiety, and Positive and Negative Affect

Potential mediators	ΔBAI	ΔPANAS Negative	ΔPANAS Positive	ΔHope
ΔIrrational Beliefs Scale	.42**	.40**	−.36**	−.39**
ΔApproach coping	−.12	−.07	.37**	.32*
ΔAvoidance coping	.16	.27*	−.02	−.17

Note. Change scores were calculated as the difference between pre- and postintervention scores. Thus, an increase in cognitive distortions related to an increase in anxiety and negative affect and a decrease in positive affect and hope. BAI = Beck Anxiety Inventory, PANAS = Positive and Negative Affect Scale. $n = 46$.
*$p < .05$.**$p < .01$.***$p < .001$.

intervention for beneficial changes in BAI ($p = .018$) and PANAS negative scores ($p = .024$). No individual post hoc comparisons were statistically significant for other outcomes (i.e., PANAS positive, Irrational Beliefs Scale, Approach Coping, Avoidance Coping, and Hope Scale).

Cognitive Beliefs and Coping Style as Possible Mediators

According to the Baron and Kenny (1986) approach suggested by Shapiro et al. (2006), three conditions are required to establish mediation. First, that the primary predictor variable (in this case our intervention) must be associated with outcomes (in this case the BAI, PANAS, and hope). Second, that the primary predictor variable (in this case our intervention) must be associated with the mediator variable (in this case the Irrational Beliefs Scale and/or approach and avoidance coping). Third, that when the primary predictor variable and mediator are entered into the same equation, the mediator variable is a unique predictor of outcomes, and the effects of the primary predictor become nonsignificant.

Zero-order correlations between potential mediators and outcomes appear in Table 3. As indicated in the above primary analyses of intervention effects reported in Table 2, the intervention did not significantly impact PANAS positive scores and therefore did not meet the first criterion for mediation. Thus, we examined only BAI, PANAS negative, and the Hope Scale as outcomes in mediation analyses. In addition, only the Irrational Belief Scale (and not approach or avoidance coping) met the second criterion for establishing mediation. Thus, in subsequent analyses, we examine only cognitive distortions as a mediator.

To assess whether cognitive distortions may be a driving mechanism for changes in the BAI, PANAS, and Hope Scale, we conducted analyses first with the intervention group alone entered as a predictor. Then we conducted separate analyses with intervention group as a predictor and cognitive distortions as a covariate. Table 4 displays results, and Figure 3 depicts results for hope outcomes. Consistent with hypotheses, a change in Irrational Belief Scale scores was a significant unique predictor of all outcomes, and the effect of the intervention became nonsignificant. Thus, change in cognitive distortions was a mediator of intervention effects for anxiety, negative affect, and hope.

Table 4
4 × 2 ANCOVA Interactions for Effects of Intervention Group on Pre- and Postintervention Changes in Anxiety, Negative Affect, and Hope, First Without and Then With Cognitive Distortions as a Mediator

Outcome	*df*	*F*	*p*	Standardized β	Δβ
BAI					
Step 1					
Group	3, 52	3.35	.03*	.163	
Step 2					
Group	3, 52	2.49	.07	.128	−.035
Irrational beliefs	1, 52	8.35	.006**	.141	
PANAS Negative					
Step 1					
Group	3, 52	3.04	.04*	.149	
Step 2					
Group	3, 52	2.10	.11	.110	−.039
Irrational beliefs	1, 52	7.26	.01*	.125	
Hope					
Step 1					
Group	3, 53	3.22	.03*	.154	
Step 2					
Group	3, 53	2.12	.11	.107	−.047
Irrational beliefs	1, 53	6.18	.02*	.106	

Note. In Step 1, we entered the intervention group alone as a predictor. In Step 2, we entered the intervention group as a predictor and cognitive distortions as a covariate. BAI = Beck Anxiety Inventory; PANAS = Positive and Negative Affect Scale.
*$p < .05$. **$p < .01$. ***$p < .001$.

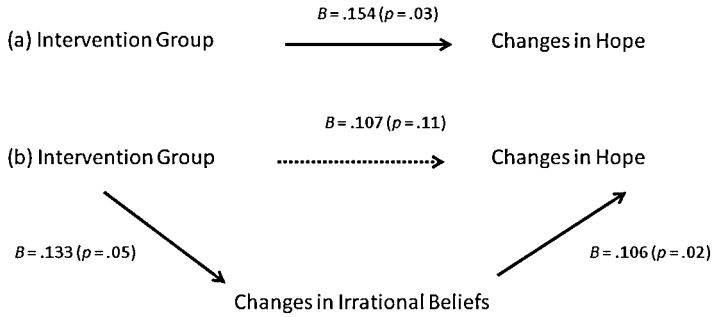

Figure 3. Cognitive distortions as a mediator of the effect of the intervention on hope.

Discussion

This study provides an important step toward empirically investigating how mindfulness works as encouraged by Shapiro and colleagues (2006). Consistent with hypotheses, changes in cognitive distortions mediated intervention effects for anxiety, negative affect, and hope. Although the effects of the longer combined intervention on approach and avoidance coping were in the expected directions with medium effect sizes overall, they were not statistically significant when compared to the other groups, and thus were not further tested as mediators.

We found that meditation can reduce anxiety and negative affect while increasing hope in a nonclinical population. Our results suggest that the weekly longer

meditation focused on both attentional and loving kindness aspects of mindfulness helped to reduce anxiety and negative affect and improve hope. The shorter meditation sessions showed some evidence of mitigating normal increases in anxiety and negative affect over the course of the semester.

Statistical examination of mediator variables suggested that the reduction in cognitive distortions that meditation practice provides is an important driving mechanism for reductions in anxiety and negative affect and increases in hope. Those who reduced their agreement to irrational belief statements such as "to be a worthwhile person I must be thoroughly competent in everything I do" showed the largest reductions in anxiety and negative affect and increases in hope. This suggests that future research might focus on how to shape meditation interventions that effectively reduce cognitive distortions.

Strengths of our study included a pre- and postdismantling design, statistical tests of mediation, having the same meditation instructor develop and deliver all interventions, and the study of positive as well as negative psychological outcomes. Nonetheless, a number of limitations warrant discussion. One limitation was that groups were nonrandomized, and pretest assessments were at slightly different times in the semester. However, the lack of difference in pretest scores somewhat strengthens our conclusions.

A second limitation is that type and duration of practice were confounded across the meditation interventions. Because we were operating within the constraints of existing courses, these conditions were not ideal and thus preclude conclusions regarding whether combined and/or longer practice is most effective. A specific recommendation for future research would be to compare loving kindness meditation, mindfulness meditation, and a combination of the two, where each practice is engaged in for an equal length of time, compared to a control group, using random assignment and longitudinal assessment with multiple data points.

A third issue is that students in the two statistics classes volunteered to participate in the study based on some interest in meditation, but their initial level of interest may not have been as high as students enrolled in the longer enrichment class on meditation. Thus, it is possible that meditation was more effective for the latter group because of "buy-in" to the intervention. This potential difference is not a major threat to our overall conclusions, but does suggest the need for researchers and clinicians to be aware of the context of mindfulness interventions and the impact of preexisting interest in the approach.

A fourth limitation is that our outcome measures rely on self-report, and the internal consistency for the avoidance coping subscale of the COPE was low and should be interpreted with caution. We used the Baron and Kenny (1986) approach suggested by Shapiro et al. (2006) to test statistical mediation, which proved an additional limitation to the study. Although this approach does not require temporal relationships between variables, emerging theory and practice in statistics suggest that establishing temporal relationships may be important (e.g., Kraemer, Kiernan, Essex, & Kupfer, 2008). Although we have established some temporal relationships by virtue of our pre- and postdesign, ideally we would have had an additional midpoint measure of cognitive distortions.

Finally, our study was limited by our sample, which was from a nonclinical population and was relatively small for conducting mediation analyses. Although studying anxiety and positive and negative affect in this population is important, whether results would generalize to larger samples or clinical samples is a question for future research.

Overall, this work makes an important step toward discovering how mindfulness meditation may work in reducing anxiety and negative affect and increasing positive affect and hope. Mindfulness may work in part by modifying distorted cognitive thought processes. Although the fundamental philosophy and intent of mindfulness may be to evoke clarity and awakening through observation rather than change per se, this practice nonetheless may promote adaptation by helping people to see more clearly and approach whatever arises with acceptance and kindness. As thinking beings, how we pay attention may affect how we are.

References

Baron, R.M., & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51, 1173–1182.

Beck, A.T., Epstein, N., Brown, G., & Steer, R.A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. Journal of Consulting and Clinical Psychology, 56, 893–897.

Boelen, P.A., & Baars, L.P.Y. (2007). Psychometric properties of the Beliefs Scale. European Journal of Psychological Assessment, 23, 133–140.

Carver, C.S. (1997). You want to measure coping but your protocol's too long: Consider the Brief COPE. International Journal of Behavioral Medicine, 4, 92–100.

Chödrön, P. (Speaker). (2006). Bodhisattva mind: Teachings to cultivate courage and awareness in the midst of suffering [Audiobook CD]. Louisville, CO: Sounds True.

Davidson, R.J., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S., et al. (2003). Alterations in brain and immune function produced by mindfulness meditation. Psychosomatic Medicine, 65, 564–570.

Folkman, S. (2008). The case for positive emotions in the stress process. Anxiety, Stress, and Coping: An International Journal, 21, 3–14.

Green, S.B., Salkind, N.J., & Akey, T.M. (2000). Using SPSS for Windows. Upper Saddle River, NJ: Prentice Hall.

Grossman, P., Niemann, L., & Stefan, S. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. Journal of Psychosomatic Research, 57, 35–43.

Jain, S., Shapiro, S.L., Swanick, S., Roesch, S.C., Mills, P.J., Bell, I., et al. (2007). A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. Annals of Behavioral Medicine, 33, 11–21.

Kabat-Zinn, J. (1994). Wherever you go there you are: Mindfulness meditation in everyday life. New York: Hyperion.

Kabat-Zinn, J., Lipworth, L., & Burney, R. (1985). The clinical use of mindfulness meditation for the self-regulation of chronic pain. Journal of Behavioral Medicine, 8, 163–190.

Kraemer, C.K., Kiernan, M., Essex, M., & Kupfer, D.J. (2008). How and why criteria defining moderators and mediators differ between the Baron & Kenny and MacArthur approaches. Health Psychology, 27(2 Suppl.), S101–S108.

Malouff, J.M., & Schutte, N.S. (1986). Development and validation of a measure of irrational belief. Journal of Consulting and Clinical Psychology, 54, 860–862.

Sears, S.R., Woodward, J.T., & Twillman, R.K. (2007). What do I have to lose? Effects of a psycho-educational intervention on cancer patient preference for resuscitation. Journal of Behavioral Medicine, 30, 533–544.

Shapiro, S., Astin, J., Bishop, S., & Cordova, M. (2005). Mindfulness-based stress reduction for health care professionals: Results from a randomized trial. International Journal of Stress Management, 12, 164–176.

Shapiro, S.L., Brown, K.W., & Biegel, G.M. (2007). Teaching self-care to caregivers: Effects of mindfulness-based stress reduction on the mental health of therapists in training. Training and Education in Professional Psychology, 1, 105–115.

Shapiro, S., Carlson, L., Astin, J., & Freedman, B. (2006). Mechanisms of mindfulness. Journal of Clinical Psychology, 62, 373–386.

Snyder, C.R., Harris, C., Anderson, J.R., Holleran, S.A., Irving, L.M., Sigmon, S.T., et al. (1991). The will and the ways: Development and validation of an individual-differences measure of hope. Journal of Personality and Social Psychology, 60, 570–585.

Stanton, A.L., Danoff-Burg, S., Cameron, C.L., Bishop, M., Collins, C.A., Kirk, S.B., et al. (2000). Emotionally expressive coping predicts psychological and physical adjustment to breast cancer. Journal of Consulting and Clinical Psychology, 68, 875–882.

Tacón, A., McComb, J., Caldera, Y., & Randolph, P. (2003). Mindfulness meditation, anxiety reduction, and heart disease: A pilot study. Family & Community Health, 26, 25–33.

Teasdale, J.D., Segal, Z.V., Williams, J.M.G., Ridgeway, V.A., Soulsby, J.M., & Lau, M.A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. Journal of Consulting and Clinical Psychology, 68, 615–623.

Walach, H., Nord, E., Zier, C., Dietz-Waschkowski, B., Kersig, S., & Schupback, H. (2007). Mindfulness-based stress reduction as a method for personnel development: A pilot evaluation. International Journal of Stress Management, 14, 188–198.

Watson, D., Clark, L.A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect. Journal of Personality and Social Psychology, 54, 1063–1070.