



Meditation Quality Matters: Effects of Loving-Kindness and Compassion Meditations on Subjective Well-being are Associated with Meditation Quality

Xianglong Zeng¹ · Yuan Zheng¹ · Xiaodan Gu¹ · Rong Wang²  · Tian PS. Oei³

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Abstract

Loving-kindness and compassion meditations (LKCM) are considered a promising practice for increasing long-term well-being. While previous studies have mainly focused on meditation practice quantity, the current study provides an initial exploration of the quality of meditation during multiweek LKCM training. Data were collected through offline (Study 1; $N=41$) and online (Study 2; $N=243$) LKCM interventions. Quality of meditation was measured using two kinds of difficulties experienced during LKCM each week/unit (i.e., difficulty in concentration and difficulty in generating prosocial attitudes). Subjective well-being (SWB) was assessed by life satisfaction before and after training as well as positive and negative emotions each week/unit. Two studies consistently suggested that meditation quality was significantly associated with changes in SWB. Study 1 even showed that quality had a stronger association with SWB than did meditation quantity. Moreover, both short-term (measured each week/unit) and long-term (measured across the entire training period) associations between the quality of meditation and SWB were significant. Focusing on meditation quality, our findings provide theoretical and methodological pathways for understanding the contribution of meditation practice to LKCM training, which is helpful for guiding future research and best practices.

Keywords loving-kindness meditation · subjective well-being · appreciative joy · does-effect relationship · best practice

✉ Rong Wang
wangrong815@szu.edu.cn

¹ Beijing Key Laboratory of Applied Experimental Psychology, Faculty of Psychology, National Demonstration Center for Experimental Psychology Education (Beijing Normal University), Beijing Normal University, Beijing, P.R. China

² College of Management, Shenzhen University, Shenzhen, P.R. China

³ School of Psychology, The University of Queensland, Brisbane, QLD, Australia

1 Introduction

Loving-kindness and compassion meditations (LKCM) are a group of Buddhist meditations that have recently been widely applied (Lv et al., 2020). The core psychological operation of LKCM is described as ‘keep generating one’s kind intentions toward certain targets’ (Zeng et al., 2015, p. 1). LKCM practitioners usually imagine a target (e.g., a friend) and generate prosocial attitudes toward him/her by silently repeating blessing phrases. The four LKCM subtypes differ in terms of their imagination and blessing phrases, cultivating four immeasurables (i.e., sublime attitudes). First, loving-kindness meditation imagines peaceful or smiling targets and blesses them with phrases such as ‘may you be happy/safe,’ to cultivate loving-kindness (i.e., friendliness). Second, compassion meditation imagines people suffering and blesses them with ‘may you be free from suffering,’ to cultivate compassion (i.e., willingness to end the suffering). Third, appreciative joy meditation imagines people experiencing success or happiness and blesses them with ‘may you gain more in the future’ to cultivate appreciative joy (i.e., happiness for success of others). Fourth, equanimity meditation imagines various fates of targets and uses ‘he/she is the bearer of his/her fate,’ to cultivate equanimity (i.e., attitude of calm and non-attachment based on wisdom) (Zeng, Chan, et al., 2017). The targets in LKCM change gradually from easy to difficult: usually starting with friends or self, then neutral people, and finally disliked people or all beings (Sujiva, 2007; Zeng, Wang, Oei, et al., 2019).

A series of studies have supported the idea that LKCM training cultivates prosocial attitudes (see Luberto et al., 2018 for a review). Another important LKCM application is generating positive emotions (see Zeng et al., 2015 for a review). Furthermore, an enhanced level of daily positive emotions can be maintained for one year after training (Cohn & Fredrickson, 2010), and they lead to changes in other outcomes, including life satisfaction (Fredrickson et al., 2008). Therefore, LKCM is considered promising for enhancing subjective well-being (SWB), which is usually represented by high life satisfaction, positive emotions, and low negative emotions (Diener, 2009). Positive psychology training has also focused on LKCM to improve other positive mentalities, such as gratitude (Zhou et al., 2021), and to treat a wide range of clinical problems (Graser & Stangier, 2018).

Meditation practices are time-consuming. Most LKCM training sessions take several weeks and require daily meditation practice at home. However, a recent systematic review has summarized the association between meditation practices and the effects of LKCM training. More than half of the reviewed studies did not find a significant association between the quantity of meditation practices and their effects (Zeng, Chio, et al., 2017). A previous study reported that improved positive attitudes toward one’s self could be cultivated through loving-kindness discussions without meditation practice (Kang et al., 2014). Considering that most LKCM training sessions included other components such as didactic teaching or psychoeducation, the weak associations between meditation practice and its effects during interventions are somewhat reasonable.

Moreover, previous studies’ methodological problems likely affected the findings. First, previous studies lacked an evaluation of meditation quality. Although the idea that the meditation quality is likely to be more important than its quantity has long been proposed, the empirical evaluation of meditation quality remains nascent. Goldberg et al., (2020) reported that the quality of mindfulness meditation in mindfulness-based stress reduction could influence the effects of mindfulness and psychological symptoms. Matko et al., (2021) suggested

that the perceived meditation ease of mantra meditation in meditation-based lifestyle modification could predict its effects on well-being. Sporadic studies have considered the problem of LKCM quality; however, they were limited to one-time practice in the laboratory. Zeng et al., (2019) developed the Difficulties during Meditation Involving Immeasurable Attitudes Scale (DMIS) to assess LKCM quality based on two kinds of difficulties during meditation: difficulty in concentration and in generating prosocial attitudes. It is believed that these two difficulties match the core psychological operations of LKCM (i.e., keep generating kind intentions toward certain targets), while the former captures the generation of kind intentions, and the latter evaluates whether practitioners can maintain this without distraction. Thus, the above two difficulties are the most commonly reported in previous research (e.g., Galante et al., 2016). Using one-time LKCM practice, Zeng et al., (2019) suggested that difficulty in concentration and difficulty in generating prosocial attitudes influence the effects of the different subtypes of LKCM on emotions. Navarrete et al., (2021) developed the Compassion Practice Quality Scale (CPQS), which described 12 detailed aspects of practice (e.g., image sustainment, vividness, and comfort) and included two sub-scales (i.e., imagery and somatic perception). Navarrete et al., (2021) found that the scale's items and dimensions are associated with meditation effects on attitudes, emotions, and mindfulness.

The second methodological issue in previous studies is the lack of a comprehensive exploration of the association between meditation practice and its effects. Zeng et al., (2017) distinguished long- and short-term associations. The long-term association was used to calculate the total amount of meditation practice throughout training, and it has been hypothesized that continuous meditation practice cumulatively influences outcome variables. Short-term association was used to evaluate the association between meditation and outcome variables in the same week or day. It explores the temporary and immediate effects of daily meditation. Generally, more focus has been placed on long-term than short-term associations (Zeng, Chan, et al., 2017). However, a recent review revealed that short-term associations were more likely to be significant than long-term ones. Long- and short-term associations may reflect situations that are more complex than the cumulative or temporary effects. Therefore, a comprehensive exploration of the association between meditation practices and their effects is necessary.

Overall, understanding the contribution of meditation practice to LKCM training is important. Most previous studies on LKCM training have only considered meditation's contribution from a quantitative perspective. Although several studies have explored the influence of LKCM meditation quality, they have only conducted one-time practices in the laboratory. Therefore, through both online and offline training, the present work aimed to clarify how LKCM quality changed during training and how its effects were contingent on meditation quality. Following previous studies, we hypothesized that, similar to other meditation types, LKCM quality would improve gradually during training (Matko et al., 2021). In addition, better quality practice would lead to more constructive training outcomes. Specifically, SWB (including life satisfaction and positive and negative emotions) was selected as a representative outcome of the LKCM training. Because emotions are relatively changeable, both short- and long-term effects can be considered. The findings obtained are expected to deepen our understanding of the importance of meditation quality and benefit future research on meditation and other psychological interventions by exploring the contributions of potential active factors to meditation effects.

2 Study 1

Data were collected from a four-week offline LKCM training program. To distinguish it from other meditations (e.g., mindfulness meditation) that are usually integrated in LKCM training and to avoid confusion (e.g., Zhou et al., 2021), our LKCM training mainly focused on appreciative joy meditation. We also required participants to practice at home for at least five days per week. By doing so, we evaluated meditation quantity (i.e., time of meditation practice) and compared its contribution with that of meditation quality (i.e., difficulties in meditation practice). It is worth mentioning that although the entire project was a randomized controlled trial that compared the training group with a waitlist group, only participants in the training group could report the quality and quantity of their meditation practice. Thus, only the data from the training group were used in this study. The key hypotheses of Study 1 were as follows:

Hypothesis 1 Levels of meditation quality will increase during the training.

Hypothesis 2 On average, the quality and quantity of meditation throughout training will be related to life satisfaction and positive and negative emotions (i.e., long-term effects).

Hypothesis 3 The quality and quantity of meditation in each week will be positively related to positive and negative emotions in the same week (i.e., short-term effects).

2.1 Methods

2.1.1 Participants and Procedure

We recruited 101 Chinese participants (71 women; $M_{\text{age}} = 27.55$, $SD = 10.11$) via mass mail and posts from universities in Hong Kong and mainland China. The inclusion criteria were that all participants were able to speak/understand Chinese (Mandarin) and had no self-reported current or previous mental disorders. Qualified participants were randomly assigned to the LKCM training ($n = 59$) or waitlist control group ($n = 42$) in a 3:2 ratio. As mentioned earlier, the current study included only 41 participants assigned to the training group who completed the assessment (27 women; $M_{\text{age}} = 28.44$, $SD = 11.44$).

LKCM training consisted of four weekly 90-minute group sessions, including psycho-education, meditation practice, and discussion. After receiving the recorded scripts, participants were also required to practice 12–15 min of appreciative joy meditation at home for at least five days per week. The targets of appreciative joy meditation changed accordingly (from friends to self, to strangers, and to difficult targets). Meanwhile, the targets used in earlier weeks were used at the beginning of meditations in later weeks. The details of the training are provided in Table S1 in the supplemental materials.

First, our participants completed measures of core variables one week before the intervention. They were then randomly assigned to the LKCM training group or the waitlist control group using a computer-generated randomizer. Only participants in the LKCM training group had a four-week training. However, participants in both groups were required to assess positive and negative emotions at the end of each week and report life satisfaction

only at the end of the fourth week. Moreover, participants in the training group reported the quantity and quality of the weekly meditation practice. Due to ethical considerations, participants in the waitlist condition also received the same training after the project was completed, but no data were collected from them. All measures were completed online, and participants signed consent forms prior to the entire research project. Participants compulsorily rated all items each week, and the missing data for the whole week were replaced by the average scores in the last and subsequent weeks. Those who completed the tasks received 100 RMBs/HKD as token payments.

2.1.2 Measures

Subjective well-being. We employed the 5-item Satisfaction with Life Scale (Diener et al. 1985). The Chinese version of this scale has demonstrated satisfactory psychometric properties such as high reliability and validity (e.g., Wang et al., 2017). Participants rated all items on a 7-point scale ranging from 1 ('not satisfied at all') to 7 ('very satisfied'). Moreover, emotional word lists (Lee et al., 2013) were used to evaluate participants' frequency of experiencing six types of emotions in the past week: high-arousal positive emotions ('excited', 'enthusiastic', 'energetic', 'elated'), medium-arousal positive emotions ('happy', 'satisfied', 'content', 'delighted'), low-arousal positive emotions ('calm', 'tranquil', 'serene', 'relaxed'), high-arousal negative emotions ('nervous', 'fearful', 'hostile', 'distressed'), medium-arousal negative emotions ('sad', 'lonely', 'blue', 'gloomy'), and low-arousal negative emotions ('bored', 'tired', 'sleepy', 'sluggish'). Each item was rated based on five points ranging from 1 ('never') to 5 ('always'). The Cronbach's alpha for these scales ranged from 0.658 to 0.823. These words have been used in previous studies on LKCM to assess emotions in Chinese samples (e.g., Zeng, Wang, Oei, et al., 2019).

Quantity and Quality of Meditation Practices. We employed DMIS to evaluate meditation quality (Zeng, Wang, Chan, et al., 2019). The DMIS was originally developed in Chinese and had two dimensions (i.e., difficulty in concentration and difficulty in generating prosocial attitudes), each of which was measured by six items based on six points ranging from 1 ('very untrue of me') to 6 ('very true of me'). The meditation quantity was measured based on the meditation time of each week. These measurements were collected at the end of each week up to four times. Cronbach's alpha for difficulty in concentration was 0.909 and that for difficulty in generating prosocial attitudes was 0.878.

2.1.3 Strategy of Statistical Analysis

First, a series of repeated measures analysis of variance (ANOVA) and paired-sample *t*-tests were used to evaluate the changes in quantity and quality of meditation practices, as well as changes in indicators of SWB (i.e., emotions and life satisfaction). Since life satisfaction was only measured before and after the training, the quality and quantity of meditation practice across four weeks were averaged and used as predictors in hierarchical linear regressions. However, emotions were measured every week, and the relevant data were multilevel and longitudinal. Linear mixed models were estimated using SPSS, with weeks (Level 1) nested within participants (Level 2). We focus on two specific models.

Table 1 Results of Repeated Measures ANOVA to Test Changes in Quantity and Quality of Meditation Practice in Study 1

	Times of Meditation		Difficulty in Concentration		Difficulty in Generating Prosocial Attitude	
	M	SD	M	SD	M	SD
1st Week	3.59	1.16	3.57	0.89	2.60	0.73
2 nd Week	3.76	1.11	3.65	0.86	2.75	0.62
3rd Week	3.41	1.25	3.61	0.90	2.97	0.76
4th Week	3.32	1.39	3.45	0.92	3.13	0.82
Time effect	$F=2.19$, $p=0.106$		$F=1.42$, $p=0.253$		$F=4.43$, $p=0.009$	
	partial $\eta^2 = 0.147$		partial $\eta^2 = 0.101$		partial $\eta^2 = 0.259$	

Note. The *F*-test involved four time points ($df=3, 38$)

- Means-as-outcome regression model. The following participant-level (Level 2) predictors were included: mean meditation time, mean difficulty in concentration, and mean difficulty in generating prosocial attitudes (Level 1: $y_i = b_0 + e$; Level 2: $b_0 = G_{00} + G_{01} \times \text{mean_time} + G_{02} \times \text{mean_concentration} + G_{03} \times \text{mean_attitudes} + \mu_0$). Fixed effects included G_{00} (intercept) and G_{01} , G_{02} , and G_{03} (mean), whereas random effects included only b_0 (intercept). As such, we could learn whether varying the mean quantity and quality of meditation practice was associated with different levels of participants' emotions.
- Random coefficient model. Three-week level (Level 1) predictors (i.e., meditation time, difficulty in concentration, and difficulty in generating prosocial attitudes) were introduced into Model 3 to explore whether the quantity and quality of meditation practice were significantly related to participants' emotions (Level 1: $y_i = b_0 + b_1 \times \text{time} + b_2 \times \text{concentration} + b_3 \times \text{attitudes} + e$; Level 2: $b_0 = G_{00} + \mu_0$, $b_1 = G_{10} + \mu_1$, $b_2 = G_{20} + \mu_2$, $b_3 = G_{30} + \mu_3$). Fixed effects included G_{00} (intercept), G_{10} , G_{20} , and G_{30} , and random effects included b_0 (intercept), b_1 , b_2 , and b_3 .

2.2 Results

2.2.1 Changes in Indicators of Subjective Well-Being and Meditation Practice

Inter-correlation coefficients among the variables measured before and after training are shown in Table S2 in the supplemental materials. First, we evaluated changes in SWB indicators, namely positive emotions, negative emotions, and life satisfaction. As shown in Table S3 in the supplemental materials, paired-sample *t*-tests supported that our training significantly decreased all three types of negative emotions and significantly increased middle-arousal positive emotions and life satisfaction. As a secondary analysis, repeated-measures ANOVA further revealed a significant time effect for high- and low-arousal negative emotions, indicating that both high- and low-arousal negative emotions changed across the five time points.

Similarly, a repeated measures ANOVA was conducted to test whether meditation time and mediation quality changed across the four weeks. As shown in Table 1, for meditation time and concentration difficulty, the time effects were not significant. However, the time

effect on difficulty in generating prosocial attitudes was significant. Based on further analysis, we observed a linear growth trend for difficulty in generating prosocial attitudes from the first week to the fourth week. According to the above findings, H1 was not confirmed, although there was some supporting evidence.

2.2.2 The Association Between Meditation Practice and Life Satisfaction

Hierarchical linear regression analysis was conducted by treating life satisfaction after training as a dependent variable (see Table S4a in the supplemental materials). Life satisfaction before training (Step 1), mean meditation time (Step 2), and mean difficulties in concentration and generating prosocial attitudes (Step 3) were entered into the equation in three steps. We found that difficulty in generating prosocial attitudes was significantly associated with lower life satisfaction after the training (unstandardized $B = -0.53$, $SE = 0.22$, standardized $\beta = -0.27$, $p = 0.02$); however, the regression coefficients of meditation time and difficulty in concentration were not significant (time: unstandardized $B = 0.12$, $SE = 0.10$, standardized $\beta = 0.11$, $p = 0.272$; concentration: unstandardized $B = 0.20$, $SE = 0.17$, standardized $\beta = 0.14$, $p = 0.249$). Moreover, in Step 2, the quantity of meditation practice explained an additional 3% of the variance in life satisfaction after training (F change = 3.23, $p = 0.080$). In Step 3, the quality of meditation practice explained an additional 5% of the variance in life satisfaction after training (F change = 2.95, $p = 0.065$).

We also conducted hierarchical linear regression analysis by treating the difference in life satisfaction scores between pre-test and post-test as the dependent variable (see Table S4b in the supplemental materials). Similar results were also observed. Specifically, based on the quantity of meditation practice, the quality of meditation practice explained an additional 11% of the variance in life satisfaction scores (F -change = 2.61, $p = 0.087$). Only the coefficient of difficulty in generating prosocial attitudes was significant (unstandardized $B = -0.47$, $SE = 0.23$, standardized $\beta = -0.36$, $p = 0.047$). The above findings initially support that despite the meditation quantity, meditation quality, especially the difficulty in generating prosocial attitudes, influences life satisfaction.

2.2.3 The Association Between Meditation Practice and Emotions

Two-level (Level 1: week, Level 2: participant) linear mixed models were used to measure positive and negative emotions weekly. The means-as-outcomes regression models introduced mean meditation time, difficulty in concentration, and difficulty in generating prosocial attitudes as Level 2 predictors to test whether participants who varied in their mean quantity and quality of meditation practice showed different levels of emotions. As presented in Table 2, the mean difficulty in generating prosocial attitudes could significantly and negatively influence high- and middle-arousal positive emotions, but significantly and positively influence high- and middle-arousal negative emotions. Neither mean meditation time nor mean difficulty in concentration had a significant influence on emotions. Our H2 was partially supported.

After considering the mean quantity and quality of meditation practice, the between-participants intercept variance and within-participants residual variance remained significant. We further built random coefficient models which introduced meditation time, difficulty in concentration, and difficulty in generating prosocial attitudes as Level 1 predictors. By

Table 2 Results of Means-as-outcomes Regression in Linear Mixed Models in Study 1

	Positive Emotion						Negative Emotion					
	High arousal		Middle arousal		Low arousal		High arousal		Middle arousal		Low arousal	
	Effect	SE	Effect	SE	Effect	SE	Effect	SE	Effect	SE	Effect	SE
Intercept	5.34***	0.62	5.18***	0.63	4.22***	0.66	0.93*	0.42	1.34*	0.60	1.43**	0.51
Meditation Time	-0.13	0.09	-0.03	0.10	-0.03	0.10	-0.04	0.06	-0.04	0.09	-0.15	0.08
Concentration	0.12	0.15	0.03	0.15	-0.08	0.16	-0.06	0.10	-0.11	0.14	0.24	0.12
Prosocial Attitudes	-0.85***	0.20	-0.71**	0.20	-0.30	0.21	0.48**	0.14	0.42*	0.19	0.28	0.16
Residual Variance	0.16***	0.02	0.14***	0.02	0.19***	0.02	0.15***	0.02	0.18***	0.02	0.20***	0.03
Intercept Variance	0.30***	0.08	0.32***	0.08	0.34***	0.09	0.12**	0.04	0.27***	0.07	0.18**	0.05

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

doing so, we could explore, on average, whether the quantity and quality of meditation practices were significantly related to participants' emotions. As shown in Table 3, difficulty in concentration could significantly and negatively influence high-arousal positive emotions, and significantly and positively influence high arousal and low arousal negative emotions. The effects of meditation time and difficulty in generating prosocial attitudes on emotions were not significant. These findings partially supported H3.

2.3 Discussion

In terms of changes in the two indicators of meditation quality during the four-week training period, the results first revealed that difficulty in generating prosocial attitudes increased consistently during training. The targets of meditation move from friends to disliked people, who vary dramatically in terms of their relationships with practitioners. It is not surprising that people find it more difficult to generate prosocial attitudes toward targets with fewer emotional attachments (i.e., neutral ones) or worse relationships (i.e., disliked ones). These findings may indicate that progress within four weeks of training is too rapid. More time should be given to practitioners before moving to more difficult targets. Furthermore, we found that the difficulty of concentration did not change significantly during training. Such findings were also unexpected, but reasonable to some extent. Difficulty in concentration is related to the stability of attention, which may require a long cultivation time. There is also the possibility that practitioners' basic ability to concentrate is improved during training. However, the practice became increasingly distracting when moving to difficult targets, leading to non-significant changes in the difficulty in concentration, as we observed.

On an average, the quality of meditation was associated with SWB. Specifically, average difficulty in generating prosocial attitudes was associated with life satisfaction and high- and medium-arousal positive and negative emotions. Given that difficulty in generating prosocial attitudes is related to emotional attachment to targets and generation of prosocial emotions, its wide association with SWB is reasonable. More importantly, the findings indicate that the quantity of meditation is likely to be less important than its quality, since the former's contribution was smaller than that of the latter when predicting life satisfaction changes.

We also observed an association between the quality of meditation and emotions weekly. Compared to the results based on the mean qualities of meditation over four weeks, the associations between the quality of meditation and emotions in each week showed a different pattern. Only difficulty in concentration significantly predicted some types of emotion (i.e., high-arousal positive, high-arousal negative, and low-arousal negative emotions). These results are considered reasonable. Concentration is the basis of meditation practices, which allow practitioners to focus on other psychological operations (i.e., generating kind attitudes in LKCM). A previous experimental study reported that difficulty in concentration showed low correlation with a wide range of emotions (Zeng, Wang, Chan, et al., 2019). In the current study, low-arousal negative emotions reflected tiredness during meditation, which was reasonably associated with divergence of attention. If the imagination of disliked targets induces extensive distraction (e.g., irrelevant memory) and makes it difficult to focus on the meditation operation, it is not surprising that changes in relevant emotions (e.g., high-arousal negative emotions) are limited.

Table 3 Results of Random Coefficient Model in Study 1

	Positive Emotion						Negative Emotion					
	High Arousal		Middle Arousal		Low Arousal		High Arousal		Middle Arousal		Low Arousal	
	Effect	SE	Effect	SE	Effect	SE	Effect	SE	Effect	SE	Effect	SE
Intercept	3.82***	0.26	3.16***	0.28	2.69***	0.28	1.90***	0.21	1.66***	0.32	1.83***	0.30
Meditation Time	-0.03	0.05	0.03	0.05	0.04	0.05	-0.05	0.04	0.01	0.04	-0.04	0.04
Concentration	-0.27***	0.06	-0.10	0.06	0.00	0.07	0.10*	0.05	0.09	0.07	0.35***	0.07
Prosocial Attitudes	0.05	0.06	0.07	0.06	0.04	0.07	-0.04	0.05	0.02	0.08	-0.13	0.07
Residual Variance	0.06***	0.01	0.07***	0.01	0.07***	0.01	0.04***	0.00	0.10***	0.01	0.09***	0.01
Intercept Variance	0.08	0.35	0.18	0.38	0.04	0.00	0.12	0.15	0.65	0.73	0.52**	0.16
Time Variance	0.04	0.17	0.03	0.05	0.04	0.04	0.02	0.02	0.01	0.00	0.01	0.00
Concentration Variance	0.04	0.00	0.03	0.00	0.05	0.00	0.02	0.00	0.05	0.00	0.02	0.00
Prosocial Attitudes Variance	0.04	0.00	0.03	0.00	0.05	0.03	0.04	0.02	0.09	0.00	0.05	0.00

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

3 Study 2

In Study 2, we conducted an online self-help LKCM intervention to further evaluate the contribution of meditation practices. We recruited a larger sample in Study 2 to examine the stability and repeatability of the findings of Study 1. Furthermore, Study 1 suggested that difficulties experienced varied across different weeks, in which the targets of LKCM were different. Previous training usually started with LKCM for close ones (e.g., friends) or oneself (Shahar et al., 2015; Zeng, Wang, Oei, et al., 2019). With the flexibility of online self-help intervention, in Study 2, we manipulated the order of LKCM for close ones and self to explore the impact of order on the effects of meditation practice. Therefore, in addition to the influences of meditation time and quality on SWB, we also examined whether the training effects were different between the group that started with LKCM for close ones and the group that started with LKCM for oneself. In addition to the three hypotheses in Study 1, we posited the fourth hypothesis as follows:

Hypothesis 4 The order of LKCM influences (a) the magnitude of training effects and (b) meditation quality. Specifically, LKCM improves SWB more significantly in the group that starts with LKCM for close ones (vs. self) (i.e., H4a). In addition, those in the group that starts with LKCM for close ones (vs. self) will experience lower levels of difficulty during the training (i.e., H4b).

3.1 Methods

3.1.1 Participants

The online intervention included 865 Chinese participants. The inclusion criteria were as follows: Chinese-speaking adults without previous or currently diagnosed mental disorders. The participants were randomly assigned to two groups (starting with self vs. starting with close ones). Among all participants, 243 (175 women, mean age = 30.27, $SD = 10.24$) completed the interventions (106 started with LKCM for self and 137 started with LKCM for close ones). The dropout rate was 71.9%, which was similar to that reported in previous free online LKCM interventions of similar lengths (Galante et al., 2016). Results of independent samples *t*-tests indicated no significant difference in life satisfaction, positive emotions, and negative emotions between completers and dropouts ($ps \geq 0.151$).

3.1.2 Procedure

Online intervention was delivered as a free intervention for the public to help people self-regulate during the COVID-19 pandemic. It was described as a '21-day course for positive psychological meditation.' For ethical consideration, all participants could start the LKCM intervention immediately after they finished the pre-intervention assessment, and they were randomized using a computer-generalized randomizer to start with LKCM for friends or for self. We obtained consent forms from all participants prior to the meditation practice, debriefed them on the research purpose, and introduced LKCM in detail after the interven-

tions. Of our participants, 10% had a chance to receive 400 RMB as an incentive to participate in the study.

During the 21-day self-help intervention, participants followed the recorded instructions to practice meditation for 12–15 min per day. On the first day, they used breathing meditation to learn its basic principles. The remaining 20 days were divided into four units (5 days/unit). The first two units were loving-kindness meditation for the self and close ones, which were randomized between participants. The third unit included a two-day appreciative joy meditation for the self, a two-day appreciative joy meditation for close ones, and a mixed appreciative joy meditation for close ones and self. The fourth unit included appreciative joy meditation for close, self, and neutral others. Notably, the program rules stipulated that a new intervention practice could be unlocked only when the participant completed the day's task. For example, if the participant did not complete the exercises on day 2, the progress of the intervention for this participant would stop at day 2. Unless they continued to complete the exercises, they could not access the intervention content on day 3. Therefore, all the completers participated in 21 days of meditation.

3.1.3 Measures

All measures were completed prior to the intervention, as well as on the last day of each unit of intervention, that is, up to five times (the last time was the post-intervention assessment). The instruments used for measuring life satisfaction and meditation practice quality were the same as those used in Study 1. However, due to differences in study designs, the duration for quality of meditation was adjusted from 'last week' to 'past unit.' In this study, the Cronbach's alpha coefficients were 0.863 for life satisfaction, 0.947 for difficulty in concentration, and 0.892 for difficulty in generating prosocial attitudes. We did not directly assess meditation quantity in Study 2, as all participants were required to complete the 21-day intervention. In other words, all participants who completed the intervention reported the same amount of meditation.

Positive and negative emotions were measured using 30 emotional words (Fredrickson et al., 2003; Lee et al., 2013). Each word was rated from 1 ('never') to 5 ('always'), according to the frequency of experiencing it in the last week (pre-assessment) or in the days of the past unit. Words of positive emotions were 'happy', 'joyful', 'calm', 'serene', 'peaceful', 'content', 'grateful', 'hopeful', 'thankful', 'appreciative', 'optimistic', 'friendliness', 'encouraged', 'care', 'love', 'excited', 'energetic', and 'powerful' ($\alpha=0.940$). Words of negative emotions included 'sad', 'stressed', 'envy', 'fearful', 'nervous', 'hostile', 'scared', 'downhearted', 'afraid', 'unhappy', 'overwhelmed', and 'distaste' ($\alpha=0.839$).

3.1.4 Strategy of Statistical Analysis

The strategy of statistical analysis was similar to Study 1.

Table 4 Results of Repeated Measures ANOVA to Test Changes in Quality of Meditation Practice in Study 2

	Difficulty in Concentration				Difficulty in Generating Prosocial Attitudes			
	Starting with LKCM for self		Starting with LKCM for close ones		Starting with LKCM for self		Starting with LKCM for close ones	
	M	SD	M	SD	M	SD	M	SD
1st Week	3.25	0.91	3.35	1.00	2.87	0.89	2.54	0.88
2 nd Week	3.50	1.00	3.27	1.00	2.84	0.84	2.61	0.85
3rd Week	3.35	0.97	3.22	1.04	2.67	0.87	2.48	0.84
4th Week	3.27	1.03	3.18	1.02	2.78	0.89	2.52	0.80
Time Effect	$F(3, 239)=3.85$ ($p=0.010$, partial $\eta^2=0.046$)				$F(3, 239)=4.42$ ($p=0.005$, partial $\eta^2=0.053$)			
Group Effect	$F(1, 241)=0.56$ ($p=0.454$, partial $\eta^2=0.002$)				$F(1, 241)=7.03$ ($p=0.009$, partial $\eta^2=0.028$)			
Interaction	$F(3, 239)=3.69$ ($p=0.013$, partial $\eta^2=0.044$)				$F(3, 239)=0.74$ ($p=0.528$, partial $\eta^2=0.009$)			

3.2 Results

3.2.1 Changes in Subjective Well-Being and Quality of Meditation Practice

The inter-correlation coefficients among the variables measured before and after training are presented in Table S5 in the supplemental materials. To explore participants' changes in SWB, a 2 (before the training vs. after the training) \times 2 (order of LKCM) repeated measures ANOVA was conducted for life satisfaction, positive emotions, and negative emotions. As shown in Table S6, the main effects of time were significant for all the three dependent variables, but the interaction effects were not significant. These findings indicate that the participants' SWB changed after the training. However, starting LKCM with either oneself or close ones did not influence the results. As secondary explorations, repeated measures ANOVA, including all five time points for positive and negative emotions, also showed significant main effects of time and nonsignificant interaction effects. The above findings did not confirm H4a, which stipulates that the training effects were contingent on the order of LKCM.

The changes in the quality of meditation were evaluated using a 4 (four units) \times 2 (order of LKCM) repeated measures ANOVA. As shown in Table 4, difficulty in concentration showed a significant main effect of time and an interaction effect. Further analysis that divided the two groups showed that the decrease in concentration difficulty was significant for the group that started LKCM for self: $F(3, 103)=5.95$, $p=0.001$, partial $\eta^2=0.148$, but not for the group that started LKCM for close ones: $F(3, 134)=1.56$, $p=0.202$, partial $\eta^2=0.034$. For difficulty in generating prosocial attitudes, the main effects of both time and group were significant; however, the interaction effect was not significant. Specifically, difficulty in generating prosocial attitudes decreased in both groups, but the group that started with LKCM for self showed greater difficulty in generating prosocial attitudes compared to the other group in the first ($t=2.84$, $df=241$, $p=0.005$, Cohen's $d=0.367$), second ($t=2.09$, $df=241$, $p=0.038$, Cohen's $d=0.271$), and fourth units ($t=2.39$, $df=241$, $p=0.018$, Cohen's $d=0.307$). However, there were no significant differences in the difficulty of generating pro-

Table 5 Results of Hierarchical Linear Regression Analyses on the Moderating Role of Group in the Relation between Meditation Practice Quality and Life Satisfaction (Study 2)

Variable	M1	M2	M3
Control Variables (Step 1)			
Life Satisfaction (Pre-measure)	0.77***	0.70***	0.70***
Predictors (Step 2)			
Difficulty in Concentration		-0.13**	-0.34*
Difficulty in Generating Prosocial Attitudes		-0.12*	-0.07
Group		-0.04	-0.04
Interactions (Step 3)			
Concentration × Group			0.22
Prosocial Attitudes × Group			-0.06
<i>F</i>	351.47***	105.94***	71.03***
ΔF	351.47***	10.40***	1.08
<i>R</i> ²	0.59	0.64	0.64
ΔR ²	0.59	0.05	0.00

Note. Standardized beta coefficients are reported

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

social attitudes between the two groups in the third unit ($t = 1.72$, $df = 241$, $p = 0.087$, Cohen's $d = 0.222$). These findings provide supporting evidence for H1 and H4b.

3.2.2 The Association Between Quality of Meditation and Life Satisfaction

Hierarchical linear regression analysis was employed to test the association between the quality of meditation and life satisfaction, as well as the potential moderating roles of the order of LKCM in the focal relationship. As shown in Table 5, life satisfaction before the training, the three main effects (i.e., mean difficulty in concentration, mean difficulty in generating prosocial attitudes, order of LKCM), and two interaction terms (i.e., difficulty in concentration × order of LKCM and difficulty in generating prosocial attitudes × order of LKCM) were added to the equation in three steps. The results showed that after controlling for life satisfaction before training, both difficulties in concentration (unstandardized $B = -0.17$, $SE = 0.07$, standardized $\beta = -0.13$, $p = 0.009$) and generating prosocial attitudes (unstandardized $B = -0.16$, $SE = 0.07$, standardized $\beta = -0.12$, $p = 0.019$) were negatively related to life satisfaction after training (see Model 2). An additional 5% of the variance in life satisfaction after the training was explained. However, the non-significant interaction effects indicate that the effects of meditation practice quality did not operate contingently on the group. We also performed additional hierarchical linear regression analysis by treating changes in life satisfaction as the dependent variable, and observed a significant coefficient of difficulty in concentration and non-significant coefficients of difficulty in generating prosocial attitudes as well as two interaction terms. The detailed results are presented in Table S7 in the supplemental materials.

3.2.3 The Association Between Quality of Meditation and Emotions

Similar to Study 1, two-level (Level 1: unit, Level 2: participant) linear mixed models in SPSS were used to test the quality of the meditation-predicted emotions measured every week. The means-as-outcomes regression models introduced the mean difficulty in concentration and in generating prosocial attitudes as Level 2 predictors to test whether participants

Table 6 Results of Means-as-outcomes Regression in Linear Mixed Models in Study 2

	Positive Emotion		Negative Emotion	
	Effect	SE	Effect	SE
Intercept	4.81***	0.14	1.08***	0.12
Difficulty in Concentration	-0.15**	0.05	0.16***	0.04
Difficulty in Generating Prosocial Attitudes	-0.37***	0.06	0.06	0.05
Residual Variance	0.11***	0.01	0.10***	0.01
Intercept Variance	0.24***	0.02	0.16***	0.02

Note. * $p < 0.05$; ** $p < 0.01$;
*** $p < 0.001$

Table 7 Results of Random Coefficient Model in Study 2

	Positive Emotion		Negative Emotion	
	Effect	SE	Effect	SE
Intercept	4.33***	0.08	1.25***	0.06
Difficulty in Concentration	-0.15***	0.02	0.08***	0.02
Difficulty in Generating Prosocial Attitudes	-0.19***	0.02	0.09***	0.02
Residual Variance	0.08***	0.00	0.07***	0.00
Intercept Variance	0.53***	0.11	0.01	0.10
Difficulty in Concentration Variance	0.01	0.00	0.02	0.00
Difficulty in Generating Prosocial Attitudes Variance	0.02	0.01	0.02	0.00

Note. * $p < 0.05$; ** $p < 0.01$;
*** $p < 0.001$

who varied in their mean quality of meditation showed different emotional levels. As shown in Table 6, both difficulties in concentration and generating prosocial attitudes could negatively influence positive emotions, whereas only difficulty in concentration could positively influence participants' negative emotions. Moreover, after considering the mean quality of meditation practice, the between-participant intercept variance and within-participant residual variance remained significant. Therefore, H2 is partially supported.

Furthermore, random coefficient models introduced difficulties in concentration and generating prosocial attitudes as Level 1 predictors to explore, on average, whether the meditation quality was significantly related to emotions. As shown in Table 7, both difficulties in concentration and generating prosocial attitudes negatively influenced positive emotions and positively influenced negative emotions. H3 was supported again.

3.3 Discussion

In line with our hypothesis, difficulties in concentration and generation of prosocial attitudes decreased during the training in Study 2. Unlike the fast-paced training in Study 1, participants in Study 2 spent three units practicing LKCM for close ones and self, and then turned to LKCM for neutral ones in the last unit. There were no difficult targets for this study. This pace possibly allowed participants to become familiar with the skills, and thus perceive fewer difficulties with more practice.

We found that the average quality of meditation was associated with the three components of SWB, except that difficulty in generating prosocial attitudes was not significantly

associated with negative emotions. One potential reason is that the training did not involve disliked people as targets; thus, the ability to counter negative emotions and generate prosocial attitudes is not an important issue. The association between difficulty in generating prosocial attitudes and negative emotions was as expected, but it did not reach statistical significance. Moreover, the association between the quality of meditation and emotions in each unit was expected. Compared with the association based on the average quality of meditation, the associations based on each unit are more specific and have more data in the calculation. This might explain why the association between difficulty in generating prosocial attitudes and negative emotions became significant when calculated based on each unit.

Finally, our results indicated that the difficulty in generating prosocial attitudes was relatively higher in the group that started LKCM for the self (vs. close ones). In other words, such findings support the idea that starting with LKCM for close ones should be easier for beginners. However, the current study could not determine the exact reasons why generating prosocial attitudes toward oneself is more difficult. As suggested by previous studies, mentalities such as self-criticism or fear of compassion may lead to difficulties (Gilbert et al., 2011). Furthermore, it may be the results were obtained simply because LKCM for the self does not have a stable and positive target (e.g., facing a smiling friend). The current study found that the order of LKCM did not exert a significant influence on the effects of training. It seems that even when starting LKCM with the self, practitioners are likely to experience more difficulty in the beginning; however, such difficulties have little impact on the effects of the entire training. It is worth mentioning that unlike Study 1, training in Study 2 as an online self-helping program did not involve difficult targets. Thus, our investigation was limited to the early stages of the LKCM training. Further research is encouraged to deepen our understanding by including different types of targets in training.

4 General Discussion

While recent studies have mainly focused on the quantity of LKCM (Navarrete et al., 2021; Zeng, Wang, Chan et al., 2019), the current research provides the first exploration of the quality of meditation in multi-week LKCM training. Consistent with the findings of previous studies (e.g., Matko et al., 2021), both parts of the present study showed that the quality of meditation was associated with the effects on SWB. Furthermore, Study 1 suggested that quality of meditation was a more important predictor than quantity of meditation, indicating the importance of considering quality issues in practice (Goldberg et al., 2020). Admittedly, owing to the limitations of the study design, we cannot defer the causal relationship between meditation practice and the effects of training. Specifically, in the current study, we regarded quality of meditation as a predictor of SWB. It is also possible that people with lower levels of SWB perceive more difficulties in concentrating during meditation or generating prosocial attitudes toward others. It is also likely that practitioners with more balanced or positive emotions are willing to meditate more and experience fewer difficulties during practice. Nevertheless, our findings provide a new perspective for understanding the role of meditation in LKCM training by shedding light on the importance of LKCM meditation quality.

Furthermore, measures of the quality of meditation provide suggestions for the design or optimization of interventions. The participants experienced increased difficulty during the training in Study 1 and decreased difficulty during that in Study 2. Such findings sug-

gest that the progress of Study 1 training might be too fast for some trainees, and Study 2 training might proceed faster if needed. Notably, many factors might influence the quality of meditation, and improvements in the pace of changing targets were not necessarily. Other aspects, such as training intensity, could also be considered. Traditional LKCM training in Buddhism usually requires more time on easier targets and allows individuals to be skillful in meditation for easier targets before moving to more difficult targets. In contrast, many modern training programs are short, fast-paced, and group-based (e.g., Zhou et al., 2021). Understanding how to balance the overall efficacy and skills of individual trainees remains a challenge. The self-help training used in Study 2 has become increasingly popular in recent years (Amanvermez et al., 2022); however, it is still fixed in structure and components. Future self-help training can be customized and may even allow practitioners to decide on their own progress based on meditation quality.

The DIMS measured meditation quality with two typical difficulties during the LKCM. While both types of difficulties were associated with SWB, the specific patterns of associations were explored and explained post hoc, and the robustness of some detailed findings was questionable. Academic attention to LKCM quality has increased in recent years. Therefore, few studies have focused on the relationship between the quality of LKCM and its effects, especially during multiweek training. By conducting both online and offline interventions, our study further confirmed that the two identified types of difficulties (i.e., concentration and generating prosocial attitudes) were important issues for meditation as well as its effects. Considering that a recent study accounted for other aspects of LKCM quality (Navarrete et al., 2021), future research should further explore LKCM quality and its potential influences.

In this study, emotions were measured each week/unit; therefore, we tested both the long-term associations across the training (i.e., mean quality and change after training) and the short-term associations each week/unit. The empirical findings suggest that both the methods have advantages. Specifically, the long-term associations across the training appear more stable, while the short-term associations in each week/unit might capture specific associations in certain training steps (e.g., associations during meditation for disliked people).

4.1 Limitations and Future Directions

This study has several notable limitations. First, the sample size was small in Study 1 and the dropout rate was relatively high in Study 2. Therefore, the major finding that the quality of meditation was associated with effects should be solid; however, the stability of the details should be treated with caution. Second, the measurement of the effects and meditation practices relied on self-reporting. These associations may be confounded by the expectancy effects. Future studies should assess the outcomes of training in an objective manner and even make efforts to further develop various measurements for LKCM quality. Moreover, we only focused on healthy participants' SWB, which is an important outcome of LKCM training. We hope that future research will generalize the findings to other meditation trainings, as well as their effects. Third, similar to most studies that explored meditation's contribution, this study only used data from training groups and the relationship between meditation and its effects was correlational. While direct manipulation of experienced quality during the intervention is difficult, future researchers can attempt to change the difficulty levels in meditation to explore causal relationships.

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Data Availability The data that support the findings of this study are available at https://osf.io/d9352/?view_only=dfbc02e7432b4217b4ce254d140ad1aa.

Declarations

Disclosure Statement The authors report there are no competing interests to declare.

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