

Research Article

## Does a Brief Mindfulness Training Enhance Heartfulness in Students? Results of a Pilot Study

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### Abstract

**Background:** There is robust evidence that mindfulness trainings enhance mindfulness as operationalized in Western psychology, but evidence about their effect on aspects of heartfulness is sparse. The present study, therefore, sought to evaluate whether a brief mindfulness training enhances heart qualities, including self-compassion, gratitude, and the generation of feelings of happiness.

**Methods:** Eighteen students enrolled in a mindfulness training that was offered as part of an interdisciplinary class. The training consisted of five training sessions and four booster sessions of 45 min each over the course of nine weeks. Mindfulness was measured with the Five Facet Mindfulness Questionnaire-Short Form (FFMQ-SF) and self-compassion was



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measured with the Self-Compassion Scale Short Form (SCS-SF). In addition, two items were drawn from the Caring for Bliss Scale (CBS) measuring gratitude and the generation of feelings of happiness in the present moment. Assessments were conducted before the training (pre), after the training (post), and four weeks after the completion of the training (follow-up).

**Results:** Results demonstrated that mindfulness, general self-compassion, and the generation of feelings of happiness increased from pre to post, while self-critical attitudes decreased; also, these changes were maintained at follow-up. Gratitude increased from pre to post and then decreased from post to follow-up.

**Conclusions:** A brief mindfulness training seems to be beneficial for students to improve mindfulness and aspects of heartfulness, but further research is needed to investigate the effectiveness of the training relative to a cohort or active control group.

### **Keywords**

Mindfulness; self-compassion; gratitude; happiness; caring for bliss; training; students

## **1. Introduction**

Stress and mental health issues have become an increasing problem among college students [1, 2]. However, there is evidence that mindfulness-based trainings, such as the Mindfulness-Based Stress Reduction (MBSR) training [3], are effective in reducing stress-related symptoms. For instance, a meta-analysis covering nonclinical populations revealed that MBSR increased mental health, such as well-being, and reduced anxiety and depression relative to controls [4]. Similarly, a meta-analysis in healthy adults showed that MBSR reduced perceived stress, psychological distress, and severity of global psychological symptoms relative to waitlist controls [5]. A more recent meta-analysis which involved 18 studies revealed that MBSR reduced perceived stress, distress, anxiety, depression, burnout, and low quality of life in healthy adults compared to controls [6]. There are also three meta-analyses that examined the effectiveness of mindfulness-based interventions on stress indicators among college students. Regehr, Glancy, and Pitts [1] meta-analyzed 24 studies with students of a wide range of disciplines (e.g., nursing, economics, technology) and found that cognitive, behavioral, and mindfulness-based interventions were able to reduce anxiety, depression, and cortisol relative to controls. McConville, McAleer, and Hahne [7] reviewed 19 studies with health profession students (e.g., medicine, social work, psychology) and found that mindfulness-based interventions decreased the level of stress, anxiety, and depression and improved mindfulness, mood, self-efficacy, and empathy relative to controls. In a recent meta-analysis with 25 studies with college students of diverse disciplines, Bamber and Morpeth [8] found that mindfulness meditation reduced students' anxiety relative to no-treatment controls.

In Western psychology, mindfulness has been defined as “moment-to-moment, non-judgmental awareness, cultivated by paying attention in a specific way, that is, in the present moment, and as non-reactively and as non-judgmentally and openheartedly as possible” [9]. The term mindfulness here is used to refer primarily to the meta-awareness and not to the focusing aspect of mind [10]. Mindfulness is the key element in the 8-week MBSR training which consists of

weekly group sessions (2-2.5 h), one retreat day in silence (7-8 h), and daily home assignments (45-60 min). In the MBSR training, participants learn formal as well as informal mindfulness practices. The formal mindfulness practices include the body scan, mindful yoga, and different forms of meditation. The informal mindfulness practices refer to mindfulness while conducting daily activities, such as taking a shower or washing dishes. The home assignments typically involve practicing mindfulness with the help of a CD.

A related construct to mindfulness is self-compassion. Self-compassion can be defined as kindness toward oneself in the face of personal shortcomings, inadequacies, or failures [11]. It consists of three core components: treating oneself kindly during difficult times, recognizing that mistakes or failures are part of the common human experience, and maintaining a balanced awareness of painful thoughts and feelings. Germer and Neff [12] and Neff and Germer [13] developed an 8-week Mindful Self-Compassion (MSC) program, in which participants learn formal as well as informal mindful self-compassion practices, such as a compassionate body scan or placing one's hand on one's heart during times of stress. The program resembles Kabat-Zinn's MBSR approach, and is as time-intensive as the MBSR program, with the exception that the program includes a half-day retreat instead of a one-day retreat. Kirby, Tellegen, and Steindl [14] conducted a meta-analysis of 21 randomized controlled trials to examine the effect of compassion-based interventions (e.g., MSC, Loving-kindness, Compassion Focused Therapy) on mindfulness, self-compassion, and health outcomes. Substantial effects in favor of the compassion-based interventions were found for increased levels of compassion, self-compassion, mindfulness, and well-being, and decreased levels of depression, anxiety, and psychological distress. A meta-analysis of 24 studies by Macbeth and Gumley [15] revealed a negative relationship between self-compassion and psychopathology. In regard to self-compassion, studies have demonstrated that self-critical attitudes correlated more strongly with negative affect, depressive symptoms, perceived stress, rumination, and neuroticism, while compassionate attitudes correlated more strongly with positive affect [16, 17].

Besides self-compassion, the other aspects of mindfulness which are related to the quality of the heart, such as gratitude or feelings of unconditional happiness, have received less attention in the mindfulness research so far [18, 19]. This is surprising because in the Asian language mindfulness may be described as presence of heart as well as mind [20, 21]. Specifically, the Japanese kanji (ideogram) for mindfulness (*nen*) is made up of two parts: the upper part (*ima*), which appears like a roof, means this present moment or the now, and the lower part (*shin*) can be translated as mind or heart. Kabat-Zinn [22] emphasized the gentle, appreciative, and nurturing side of mindfulness practice, and stated that "another way to think of it would be "heartfulness" (p. 7). Based on this, Voci et al. [19] argued that "heartfulness can be used to describe the warm side of mindfulness" (p. 339), and proposed two variables that reflect the quality of heartfulness, namely self-compassion and gratitude. Similarly, Rosenzweig [23] described gratitude and compassion as the "sisters" of mindfulness. Two previous studies found that self-compassion and gratitude mediated the relationship between mindfulness and psychological well-being [19, 24]. Finlay-Jones, Kane, and Rees [25] examined a 6-week online self-compassion program for psychology trainees and found, among others, significant increases in self-compassion and happiness after the training and at follow-up after three months.

There has been an increasing interest in helping students to develop, in addition to scientific and analytical skills, qualities of the heart such as compassion or the development of the person as

a whole [26] through mindfulness. The challenge encountered in integrating the standard MBSR and MSC programs into the curriculum of college students is that these programs require high levels of time commitment, for up to 26 h generally. Carmody and Baer [27] studied the effect of variation in mindfulness-based stress reduction class hours on psychological distress and found that the correlation between the sizes of the effects and the length of a program was neither significant for clinical nor non-clinical samples. Therefore, abbreviated mindfulness programs may be worthwhile for university settings.

The purpose of the present study was to evaluate the impact of a brief mindfulness training (an adapted version of MBSR, with elements of MSC) on heart qualities, including self-compassion, gratitude, and the generation of feelings of happiness, in a student sample. It was hypothesized that a brief 9-week mindfulness training of 45 min per week (6 h and 45 min in total) would enhance mindfulness and heart qualities directly after the training as well as four weeks later.

## **2. Methods**

### **2.1 Participants**

The 9-week mindfulness training was offered as part of an interdisciplinary class in Mindfulness-Based Stress Reduction at Utah State University in 2017 and was advertised through a circular email at the College of Education and Human Services. There were no exclusion criteria other than the age being below 18 years or not being enrolled at Utah State University. A total of 18 students signed up for the class and all of them agreed to participate in the study. Approval for the study was obtained from the Institutional Review Board at Utah State University.

The mean age of the participants was 24 years ( $SD = 4.49$ ; range: 17-33). Among the 18 students, 11 (61.1%) were female and seven (38.9%) were male. Regarding the racial background, 83.3% identified as White or Caucasian and 28% as others.

### **2.2 Mindfulness Training**

The 9-week mindfulness training consisted of weekly 45-min group sessions and was led by the first author, who is a psychotherapist, mind-body medicine therapist, and a hatha yoga trainer. The first author did also attend the 8-week practicum in Mindfulness-Based Stress Reduction at the Center for Mindfulness at the University of Massachusetts Medical School. Table 1 gives an overview of the main components of the training. In the first five sessions, the participants were experientially introduced to the formal mindfulness practices, such as mindful yoga, the body scan, and different forms of meditation. The next four sessions were used to deepen the formal mindfulness practices, and the participants also received some psychoeducation about stress. In all sessions, a focus lied on the group sharing of the experiences with the mindfulness practices. The home assignments were given as invitations to practice mindful self-care. Furthermore, the participants received a handout containing the working definition of mindfulness, the foundational attitudes, and some guidelines for practicing mindfulness, and were also provided with a link to a free audio of mindfulness exercises to support the home practice.

### **2.3 Measures and Procedures**

Two weeks before the start of the mindfulness training, the students received an email containing an online link to the survey and were asked to provide their consent for participating in the study. Assessments were conducted through a web-based survey platform before the training (pre), after the training (post), and four weeks after the completion of the training (follow-up). It took approximately 20 min to complete each survey. The following measures were provided at all measurement points:

*Mindfulness practices.* The familiarity with different mindfulness practices (e.g., sitting meditation, body scan, yoga) was inquired before the start of the training. In addition, the participants were asked to indicate how frequently they practice each of the mindfulness practices they are familiar with on a 6-point scale ranging from 0 (never) to 5 (almost every day). The students were also asked to indicate how useful they found these practices, on a 5-point scale ranging from 0 (not useful at all) to 4 (extremely useful). Directly after the training and four weeks after the training, the participants were solely asked to indicate how frequently they practiced each of the mindfulness practices and how useful they found these practices.

*Mindfulness.* The Five Facet Mindfulness Questionnaire-Short Form (FFMQ-SF) [28] is a 24-item scale and was used to assess overall mindfulness. The items (e.g., “I perceive my feelings and emotions without having to react to them”) were rated on a 5-point scale ranging from 1 (never or very rarely true) to 5 (very often or always true). Negative items were reverse-coded and all items were summed up, with higher scores indicating greater mindfulness (Cronbach’s  $\alpha = 0.80$  at pre, 0.85 at post, and 0.84 at follow-up). The five facets of mindfulness were not analyzed separately because of low internal consistencies ( $\leq 0.70$ ) for three out of the five facets.

*Self-compassion.* The Self-Compassion Scale-Short Form (SCS-SF) [29] consists of 12 items, and was used to assess overall self-compassion as well as the two factors, compassionate attitudes versus self-critical attitudes [30]. The items (e.g., “I’m disapproving and judgmental about my own flaws and inadequacies”) were rated on a 5-point scale ranging from 1 (almost never) to 5 (almost always). A mean score was calculated for self-compassionate attitudes including the items of self-kindness, common humanity, and mindfulness (Cronbach’s  $\alpha = 0.87$  at pre, 0.76 at post, and 0.80 at follow-up), and for self-critical attitudes including the items of self-judgement, isolation, and over-identification (Cronbach’s  $\alpha = 0.86$  at pre, 0.65 at post, and 0.90 at follow-up, respectively). For the overall score, the items of self-critical attitudes were reverse-coded and then a mean score was calculated for all items (Cronbach’s  $\alpha = 0.93$  at pre, 0.77 at post, and 0.92 at follow-up).

*Caring for bliss.* Two items of the Caring for Bliss Scale (CBS) [31] were included in the present study and were analyzed separately. The items were: “I take time to acknowledge the things for which I am grateful” and “I can generate a feeling of happiness in the here and now.” The items are rated on a 5-point scale ranging from 0 (never) to 5 (regularly).

**Table 1** Main components and home assignments of the five mindfulness sessions and the four booster sessions.

Session 1	Session 2	Session 3	Session 4	Session 5	Booster Sessions 6-9
<i>Main components</i>					
Reception and group rules.	Group sharing of the home assignments.	Group sharing of the home assignments.	Group sharing of the home assignments.	Group sharing of the home assignments.	Repetition of the formal mindfulness practices:
Raisin exercise.	Belly breathing and introduction to mindful yoga.	Introduction to the body scan.	Introduction to sitting and walking meditation.	Introduction to the concept of self-compassion.	Mindful yoga, body scan, sitting meditation, walking meditation, self-compassion meditation.
Automatic pilot.				Guided self-compassion meditation.	Psychoeducation stress.
Working definition of mindfulness and foundational attitudes.					
Intro awareness of breathing/belly breathing.					
<i>Home assignments</i>					
Eat one meal mindfully.	Alternate mindful yoga and awareness of breathing at least once in seven days (minimum 15 min).	Alternate body scan and awareness of breathing at least once in seven days (minimum 15 min).	Alternate sitting or walking meditation and awareness of breathing at least once in seven days (minimum 15 min).	Alternate self-compassion meditation and awareness of breathing at least once in seven days (minimum 15 min).	Formal mindfulness practice of choice at least once in seven days (minimum 15 min).
Awareness of breathing at six of seven days before sleeping (minimum 15 min).		Journalize any insight or experience with the practices.	Journalize any insight or experience with the practices.		Invitation to bring an object, poem or anything else related to mindfulness for the final group sharing.

## **2.4 Statistical Analysis**

Data were analyzed with multilevel modeling (MLM) using the packages nlme [32] in R [33] and an intent-to-treat sample containing all the participants [34]. Measurement occasion was used as a time variable, with pre-treatment set to 0, post-treatment set to 1, and follow-up set to 2. For each treatment outcome, a series of growth curve models were run in four steps [35, 36] using Restricted Maximum Likelihood (REML) estimation, which can deal with missing data. In the first step, a random intercept model was estimated in order to calculate the intraclass correlation coefficient (ICC). In the second step, a fixed effect for time was added. In the third step, a random effect for time was included, and tested whether this model was significantly better than the simpler model of step two using the chi-square difference test. In the fourth step, the error structure was assessed using the best model of step three. First, a model with a general correlation structure (i.e., a separate covariance for each distinct pair of time points) was estimated. Second, a separate residual variance for each time point with a general correlation structure was allowed for. These two models were then compared using the chi-square difference test. In comparing the models, the more parsimonious model was selected when there was no difference in the fit between the simpler and the more complex model. In an additional step, a covariate reflecting how frequently each participant practiced mindfulness was added to the equation using the selected model.

## **3. Results**

### **3.1 Mindfulness Practices before and after the Training**

The results regarding the familiarity with different mindfulness practices, frequency of practice, and how useful the participants found these practices before the training are provided in Table 2. Awareness of breathing was the most familiar mindfulness practice (83.3%) and self-compassion or loving-kindness was the least familiar (27.8%). Among the participants who reported to be familiar with the awareness of breathing, 83.3% reported to practice it, on an average once every other week. In regard to the usefulness of the practices, the participants rated, on an average, the mindfulness practices which they were familiar with as being not very useful or neutral (usefulness not clear) for oneself.

All 18 participants completed the training and filled out the pre and post-assessment. At follow-up, two participants did not complete the assessment. The results regarding the frequency of practicing different mindfulness practices and how useful the participants found these practices directly after the training and four weeks after the training are provided in Table 3. The most frequently practiced techniques were awareness of breathing, bring mindfulness to a daily activity such as eating, walking, or brushing teeth and tune in to your breathing during the day. The frequency with which the participants reported to practice these techniques ranged between once a week to two or three times a week. The afore-stated three mindfulness practices, as well as self-compassion or loving-kindness, were rated by the participants as the most useful, with the corresponding scores ranging between “somewhat useful” to “extremely useful”.

**Table 2** Familiarity with different mindfulness practices, frequency of practice, and the usefulness for oneself before the training.

Mindfulness practice	n	Familiarity		Frequency		Usefulness	
		%		M	SD	M	SD
Awareness of breathing	15	83.3		2.27	1.33	1.87	0.92
Sitting meditation	14	77.8		1.64	1.65	1.86	1.17
Yoga, Qigong or Tai Chi	11 <sup>a</sup>	61.1		1.73	1.74	1.40	0.52
Bring mindfulness to a daily activity such as eating, walking or brushing teeth	11	61.1		1.82	1.60	1.64	0.67
Body Scan	8 <sup>b</sup>	44.4		0.63	0.74	1.71	0.76
Walking meditation	7	38.9		1.29	1.98	2.29	0.95
Tune into your breathing during the day	7	38.9		2.43	1.72	1.71	1.11
Self-Compassion/Loving-kindness	5	27.8		1.80	1.30	1.00	1.00

Note. M = Mean, SD = Standard deviation. Possible range: 0–5 for frequency of practice (0 = never, 1 = less than once every second week, 2 = about once every second week, 3 = about once a week, 4 = about 2 or 3 times a week, 5 = almost every day), 0–4 for usefulness for oneself (0 = not useful at all, 1 = not very useful, 2 = neutral (usefulness not clear), 3 = somewhat useful, 4 = extremely useful). <sup>a</sup>n = 10 for usefulness item, <sup>b</sup>n = 7 for usefulness item.

**Table 3** Frequency of practicing different mindfulness practices and the usefulness for oneself after the training.

Mindfulness practice	Frequency						Usefulness					
	Post <sup>1</sup>			Fu <sup>2</sup>			Post <sup>1</sup>			Fu <sup>2</sup>		
	n	M	SD	n	M	SD	n	M	SD	n	M	SD
Awareness of breathing	18	3.94	1.21	16	3.81	0.98	18	3.72	0.46	14	3.79	0.43
Sitting meditation	17	2.35	1.32	16	2.44	1.36	18	3.33	0.69	14	3.36	0.63
Yoga, Qigong, or Tai Chi	18	1.56	1.04	16	1.31	1.62	18	3.00	1.19	14	2.79	1.31
Bring mindfulness to a daily activity such as eating, walking, or brushing teeth	18	3.67	1.03	16	3.56	1.09	18	3.50	0.71	14	3.43	0.76
Body Scan	18	1.78	1.17	16	1.75	1.44	18	3.06	1.06	14	2.79	1.05
Walking meditation	18	1.89	1.37	16	1.81	1.52	17	3.06	0.97	14	2.79	1.05
Tune into your breathing during the day	18	4.06	1.21	16	3.81	1.47	18	3.61	0.70	14	3.71	0.47
Self-Compassion/Loving-kindness	18	2.94	1.30	16	2.56	1.41	17	3.47	1.07	14	3.50	0.94

Note. M = Mean, SD = Standard deviation. Fu = Follow-up. Possible range: 0-5 for frequency of practice (0 = never, 1 = less than once every second week, 2 = about once every second week, 3 = about once a week, 4 = about 2 or 3 times a week, 5 = almost every day), 0–4 for usefulness for oneself (0 = not useful at all, 1 = not very useful, 2 = neutral (usefulness not clear), 3 = somewhat useful, 4 = extremely useful). <sup>1</sup>Since the fifth mindfulness training session/last four weeks, <sup>2</sup>Since the last booster session/last four weeks.



### 3.2 Treatment Outcomes

Table 4 shows the means and standard deviations (*SD*) of the treatment outcomes and the effect sizes for the differences between pre-treatment and post-treatment, pre-treatment and four-week follow-up, and post-treatment and four-week follow-up. As can be seen, all changes between pre-treatment and post-treatment were at least small in size. A large effect size change resulted for self-compassion and medium effect size changes were found for self-critical attitudes and happiness. Comparing pre-treatment with follow-up resulted in changes that were at least small in size with the exception of gratitude, which decreased between post and follow-up. Again, the largest effects revealed for self-compassion, self-critical attitudes, and happiness.

**Table 4** Means, standard deviations, and pre-post, pre-follow-up, and post-follow-up comparisons.

Variable	Range	Pre ( <i>n</i> = 18)		Post ( <i>n</i> = 18)		Fu ( <i>n</i> = 16)		Cohen's <i>d</i>		
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	Pre-Post	Pre-Fu	Post-Fu
Mindfulness (FFMQ-SF total)	24-120	74.17	9.05	77.00	8.98	78.88	8.66	0.36	0.54	0.27
Self-compassion (SCS-SF total)	1-5	2.78	0.79	3.02	0.51	3.15	0.65	0.86	0.58	0.29
compassionate attitude	1-5	3.09	0.81	3.26	0.66	3.30	0.59	0.30	0.31	0.08
self-critical attitude	1-5	3.54	0.80	3.21	0.58	3.00	0.78	-0.78	-0.79	-0.51
Gratitude (CBS)	0-4	2.44	0.98	3.06	0.87	2.63	0.89	0.49	0.18	-0.32
Happiness (CBS)	0-4	2.11	0.76	2.39	0.92	2.56	0.81	0.50	0.74	0.30

*Note.* *M* = Mean, *SD* = Standard deviation. Fu = Follow-up. The post-assessment did take place after the ninth training session. The follow-up assessment did take place four weeks after the ninth training session. FFMQ-SF = Five Facet Mindfulness Questionnaire-Short Form, SCS-SF = Self-Compassion Scale-Short Form, CBS = Caring for Bliss Scale, PSS = Perceived Stress Scale.

*Mindfulness.* The growth curve model with a random effect for the intercept, but not for time, the residual variances constrained to be equal across the time points (homoscedasticity), and no residual correlations between the time points was the most appropriate for mindfulness. In this model, the effect of time was positive (2.170; *SE* = 0.970) and statistically significant, with  $t(33) = 2.237$  and  $p = 0.032$ , which indicated that mindfulness increased, on an average, by a factor of 2.17, between the time points. As visible in Table 4, mindfulness increased across all the time points (small effects), indicating that the training had a lasting effect on people’s mindfulness. Adding mindfulness practice as a covariate to the model, neither time nor mindfulness practice were statistically significant ( $b = 1.1785$ ,  $SE = 1.387$ ,  $t(31) = 1.287$ ,  $p = 0.208$  and  $b = 0.412$ ,  $SE = 1.101$ ,  $t(31) = 0.374$ ,  $p = 0.711$ , respectively).

*Self-compassion.* For the total score of self-compassion, the model with random effect for the intercept and time, a separate residual variance for each time point (heteroscedasticity), and no residual correlations between the time points was the most appropriate. In this model, the effect of time was positive (0.206; *SE* = 0.079) and statistically significant, with  $t(33) = 2.623$  and  $p = 0.013$ . The increase in self-compassion was large in size between pre-treatment and post-

treatment and medium between pre-treatment and follow-up (Table 4). The effect of time remained statistically significant even after adding mindfulness practice as a covariate ( $b = 0.234$ ,  $SE = 0.098$ ,  $t(31) = 2.395$ ,  $p = 0.023$ ). No significant effect emerged for mindfulness practice ( $b = -0.037$ ,  $SE = 0.048$ ,  $t(31) = 0.762$ ,  $p = 0.452$ ).

In regard to compassionate attitudes, the growth curve model with a random effect for the intercept, but not for time, the residual variances constrained to be equal across the time points, and no residual correlations between the time points was the most appropriate. In this model, the effect of time ( $0.086$ ;  $SE = 0.074$ ) was statistically not significant, with  $t(33) = 1.174$  and  $p = 0.249$ . The increase in compassionate attitudes towards self between pre-treatment and post-treatment as well as between pre-treatment and follow-up was small in size (Table 4). Adding mindfulness practice as a covariate, neither time nor mindfulness practice were statistically significant ( $b = 0.076$ ,  $SE = 0.105$ ,  $t(31) = 0.727$ ,  $p = 0.473$  and  $b = 0.005$ ,  $SE = 0.083$ ,  $t(31) = 0.057$ ,  $p = 0.955$ , respectively).

In regard to self-critical attitudes, the growth curve model with a random effect for the intercept and time, the residual variances constrained to be equal across the time points, and no residual correlations between the time points was the most appropriate. In this model, the effect of time was negative ( $-0.263$ ;  $SE = 0.082$ ) and statistically significant, with  $t(33) = 3.194$  and  $p = 0.003$ . The decrease in self-critical attitudes was medium in size between all the three time points (Table 4), indicating that the training had a lasting positive effect on self-critical attitudes. Again, the inclusion of mindfulness practice as a covariate resulted in a model in which neither time nor the mindfulness practice were significant ( $b = -0.191$ ,  $SE = 0.101$ ,  $t(31) = 1.893$ ,  $p = 0.068$  and  $b = -0.067$ ,  $SE = 0.063$ ,  $t(31) = 1.053$ ,  $p = 0.300$ , respectively).

*Gratitude.* The growth curve model with no random effect, the residual variances constrained to be equal across the time points, and no residual correlations between the time points was the most appropriate for gratitude. In this model, the effect of time ( $0.101$ ;  $SE = 0.162$ ) was statistically not significant, with  $t(33) = 0.624$  and  $p = 0.535$ . As can be seen from Table 4, gratitude increased substantially between pre-treatment and post-treatment, and then decreased between post-treatment and follow-up, indicating that the training did not have a lasting effect on gratitude. Adding mindfulness practice as a covariate, neither time nor the mindfulness practice were statistically significant ( $b = 0.200$ ,  $SE = 0.210$ ,  $t(31) = 0.948$ ,  $p = 0.348$  and  $b = -0.068$ ,  $SE = 0.158$ ,  $t(31) = 0.431$ ,  $p = 0.668$ , respectively).

*Happiness.* The growth curve model with a random effect for the intercept, but not for time, the residual variances constrained to be equal across the time points, and no residual correlations between the time points was the most appropriate for happiness. In this model, the effect of time was positive ( $0.214$ ;  $SE = 0.073$ ) and statistically significant, with  $t(33) = 2.934$  and  $p = 0.006$ . The increase in happiness was medium in size between pre-treatment and post-treatment as well as between post-treatment and follow-up (Table 4). A medium-size increase occurred between pre-treatment and follow-up, indicating that the program had a lasting effect on people's happiness. Adding mindfulness practice as a covariate, the effect of time remained significant ( $b = 0.224$ ,  $SE = 0.104$ ,  $t(31) = 2.148$ ,  $p = 0.040$ ), while the mindfulness practice yielded not significant ( $b = 0.004$ ,  $SE = 0.083$ ,  $t(31) = 0.043$ ,  $p = 0.966$ ).

#### **4. Discussion**

The present study investigated whether a brief mindfulness training of 6 h and 45 min can improve mindfulness and heart qualities directly after the training and four weeks later among college students. Self-compassion, gratitude, and the generation of feelings of happiness in the here and now were used as indicators of heartfulness. As expected, mindfulness, self-compassion, gratitude, and the generation of feelings of happiness increased from pre to post which was consistent with other studies that demonstrated positive effects on people's mindfulness and self-compassion after a mindfulness-based and compassion-based training [7, 14, 25]. The results of the present study showed that compassionate attitudes toward the self increased and that self-critical attitudes decreased from pre to post, with a larger effect for self-critical attitudes. In fact, self-critical attitudes showed, besides total self-compassion, the strongest effect, which was further reduced substantially four weeks after the completion of the training. The results of the multilevel modeling analysis revealed that there was a significant time effect for mindfulness, general self-compassion, self-critical attitudes, and happiness, which remained significant for general self-compassion and happiness after adding mindfulness practice as a covariate.

These findings are a first answer to the question raised by Costa [30] whether a compassion-based training can increase people's kindness and reduce their self-critical attitudes. The results of the present study indicated that people become kinder as well as less self-critical after receiving mindfulness training. Even though no significance test was performed, the effect sizes and the results of the multilevel modeling analysis suggested that the effect was stronger for self-critical attitudes in comparison to that for compassionate attitudes or kindness. Furthermore, the effects for mindfulness, self-compassion, and the generation of feelings of happiness were maintained even four weeks after the completion of the training, which was not true for gratitude. The finding that the positive effect on gratitude did not last could be attributed to the fact that the training did not explicitly focus on this heart quality, while mindfulness and self-compassion were integral components of the training. Nevertheless, gratitude increased from pre to post indicating that the training did indirectly foster it. However, it should be noted that the generation of feelings of happiness in the present moment increased from pre to post and was even maintained four weeks later, although it was also not explicitly focused on during the training. In fact, the change in happiness was the strongest after the changes of general self-compassion and self-critical attitudes. Therefore, further mindfulness training research on gratitude is needed.

The present study also demonstrated that even students who did not find the mindfulness practices very useful or neutral before the training can benefit from a brief mindfulness training. The overall rating of the usefulness of different mindfulness practices increased from "somewhat useful" to "extremely useful", directly after the training as well as four weeks later. Interestingly, after the training and four weeks later, the students indicated to practice, in particular, the mindfulness techniques that could be practiced everywhere and could be integrated conveniently into daily activities (i.e., awareness of breathing, tune into your breathing during the day, bring mindfulness to a daily activity). This raises the question whether it would be especially useful for students to focus on informal mindfulness practices. It may be that the participants viewed these practices as doable and not as an extra task that was required to be accomplished.

While cultivating mindfulness seems to be a promising intervention for strengthening heart qualities in college students, the present pilot study was based on a relatively small number of

self-selected participants, and therefore, further investigation is warranted. Additionally, the effect of the mindfulness training should be evaluated in comparison to a cohort control group or an active control group (e.g., relaxation group), and it would also be useful to have follow-up measurement points approximately three to six months after the completion of the training. In future studies, it would be interesting to incorporate practices for enhancing gratitude and the generation of feelings of happiness directly in the training. For instance, practices from positive psychology such as counting your blessings or expressing gratitude [37] could be added into the training and combined with mindfulness and compassion. It is also recommended to include different measures of mindfulness, such as the Freiburg Mindfulness Inventory (FMI) [38, 39], in order to examine mindfulness more broadly as well as to include other indicators of heartfulness such as for example generosity.

In conclusion, the findings of the present study suggested that a brief mindfulness training could enhance mindfulness and that even a training based primarily on mindfulness with some self-compassion elements could strengthen aspects of heartfulness directly after the training, and to some extent, even four weeks after the training. The strongest effects were found for general self-compassion, self-critical attitudes, and happiness. Given the enormous costs and prevalence of chronic stress and mental health issues among college students, it may be worth strengthening not just the qualities of the head (i.e., scientific and analytical skills) but also the qualities of the heart, by incorporating mindfulness practices in university settings. The present pilot study demonstrated that it is feasible to integrate a brief mindfulness-based training into a class, and that the students are willing to participate in and benefit from such training.

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## **Author Contributions**

Myriam Rudaz designed and conducted the study and wrote the manuscript. Thomas Ledermann helped with the statistical analysis, writing of the result section, and editing of the manuscript. Michael P. Twohig helped designing the study and editing the manuscript. Michael E. Levin helped designing the study and editing the manuscript.

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## **Competing Interests**

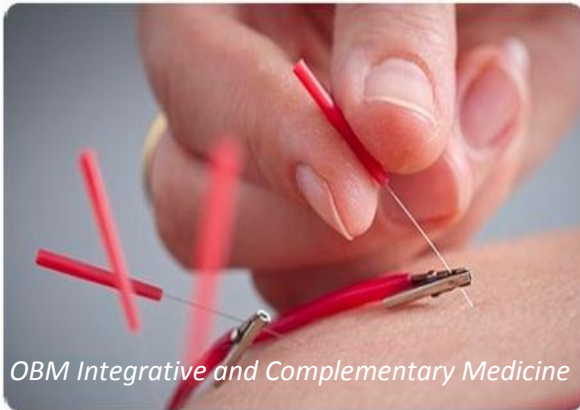
The authors have declared that no competing interests exist.

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