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Online Dispositional Flow Enhancement Training for Chinese Recreational Runners: A Single-Group Mixed-Method Evaluation

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Abstract

Background: There are limited studies examining the effectiveness of Mindful Sport Performance Enhancement (MSPE) on dispositional flow enhancement in the recreational population. This is the first empirical evaluation of an online 4-week MSPE designed to enhance dispositional flow in Chinese recreational runners.

Method: In this mixed-method study, a convergent design approach was adopted to examine the acceptability and effectiveness of the 4-week online MSPE in Chinese recreational runners (N = 41). The quantitative strand was designed with a single-group pre-test and post-test model in which the dispositional flow was assessed at 2 time points (i.e., pre and post) using the Chinese Dispositional Flow Scale-2 (DFS-2). After finishing the 4-week long online sessions, semi-structured interviews (N = 15) were conducted, and a reflexive thematic analysis (reflexive TA) was utilized to analyze qualitative data.

Results: Chinese recreational runners' dispositional flow significantly increased after four weeks online training compared to the baseline ($d = 0.53$, 95% CI for $d = (0.30, 0.75)$). This finding was substantiated by the positive experiences shared by participants highlighting the acceptability and effectiveness of the online mindfulness training.

Conclusion: This study evaluated a 4-week online MSPE on dispositional flow enhancement in Chinese recreational runners. The quantitative and qualitative findings provided evidence for its acceptability and effectiveness in the Chinese context.

Keywords: Dispositional flow, Mindfulness, Mindful sport performance enhancement

1. Introduction

The concepts of health promotion have gained traction and are being used worldwide [1]. Around the globe, various interventions are implemented to support wellness and a healthy lifestyle [1]. Recreational running, considered a healthy lifestyle, has become a popular and widespread physical activity (PA) to improve and maintain health and physical fitness [2]. Evidence shows that regular running can help reduce the chance of dying from heart disease and some specific cancers and reduce 40% of premature mortality [2]. On the other hand, people frequently lose interest in running for various reasons (e.g., fatigue and boredom) and turn

to other recreational activities [3]. Therefore, to prevent drop-out, there is a need to help recreational runners develop strategies to cope with the challenges encountered during running.

Flow is an optimal experience characterized by absolute immersion in a task and a sensation of control [4]. Due to its intrinsically-rewarding nature, the flow experience activity (such as running) is more likely to be repeated [5]. Given that flow has been linked to enhanced motivation and long-term adherence, this multidimensional experience may be especially pertinent for exercisers [4]. In other words, recreational runners' dispositional flow may contribute to their long-term commitment to running [4]. Meanwhile, flow is more achievable

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during duration running since flow and duration are linked [6]. Previous studies have shown that there is a shift in brain activity away from the frontal and prefrontal cortex areas after moderate-to-vigorous exercise lasting up to 60 minutes [6]. This is probably caused by an increase in the motor cortex's and related areas' demand for cortical resources [6]. This phenomenon, which was first identified as temporary hypofrontality, resembles alterations in brain activity that are similar to flow [6].

A recent systematic review found that mindfulness (31.03%), hypnosis (17.24%), and imagery (13.79%) were the most common intervention strategies for enhancing flow in sports settings. Stressing the connection between flow and mindfulness, both share similar characteristics, such as in-the-moment and concentration [7]. Some characteristics of mindfulness (e.g., awareness) are associated with several dimensions of flow (e.g., concentration on the task at hand) [8]. Nonjudgmental and present-moment awareness attitudes allowed mindfulness to become essential to running since it could meet challenges, such as fatigue, boredom, and negative thoughts [9]. Evidence from another systematic review also suggests that practicing mindfulness could promote flow [7]. Meanwhile, running's high repetition allows the mind to wander, making mindfulness techniques particularly useful for dealing with internal and external cues [7].

MSPE was recently developed as a mindfulness-based intervention to enhance athletic performance [8]. It was conceptualized as extending Mindfulness-based Stress Reduction (MBSR) and Mindfulness-based Cognitive Therapy (MBCT) to athletes by incorporating mindfulness-building exercises from those approaches [8]. A recent empirical and practical study based on the MSPE has found links between mindfulness and flow [10]. There is some promising evidence that MSPE could enhance flow states [8]. Only a few studies measured dispositional flow as an outcome. Among those few, the improvement is usually limited to certain dimensions. A recent investigation on MSPE's effects on national competitive swimmers revealed a significant increase in global flow measured by the Dispositional Flow Scale-2 [10]. One dispositional flow subscale (i.e., loss of self-consciousness) was shown to have a difference. Another mixed-method study conducted on baseball players confirmed this finding. Only one flow subscale was improved after MSPE training [11]. In light of the theoretical link between mindfulness and flow, it is crucial to obtain more empirical evidence to support this theory.

Since most mindfulness-based intervention studies on flow enhancement were conducted in

competitions [12], few studies have investigated their adaptability and generalizability to recreational PA, such as recreational running. How these mindfulness-based interventions perform in the recreational population remains unclear. In addition, aspects of such programs may be undesirable to recreational runners, particularly at this time of the global pandemic. A program that enables recreational runners to join whenever and wherever they wish may therefore result in increased participation and involvement.

To address these limitations, we revised the MSPE protocol to a 4-week online program to enhance dispositional flow for recreational runners. Online interventions have become a common method for delivering health-related sessions [13]. However, its ability to produce quality and effective outcomes compared to traditional face-to-face sessions is yet unknown [13]. In terms of the effects of adopting the online approach, there was conflicting evidence. In a meta-analysis study, online mindfulness-based interventions (MBIs) were found to have unequal effects on reducing depression and anxiety compared to traditional face-to-face MBIs [14]. In particular, it is not clear if an online MSPE program can enhance dispositional flow in recreational runners.

Running in groups has become a popular social phenomenon in China [15]. Recreational runners formed friendships through running groups [15]. In order to prevent diffusion of treatment and drop-out, we decided to evaluate the revised MSPE program in a single-group approach. The aims of this study were (1) to investigate the acceptability of an online 4-week MSPE program in Chinese recreational runners and (2) to examine the effectiveness of the revised 4-week MSPE on dispositional flow among Chinese recreational runners. The hypothesis of this study is a revised four-week MSPE intervention could significantly enhance dispositional flow in Chinese recreational runners.

2. Method

2.1. Study design

The effectiveness of flow interventions may be better evaluated using a mixed-method approach [16]. The simultaneous collection of qualitative and quantitative data could help confirm flow, and overcoming discriminant validity issues [16]. Furthermore, corroborating two types of data can enhance accuracy and validity along with developing a theoretical understanding of flow interventions [16]. This study followed Creswell and Clark's guidelines for a convergent design with

quantitative and qualitative strands conducted concurrently [17]. In the quantitative strand, a single-group, uncontrolled trial with data collection in two stages (baseline and endpoint) was used to measure pretest-posttest dispositional flow. Based on a systematic review [16] and concerns about the diffusion of treatment, a pretest-posttest design was employed. The flow intervention in sport and exercise was conducted primarily utilizing single-case studies ($k = 13$; 44.83%) or within-between-subject designs ($k = 13$; 44.83%). A paired sample t -test was performed to test the difference before and after the intervention. In the qualitative strand, fifteen semi-structural interviews were conducted to substantiate the quantitative finding. According to Creswell and Clark's suggestions, both strands could be unequal and written as QUAN + QUAL [17]. As a result, the quantitative findings in this study have a higher priority of interpretation, while the qualitative findings were used to confirm the quantitative results and provide a comprehensive and in-depth analysis of the acceptability and effectiveness of the intervention. Both of the strands involved the same participants with two different sample sizes. The quantitative strand has a larger sample size ($N = 41$) than the qualitative strand ($N = 15$).

2.2. Participants

The researcher sent an email with a cover letter announcing a mindfulness workshop for recreational runners to several community running groups in Guangzhou, China. The Snowball sampling technique was adopted in this recruitment process. Forty-six of them replied to the email and showed interest in the workshop. They received another email with additional workshop information as well as informed consent. Forty-one of them (14.6% were aged from 18 to 29 years, 48.8% were aged from 30 to 39 years, 34.2% were aged from 40 to 49 years, and 2.4% were aged from 50 to 59 years) completed the 4-session and endpoint measures. All of them (41.46% are female) participated in vigorous running for at least 20 minutes three or more times a week, as specified by the U.S. Department of Health and Human Services [18]. The decision on the sample size was based on the findings from a systematic review [16]. The average sample size of the previous quasi-experimental designs was 34.00 ($SD = 25.00$).

2.3. Ethics approval

The Assumption University Institutional Review Board provided ethical approval on April 1, 2022. All

the recreational runners were given a unique identifier to maintain their confidentiality during the intervention process. Runners in the qualitative strand gave verbal permission and agreed to record the interview. The recordings would be reported on and transcribed, and they were informed.

2.4. Study intervention

MSPE is a 6-session group intervention [8]. Kaufman and colleagues suggest the durations and number of the sessions can be shortened to fit existing constraints [8]. Therefore, a revised 4-week MSPE protocol (Fig. 1) was developed for this study based on the content of Kaufman, Glass, and Pineau's protocol [8]. Overall, the protocol included rationale on mindfulness, major mindfulness practices (e.g., sitting meditation, walking meditation), recommended home practice, and discussion.

2.5. Procedure

Since the outcome variable of this study was dispositional flow, 41 recreational runners submitted both the baseline and endpoint measure (i.e., the Chinese Dispositional Flow Scale-2). Specifically, 46 runners filled out the baseline measures (i.e., the Chinese DFS-2 and the demographic questions), wherein 3 dropped out before the first session, and 2 dropped out before the second session. Therefore, the final number of 41 runners completed all four sessions and submitted the endpoint measures (i.e., the Chinese DFS-2 and exit questionnaire).

All group sessions were conducted using Zoom (Zoom Video Communications, San Jose, CA). The group leader (first author) kept a reflective journal during the four-week long sessions. It documented the participation of the runners, along with the leader's reflection on the interactions. Homework-guided audio recordings were sent to participants via email after each session. Recreational runners were encouraged to practice mindfulness meditations and monitor their progress in the Daily Mindfulness Log between sessions. They were encouraged to record their mindfulness practice, submit it via an online survey and share it at the next session. According to Hindman and his colleagues, it was noted that using a log (i.e., formal or informal) could benefit the mindfulness intervention study [19].

Additionally, runners were encouraged to monitor and record their flow experience during running in the Flow Experience Log [20]. The time,

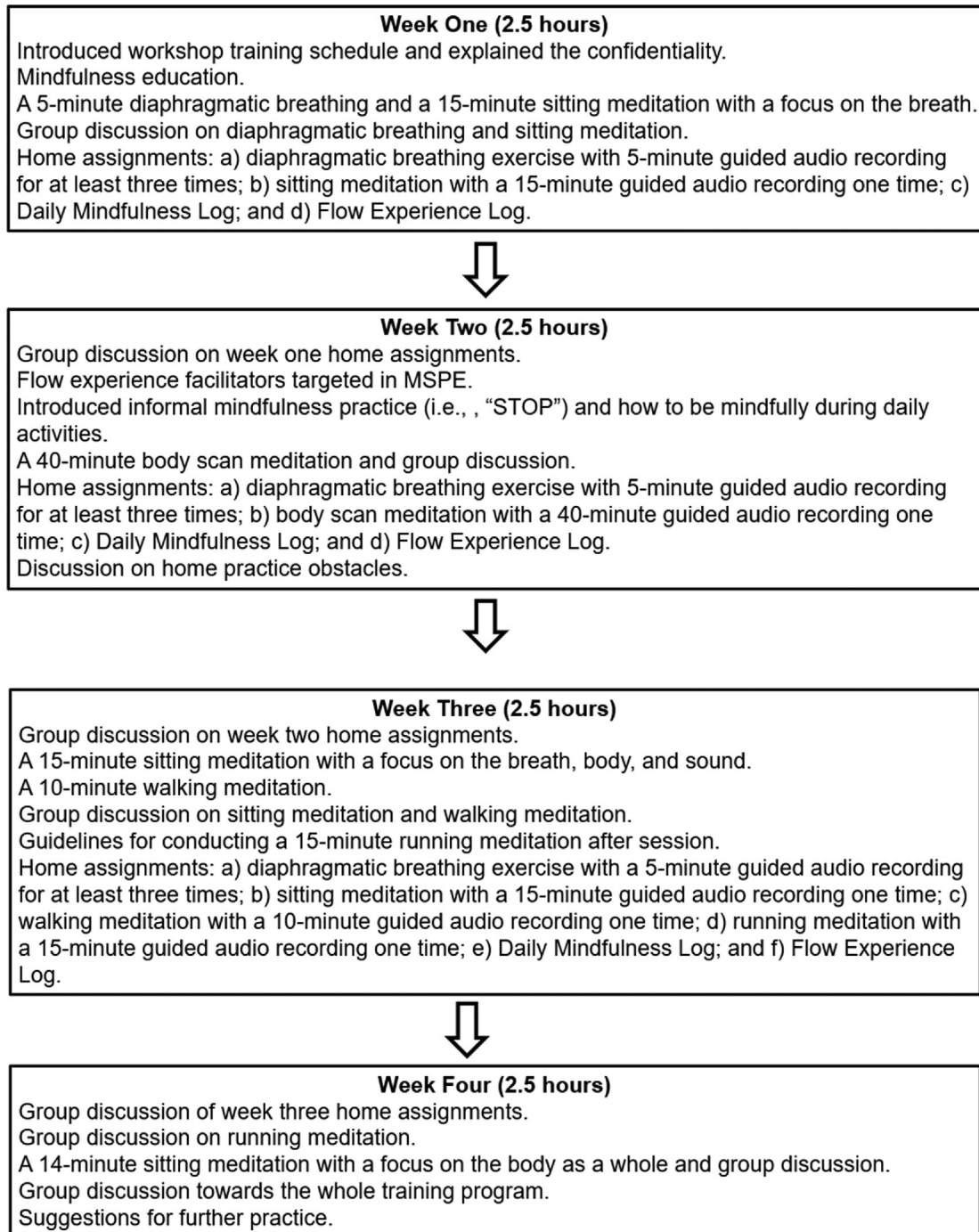


Fig. 1. A revised 4-week protocol of the Mindful Sport Performance Enhancement.

date, and running distance were all recorded in this log. Recreational runners were encouraged to rank the perceived challenges and skill levels after every run. They were also encouraged to write down any thoughts in terms of flow experience, submit them via an online survey and share them at the next session.

After finishing all the intervention sessions, 15 out of 41 recreational runners received an individual semi-structured interview (Table 2). All of them completed four sessions and submitted a baseline and endpoint measure for the Chinese DFS-2. This selection was based on their representation (e.g., gender) and their frequency of participation.

Table 1. Main outcome of MSPE intervention (n = 41).

Scale/Subscale	N	Baseline		Endpoint		Statistic			
		Mean	SD	Mean	SD	Paired-T	Df	Cohen's d	p
The Chinese DFS-2	41	4.21	.64	4.54	.62	4.88	40	.53	.000***
Challenge and Skill Balance	41	3.38	.52	3.73	.58	5.31	40	.64	.000***
Merging of Action and Awareness	41	3.39	.60	3.57	.48	2.06	40	.32	.046*
Clear Goals and Feedback	41	3.61	.69	3.80	.60	2.42	40	.28	.020*
Unambiguous Feedback	41	3.48	.66	3.69	.57	2.34	40	.34	.024*
Concentration	41	3.43	.70	3.64	.65	2.18	40	.32	.035*
Sense of Control	41	3.60	.62	3.70	.56	1.55	40	.18	.129
Loss of Self-Consciousness	41	3.17	.88	3.39	.76	2.23	40	.26	.032*
Transformation Time	41	2.80	.63	3.33	.58	4.84	40	.86	.000***
Autotelic Experience	41	2.60	.57	2.93	.47	4.17	40	.63	.000***

Note. *p < .05. ***p < .001.

2.6. Quantitative strand

2.6.1. Instruments

Demographic questionnaire. The demographic questionnaire consisted of four questions related to age, gender, level of education, and whether they had participated in vigorous running for at least 20 minutes three or more times a week.

The Chinese Dispositional Flow Scale-2 (C-DFS-2). The DFS-2 was adapted into the Chinese DFS-2 [21]. It consists of 35 items that evaluate a person's propensity to experience flow under various conditions. The Chinese DFS-2 includes nine dimensions of the concept of flow as the original scale. Recreational runners were asked to recall, on a 6-point Likert-type response format, how often they had experienced flow whilst running with 1 representing "Never" and 6 representing "Always". The higher the overall score, the more likely it is that they experienced flow. The Chinese DFS-2's internal consistency ranged from 0.83 to 0.92, which is consistent with the original scale (which ranged

from 0.81 to 0.90). A two-week Intraclass correlation coefficient (ICC) for test-retest reliability in 41 runners was found to be excellent (ICC = 0.92, p < .001, 95%CI 0.84 to 0.96) [21].

Table 3. Themes, subthemes, and percentages.

	MSPE (N = 15)
Intervention Acceptability	
Appreciation of the Facilitation Style	15 (100%)
<i>Benefits of Online Session</i>	2 (13%)
<i>Well-structured</i>	5 (33%)
<i>Group communication</i>	8 (53%)
Helpful components	
<i>Walking Meditation</i>	1 (7%)
<i>Sitting Meditation with a Focus on the Body as a Whole</i>	2 (13%)
<i>All the Sitting Meditations</i>	3 (20%)
<i>Diaphragmatic Breathing Exercise</i>	6 (40%)
<i>Body Scan</i>	6 (40%)
<i>All the Exercises are Helpful</i>	9 (60%)
Challenges	
<i>Less Awareness in the Body Scan</i>	2 (13%)
<i>Less Awareness in Active Meditation</i>	3 (20%)
<i>Maintain Focus During Active Meditation</i>	6 (40%)
<i>Maintain Focus During Sitting Meditation with a Focus on the Breath, Body, and Sound</i>	1 (7%)
Intervention Effectiveness	
Dispositional Flow Enhancement	
<i>Concentration</i>	15 (100%)
<i>Focus on Breathing</i>	5 (33%)
<i>Focus on Body Movements</i>	10 (67%)
<i>Clear Feedback</i>	1 (7%)
<i>Sense of Control</i>	4 (27%)
<i>Challenge-skill Balance</i>	5 (33%)
Improve Other Aspects of Life	
<i>Well-being</i>	1 (7%)
<i>Acceptance</i>	1 (7%)
<i>Self-compassion</i>	2 (13%)
<i>Sleep Quality</i>	2 (13%)
<i>Awareness</i>	6 (40%)
<i>Emotion Regulation</i>	6 (40%)
<i>Staying Present</i>	8 (53%)

Note: Percentage of responses within each theme/subtheme from 15 interviewees.

Table 2. Demographic information of interview participants.

No.	ID	Frequency of Participation	Age	Gender	Transcribed Words
1	T41	4	19	Female	7815
2	T61	4	37	Female	4313
3	T3	4	28	Male	16,582
4	T2	4	40	Male	4302
5	T26	4	43	Female	14,222
6	T58	4	41	Male	5144
7	T42	4	43	Female	7169
8	T38	4	36	Male	5346
9	T10	4	41	Female	6340
10	T16	4	47	Female	6386
11	T45	4	47	Male	5712
12	T47	4	41	Male	3849
13	T33	4	29	Female	13,664
14	T12	4	38	Male	4594
15	T39	4	40	Male	5326

Exit questionnaire. The exit questionnaire is a modified version of the Reaction to Treatment Questionnaire (RTO) [22]. Five items (i.e., How logical does this type of workshop seem to you?) asked participants' general comments about the MSPE workshop. The 5-item was rated on a 6-point, Likert-type scale ranging from 1 to 5.

2.6.2. Data collection and analysis

All the data collection process was done online. Recreational runners completed two questionnaires at baseline: the demographic questionnaire and the Chinese DFS-2. After the last session, runners were asked to complete the Chinese DFS-2 again and the additional exit questionnaire.

All statistical analyses were performed in R software (R 4.1.2). Using the 'psych' package, the descriptive statistics were computed. To examine the mean difference between two time points, the paired sample *t*-test was used (i.e., endpoint and baseline). The standardized mean difference (SMD) was calculated by Cohen's *d* and Hedges's *g* with Package 'effsize'. SMDs of 0, 0.3, and 0.8 considered no, medium, and large effects, respectively [23].

2.7. Qualitative strand

2.7.1. Semi-structured interview procedure

All fifteen interviews were conducted via Zoom, which had been scheduled at a time and place that were both secure and quiet. Recreational runners were asked for their approval to record the interview via Zoom before it began. They were reminded of their voluntary presence and right to refuse to answer questions or terminate the interview. The interviewer (first author) took notes, including the runners' nonverbal cues and post-interview reflection, such as body language, facial expression, and emotions. These nonverbal cues were helpful in the later coding process since they were natural and could enhance runners' spoken cues.

Ten interview questions were prepared to examine the acceptability and effectiveness of the intervention: (1) What did you like most about this mindfulness training? (2) What component(s) of this mindfulness workshop was most difficult or challenging for you? (3) How, if so, has this workshop improved your flow experience during running? (4) If you continue to practice what you learned in this workshop, how do you expect this training will improve your flow experience during running in the future? (5) How, if so, has this training improved any aspects of your life other than running? (6) What was the helpful

component(s) in this mindfulness workshop? (7) What was the unhelpful component(s) in this mindfulness workshop? (8) Have you noticed any changes since you attended this workshop? (9) What were your experiences in the group sessions? (10) What recommendations do you have to improve this mindfulness workshop?

2.7.2. Data collection and analysis

Fifteen video recordings were transcribed verbatim by Iflyrec, an online transcription platform (<https://www.iflyrec.com/>). The first author reviewed all the transcripts several times for accuracy before uploading them into NVivo Release1.2. A reflexive thematic analysis (reflexive TA) guided this data analysis process [24].

The following six steps were used to generate themes from codes in this approach [24]: (1) To begin, two researchers read through the transcripts several times to become acquainted with them. Observations and reflections were written down regarding the interview notes and any other potentially significant ideas and remarks [24]. (2) From the data, initial codes were generated by two researchers independently. According to Braun and Clarke, coding is a process of interpretation rather than simple identification, and it is driven by researcher subjectivity [24]. As a result, the initial codes were adjusted throughout the coding process. (3) Codes were classified and sorted into potential themes. Although the main themes for the code structure were based on the research questions, the subthemes were derived from the data. (4) Those potential themes were reviewed and refined to include the same codes. (5) Themes were defined and named after a discussion between two researchers. (6) The results were written and sent to a third researcher (second author) for review. The verbatim quotes and response frequencies were used to confirm the accuracy of the data in the results section.

3. Results

3.1. Quantitative strand

3.1.1. Effect of interventions

There was a significant increase over time in dispositional flow measured by the total score of the Chinese DFS-2 (Table 1). A medium effect size was found from the revised 4-week MSPE intervention ($d = 0.53$, 95% Confidence Interval (CI) for $d = (0.30, 0.75)$; $g = 0.52$, CI for $g = (0.29, 0.74)$). The paired-sample *t*-test demonstrated statistically significant

increases for eight subscales, except one subscale (the sense of control subscale).

3.1.2. Exit questionnaire

The mean of five items in the exit questionnaire, ranging from 4.83 to 5.44, indicated a satisfaction comment about the revised 4-week MSPE intervention.

3.2. Qualitative strand

The average interview time was 33 minutes. The interviewer noted that the less active runners in the previous group discussion had fewer responses to the interview questions. This resulted in fewer transcribed words for those recreational runners, such as participant T47.

3.2.1. Intervention acceptability

Theme 1: Appreciation of the facilitation style. Theme 1 focused on the runners' perception of the intervention. Fifteen codes were generated from the runners' scripts. All the recreational runners stated that they liked something about the facilitation of mindfulness training, with eight mentioning group communication (Table 3), such as “we share our experiences (in the group), we can learn from each other (T61, female).” A runner more generally commented: “After the workshop, I know what and how to be mindful (T10, female).”

Theme 2: Helpful components. Theme 2 focused on the preference of recreational runners in terms of the intervention. Eighteen codes were generated from the runners' scripts. Most runners described the experiences following the instructions of each session as a progressing journey, from the fundamental element (i.e., diaphragmatic breathing exercise) of being mindful to the active meditation in the third session. They reported their concentration and body awareness gradually improving. Participant T10 commented: “They are all helpful, even the running meditation. This training is a process that gradually develops the ability to be mindful. From sitting to walking, then to running.” Additionally, almost half of the interviewees liked all the sitting meditations, especially the body scan and diaphragmatic breathing: “The body scan is straightforward to follow. We began scanning from the toes to the feet, then to the legs. Although it challenged me to shift my attention to some specific body part, I still like this kind of challenge and the experience during the body scan (T3, male).” Others stated having developed the intention of practicing mindfulness (e.g., the diaphragmatic breathing) daily “before bedtime”.

Theme 3: Challenges. Theme 3 focused on the challenges that the recreational runners encountered. Seven codes were generated from the runners' scripts. Some runners stated that they had difficulty connecting certain parts of the body while maintaining focus on breathing during the active meditation. Participant T45 commented: “Everything happens so fast during running. Feelings have slipped without notice as all of this happens in a split second.” Some have described running meditation experiences as less relaxing than sitting meditation experiences. Additionally, they stated that they could not focus on many different things at the same time, were distracted by the outside world, and lost concentration. Participant T45 said: “I would be easily disturbed by the surroundings and could not focus on breathing or other body parts.”

3.2.1. Intervention effectiveness

Theme 4: Dispositional Flow Enhancement. Theme 4 focused on the different aspects of dispositional flow enhancement. Fourteen codes were generated from the runners' scripts. Runners used mindful approaches to approach flow: (1) letting go of other things to focus on running; (2) noticing discomfort; (3) noticing changes in their bodies; and (4) focusing attention on diaphragmatic breathing to reduce fatigue. Participant T33 stated: “Whenever I run, I pay more attention to my body, which makes it easier for me to experience the flow. I'm paying close attention to every part of my body, including the discomfort.” Additionally, some runners reported gaining more control by experiencing tension and relaxation. This is because they had developed the skills to cope with fatigue during running. Participant T10 commented: “I recall having a flow experience while running for nearly half an hour by focusing on my body.”

Theme 5: Improve other aspects of life. Theme 5 focused on the additional effects after finishing the intervention training. Twenty codes were generated from the runners' scripts. All the recreational runners reported positive changes after attending mindfulness training, such as being more aware of the body and focusing on the present moment. Examples of selected quotes included: “more focused on my life” and “being mindful helps me to calm down and be patient.”

4. Discussions

To our knowledge, the present study is the first empirical evaluation of an online 4-week MSPE designed to enhance dispositional flow in

recreational runners. Consistent with the hypothesis, our results show that this revised 4-week MSPE intervention could significantly enhance dispositional flow in Chinese recreational runners. Specifically, there is a statistically significant post-intervention enhancement in dispositional flow, as hypothesized ($d = 0.53$). The qualitative strand provides further evidence and explanation for the acceptability and effectiveness of the intervention. In particular, it emphasizes the intervention's direct application to flow indicators linked with recreational runners and other aspects of life.

4.1. Intervention acceptability

Acceptability is defined as a multidimensional concept that indicates the degree to which those administering or receiving a healthcare intervention consider it suitable. This is based on predicted or actual cognitive and emotional reactions to the intervention [25]. From the qualitative strand, we found this 4-week online MSPE intervention acceptable on four fronts: intervention coherence, opportunity costs, burden, and perceived effectiveness. Intervention coherence represents the degree to which the participant understands the intervention and how it operates. This measure assesses the face validity of the intervention for the receiver or deliverer [25]. In this study, recreational runners perceived detail and clear instructions from most of the mindfulness meditations (e.g., the diaphragmatic breathing and body scan). They were more willing to practice because they understood the rationale for the training. This was, for example, scanning bodies from feet to head to develop concentration and flexibility of attention [8].

Recreational runners reported few opportunity costs in the revised MSPE training. During the pandemic, runners could participate in the intervention online and save time and travel costs. They were more likely to adhere to attending all the sessions. On the other hand, most of the training in the revised MSPE could easily integrate into everyday activities, such as diaphragmatic breathing. Therefore, runners have fewer opportunity costs to participate in the intervention due to the online approach.

Third, most of the meditations in the revised MSPE are less burdensome except the active meditations (i.e., walking and running meditation). According to Sekhon and colleagues, burden refers to the perceived effort involved in taking part in the intervention. Interventions should not take a long time and effort to complete [25]. For the same

reason, runners agreed that the mediation should not be too challenging to implement.

Fourth, runners perceive the effectiveness of the intervention and apply what they have learned to the running context and other aspects of their life to cope with the challenges. According to Sekhon and colleagues, perceived effectiveness refers to how likely the intervention is to achieve its intended outcome [25]. Once runners perceive that the intervention is effective, it will be more acceptable. They are more willing to experiment with mindfulness skills in running and other aspects of their life.

4.2. Intervention effectiveness

Intervention effectiveness was found in the revised 4-week MSPE intervention from both quantitative and qualitative strands. A medium effect size on dispositional flow improvement ($d = 0.53$; 95% CI for $d = (0.30, 0.75)$) was found. Except for the sense of control, the eight dimensions demonstrated different significant improvements. The key facilitators of flow, namely challenge and skill balance, merging of action and awareness, and clear goals and feedback, were found to have medium and small effect sizes (i.e., $d = 0.64$; $d = 0.32$; $d = 0.28$), after the intervention [10]. Five other dimensions of flow (i.e., unambiguous feedback, concentration, loss of self-consciousness, transformation time, and autotelic experience) which have been considered experiential components of flow have small and medium effect sizes after the intervention [10]. Findings from this study provide empirical evidence to support the theoretical relationship between flow and mindfulness, specifically how the MSPE enhances different aspects of flow. Runners applied mindfulness skills (i.e., attention and emotion regulation) learned from the MSPE training to cope with the obstacles that threatened flow. They are in line with previous studies, in which appropriate self-regulation, such as anxiety management, has been identified as a major psychological process that facilitates flow [8]. The ability to direct one's attention is strongly related to flow [8].

The ability to receive unambiguous feedback was found after the training. An unambiguous feedback state occurs when predictions are made from potential actions [26]. In the current study, adjustments made during running are prominently highlighted. Unambiguous feedback also results in less internal conflict [27]. Runners developed the ability to receive unambiguous feedback from the MSPE

training to increase self-efficacy, reduce internal conflict, and protect against exhaustion and burnout.

The single-group, uncontrolled trial design constrained the current investigation. This constraint makes it difficult to draw conclusions or make solid suggestions. Having a control group might be challenging in the present study due to the sampling technique. Some runners in this study are from the same running group. Since the experiences might be shared between group sessions, it was decided to conduct a pretest-posttest before the experiment began. However, this research should be seen as a pilot study, with the main goal being to determine whether the 4-week revised MSPE could enhance dispositional flow in the nonathlete population. Furthermore, the new findings are consistent with earlier athletes' studies and fill a gap in the literature. This study's originality may serve as a springboard for future research and practitioners looking to use MSPE via online delivery.

4.3. Limitations and future work

While this study's findings are promising, future researchers may want to consider the following limitations: First, the small sample size in the study might have increased the risk of Type II error. Due to the lack of a control group, it is impossible to claim with absolute confidence that the outcome was solely attributable to the intervention. For some logistical considerations, such as runners might share their experiences between group sessions, we adopted the single-group approach to prevent diffusion of treatment. Nevertheless, qualitative findings have offered further confirmation that this intervention was beneficial. Third, due to online delivery, some formal mindfulness meditations (e.g., candy exercise) could not be included in this study. Despite these limitations, this mixed-method study still provided encouraging quantitative and qualitative evidence for the revised 4-week MSPE. Further study with a larger sample size and control group is required to strengthen the results. Furthermore, researchers may want to experiment with different durations of the sessions, some combination of online and on-site sessions, and consider more variables, such as exercise maintenance.

5. Conclusions

This mixed-method study suggests a positive impact of the online revised 4-week MSPE on dispositional flow among Chinese recreational runners. Specifically, a significant increase in

dispositional flow was found in 41 Chinese recreational runners after 4-week online training. The qualitative results further strengthened this finding and provided evidence of the acceptability and effectiveness of the revised MSPE. Further studies should experiment with a larger sample size and control group to strengthen the results in other populations, such as older adult square dancers.

Conflict of interest

No conflicts of interest.

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