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Mindfulness-Based Intervention for Schoolteachers: Comparison of Video-Conferencing Group with Face-to-Face Group

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Abstract

Objectives The COVID-19 pandemic has brought substantial mental health challenges as well as significant changes in the delivery of clinical care and interventions, such as switching from traditional face-to-face to online mode. This study aimed to compare the effectiveness and the course experience of a video-conferencing mindfulness-based intervention (MBI) with that delivered face-to-face.

Method Schoolteachers ($N = 170$) were randomly assigned to face-to-face group ($n = 94$) and video-conferencing group ($n = 76$) for an 8-week MBI. The schoolteachers' well-being, including psychological distress, insomnia, perceived stress, mindfulness, positive and negative affect, and life satisfaction, was measured before and after the MBI. Attendance, treatment fidelity, home practice compliance, and program acceptability were collected after the MBI. Qualitative feedback from the two groups was also collected to explore the differences in participants' subjective experiences.

Results Both face-to-face and video-conferencing formats of MBI resulted in better general mental health, more positive affect, and higher life satisfaction, as well as significantly lower levels of insomnia, stress, and negative affect. Observed improvement was comparable between face-to-face and video-conferencing MBI. The two groups also showed comparable adherence, intervention fidelity, and program acceptability. Qualitative results showed that while video-conferencing MBI might be weaker in group process, it provided better accessibility for participants.

Conclusions This study supported the effectiveness and feasibility of video-conferencing MBIs, which are highly accessible for teachers in need of mental health support. Further research exploring enhancements to the group process in video-conferencing MBIs may further improve the effectiveness of online programs.

Preregistration This study is not pre-registered.

Keywords COVID-19 · Group therapy · Mindfulness · Online · Teacher · Stress

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According to the statistics of the United Nations Educational Scientific and Cultural Organization (2022), 198 countries experienced nationwide school closures during 2020–2022 because of the coronavirus disease 2019 (COVID-19) pandemic. The difficult times in the pandemic have raised concerns about educators' physical and mental well-being worldwide (Hascher et al., 2021; Pokhrel & Chhetri, 2021). A study in the USA showed that almost 50% of elementary school teachers reported emotion exhaustion, high stress, and job ambiguity after school closure (Chan et al., 2021). Similarly, a study in Argentina found that 62% of teachers displayed high or moderately high levels of stress because of the uncertainty about the pandemic, work overload, and inadequate work environment (Rubilar & Oros, 2021). In an international survey conducted in 10 countries, more than

50% of teachers reported needing assistance to support their well-being (Meinck et al., 2022). Up to 36–61% of teachers reported insomnia symptoms (Gierc et al., 2022), which are often linked to the risk of mental health problems (Palagini et al., 2022; Zhang et al., 2012). The need for mental health support was amplified in East Asia, where high-stakes public examinations are always pervasive (Lee & Gopinathan, 2020; Yan & Brown, 2021). A survey in China found that 12% of teachers reached the clinical cutoff for post-traumatic stress disorder during the COVID-19 pandemic (Kukreti et al., 2021). A survey in Hong Kong also found that 28% of teachers reported having mood-related mental health conditions (Hong Kong Federation of Education Workers, 2022). In the light of these unprecedented challenges faced by educators, there is a pressing need for timely mental health services.

Among the array of mental health services available, mindfulness-based interventions (MBIs) have demonstrated effectiveness in reducing stress and enhancing psychological well-being within the teaching profession (Emerson et al., 2017; Floman, 2018; Hidajat et al., 2023; Hwang et al., 2017; Tsang et al., 2021; Zarate et al., 2019). MBIs are designed to promote one's awareness by purposefully paying attention to the present moment experience non-judgmentally (Kabat-Zinn, 1990). According to Roeser et al. (2012), MBIs can cultivate a habit of mind that helps to improve teachers' well-being and day-to-day teaching by enhancing their emotion regulation, awareness, openness, empathy, and compassion. A meta-analysis of 18 studies showed that MBIs have significant positive effects on schoolteachers' mindfulness, stress, anxiety, burnout, and depression (Zarate et al., 2019). Although MBIs could benefit educators' mental well-being, COVID-19 presented new challenges to the delivery of MBIs.

In recent years, many psychological services have shifted toward telepsychology, "the provision of psychological services using telecommunication technologies" (Joint Task Force, 2013, p. 791) as defined by the American Psychological Association. Correspondingly, many studies have been conducted to evaluate the effectiveness of telepsychology and online psychological interventions for different populations. These populations include employees (Carolan et al., 2017), university students (Cavanagh et al., 2013), parents (Flujas-Contreras et al., 2021), and the elderly (Shapira et al., 2007). Various studies have shown that online interventions can effectively reduce depressive symptoms (Ebert et al., 2015), decrease burnout (Ansley et al., 2021), and increase resilience (Lang et al., 2020). A meta-analysis of 92 studies on the effectiveness of web-based psychotherapeutic interventions indicated a medium effect size of 0.53 (Barak et al., 2008). A systematic review of 65 studies showed that online psychotherapy had similar outcomes to traditional face-to-face format in diverse clienteles (Backhaus et al.,

2012). Despite the promising results, most evidence for online psychological interventions pertains to traditional cognitive behavioral therapy (Andersson et al., 2019). In contrast, there have been fewer studies that examined the effects of online formats of MBIs, an essential pillar of the third-wave therapeutic approach (Hayes & Hofmann, 2017).

The accessibility and scalability of MBIs in communities have long been hindered by obstacles such as the scarcity of mindfulness trainers, travelling constraints, and scheduling issues. MBIs for teachers in particular tend to be time and resource intensive. For instance, the CARE program (Jennings et al., 2019) involves over 30 hr of training that spans across a school year. Online mindfulness training may be a promising alternative to traditional face-to-face mindfulness training (Mrazek et al., 2019; Spijkerman et al., 2016) because it is less costly and more accessible and flexible to people who live in remote areas and those who prefer to taking part in the intervention at their own pace.

There has been some initial empirical support for the effectiveness of online MBIs. Jayewardene et al. (2017) conducted a meta-analysis of eight randomized controlled trials (RCT) on the effectiveness of preventive online MBIs and reported a medium effect for perceived stress ($g = 0.43$) at post-intervention and a large effect ($g = 0.77$) at follow-up. In response to COVID-19, there was increasing evidence supporting the feasibility and efficacy of online MBIs. Zhang et al. (2021) reported a significant treatment effect of a brief online MBI on the mental health of Chinese residents in Hubei Province, where COVID-19 first broke out. Ellett et al. (2022) reported significant improvement in clinical outcomes for people with psychosis after they had taken an online MBI. Still, more evidence is needed to support the effectiveness of online MBIs in different clienteles, particularly educators, who have been facing enormous challenges since the pandemic.

While the effectiveness of interventions is dependent on successful program implementation, concerns have been raised regarding various aspects of online implementation. First, MBIs emphasize the importance of home practice (Santorelli et al., 2017; Segal et al., 2013) and home practice was believed to be a driving force of achieving therapeutical changes in participants. A systematic review of 21 studies of MBIs for cancer survivors has shown that the adherence rates to home practice were only 60% of the assigned amount (Baydoun et al., 2021). Given that the adherence rate for face-to-face modality was already suboptimal, whether online MBI participants could engage in sufficient practice remained a concern. Zhang et al. (2021) reported over 95% home practice adherence, given that they provided reminders every morning during the training period. The adherence to home practice without close monitoring remains a question and requires a close examination.

Second, therapist support plays a vital role in the processes and outcomes of interventions (Bowen & Kurz, 2012). Weinberg (2020) argued that the absence of face-to-face interaction and the dilution of the therapeutic presence of the therapist are the biggest obstacles to online group psychotherapy. In the meta-analysis by Spijkerman et al. (2016), online MBIs with therapist guidance were found to lead to larger effect sizes than those without therapist guidance ($g = 0.89$ vs. $g = 0.43$). Mindfulness teachers reported that they had made adaptations to compensate for the limitations of online modality, such as adjustments in verbal/nonverbal behaviors and silence management (García et al., 2022). Nonetheless, whether mindfulness teachers' support can be conveyed to participants through online modality is questionable and the perspective from clients is much needed.

Third, group process and context are essential therapeutic factors. They do not only motivate one to continue with the training, but also cultivate a sense of acceptance and support (Griffith et al., 2019; Malpass et al., 2012). Cormack et al. (2018) proposed a model of "the group as a vessel on a shared journey" to highlight the importance of group process for MBIs. The communal experiences, such as shared journeys and sense of community in meditation during the course, contribute to the effectiveness of MBIs. However, due to technological limitations, the online group process may not emulate the experience of a face-to-face group. Lopez et al. (2020) conducted a pilot study to investigate the impact of video-conferencing mode on group cohesion in dialectical behavior therapy. They found that although both the face-to-face group and video-conferencing group felt equally connected to the trainer, the participants in the video-conferencing group felt less connected to other group members than those in the face-to-face group. Last but not least, there may be a loss of in-person energy exchange in the online group setting. For example, participants are unable to chat with one another before the class or during the breaks. To sum up, whether the virtual group interaction would bring about equivalent therapeutic benefits to the face-to-face group process remained uncertain.

The current study was part of a sizeable school-based project that aimed at evaluating the effectiveness of an MBI for schoolteachers (Tsang et al., 2021). Due to the pandemic, the MBI for the waitlist control group in the randomized controlled trial was switched from face-to-face to video-conferencing delivery mode. This switch of modality offered a unique opportunity to compare the effectiveness of face-to-face mode and video-conferencing mode in delivering an MBI to schoolteachers. This study aimed to answer three research questions. First, does the MBI delivered with video-conference mode improve schoolteachers' well-being? Second, is the effect of video-conferencing MBI equivalent to face-to-face MBI? Third, how does the course experience of video-conferencing MBI differ from that of face-to-face MBI?

Method

Participants

Recruitment emails were sent to all publicly funded elementary schools ($n = 543$; Committee on Home-School Co-operation, 2019a) and all publicly funded secondary schools ($n = 471$; Committee on Home-School Co-operation, 2019b) in Hong Kong. There were 197 educators who indicated their interest and completed a screening questionnaire. Among them, 186 participants met the following study inclusion criteria: (1) working in schools, (2) not experiencing severe or unstable mental health conditions at the time of recruitment, and (3) no extensive previous experience with mindfulness. Participants were randomly assigned to either the mindfulness training condition or waitlist control condition. Those randomized to the mindfulness training condition ($n = 94$) completed the training face-to-face from October to December of 2019 and those randomized to the waitlist control condition ($n = 92$) completed the same training by video conference from March to May of 2020. Prior to the commencement of MBI for the waitlist control group, 16 participants (17.40%) withdrew due to various reasons. Therefore, a total of 76 participants completed 8-week online mindfulness training eventually (Fig. 1). The flow of the study is presented in Fig. 1.

Figure 1 shows that the final sample included 170 schoolteachers and personnel (71.20% female) from 52 schools. Most participants were teachers (74.10%), while 21.80% were school helping professionals (e.g., social workers, counsellors, educational psychologists), and 4.10% were school supporting staff (e.g., executive officers). Participants ranged from 22 to 59 years old ($M = 39.53$, $SD = 9.37$), and their years of work experience in schools ranged from less than a year to 36 years ($M = 14.58$, $SD = 9.64$). To ensure the final sample size is adequate for detecting differences between the two modes of intervention, a post hoc power analysis was conducted with G*Power (Faul et al., 2007) to calculate the achieved power for our statistical analyses. The result indicated our final sample size achieved 90% power for detecting a medium effect ($f = 0.25$; Cohen, 1988) at $\alpha = 0.05$.

Fig. 1 Flow diagram of the study
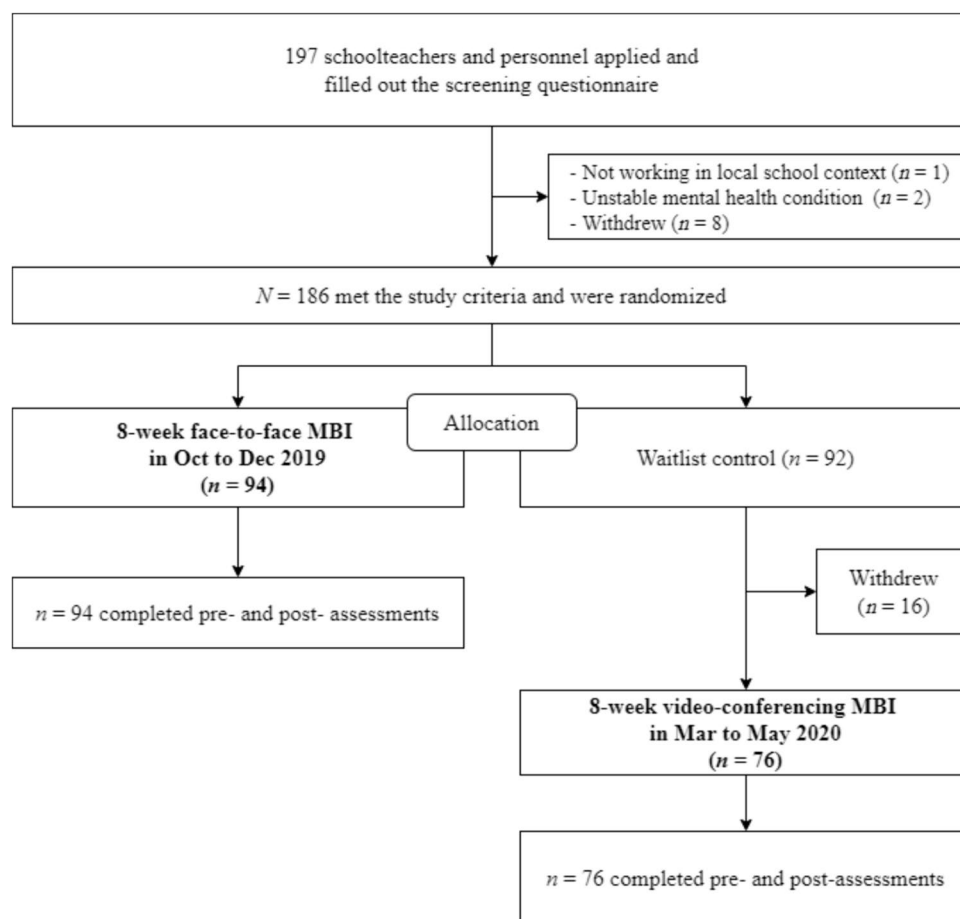
Procedure

Participants randomized to the face-to-face group completed an online self-report survey before the training in September 2019 and after the training in December 2019, and again in February 2020. Those randomized to the video-conferencing group served as the waitlist control group for the face-to-face group in a related study (Tsang et al., 2021). Their training mode was suddenly changed to online because of the COVID-19 pandemic. They completed the same online self-report survey before the training in September 2019, December 2019, and February 2020. They also completed the post-training survey in May 2020.

Intervention

In this study, we employed the 8-week MBI protocols developed by the Mindfulness in Schools Project (MiSP), namely *.b Foundations* for face-to-face group and *.begin* for video-conferencing group (Beshai et al., 2016). The two courses are school-based mindfulness training programs custom-made for adults in school settings. These courses stem from the programs of *Mindfulness-Based Stress Reduction* (Santorelli et al., 2017), *Mindfulness-Based Cognitive Therapy*

(Segal et al., 2013), and *Mindfulness: Finding Peace in a Frantic World* (Williams & Penman, 2011). Similar to these programs, both *.b Foundations* and *.begin* courses are group-based interventions with a blend of experiential and interactive learning activities. There were six *.b Foundations* groups and six *.begin* groups with about 15 participants in each group. The 12 groups were taught by 10 mindfulness trainers (two males and eight females), who were healthcare professionals trained to teach the courses according to the MiSP's requirements.

The structure and content of *.b Foundations* and *.begin* courses were exactly the same, with one taster session followed by eight weekly sessions of 90 min each (12 contact hours in total). For details of the content and effectiveness of the .b Foundations course, see Tsang et al. (2021). Apart from attending weekly sessions, participants were asked to follow audio instructions to do 20-min formal home practice daily and informal practices such as walking or eating mindfully. From Week 2 to Week 8, participants were asked to submit weekly home practice records, reporting whether they had done formal and informal practices on each day of the week. The home practice records were submitted by paper in the face-to-face group and by email in the video-conferencing group.

Although the *.b Foundations* and *.begin* courses had the same structure and content, some teaching tools were adapted for online delivery in *.begin*. For example, an online random name picker was used as an alternative to shock ball to trigger participants' stress response in Session 5; a website, "futureme.org," was used as an alternative to paper and pencil for participants to write a letter in the last session. In addition, participants were reminded to prepare a computer with stable internet connection and find a quiet place with minimal distractions to attend the class. In the taster session, basic Zoom functions were introduced and rehearsed. They were also encouraged to turn on the camera so that they could see each other during the live virtual class.

Measures

Mindfulness

The Cognitive and Affective Mindfulness Scale-Revised (CAMS-R; Feldman et al., 2007) was used to measure participants' levels of mindfulness. The scale consists of 12 items (e.g., "I am able to focus on the present moment"). Participants rated how frequently they had the experience in the past month on a 5-point Likert scale from 1 (*Never*) to 5 (*Always*). A higher score indicates a higher level of mindfulness. Internal consistencies of the scale in this study were $\alpha = 0.82$ (Pre) and 0.79 (Post) for the face-to-face group and $\alpha = 0.87$ (Pre) and 0.76 (Post) for the video-conferencing group.

General Mental Health

The General Health Questionnaire (Goldberg & Williams, 1988) was used to assess whether participants encountered problems related to mood, self-confidence, and concentration. The questionnaire consists of 12 items (e.g., "able to enjoy normal day-to-day activities"). Participants rated how frequently they had the experience in the past month on a 5-point Likert scale from 1 (*Never*) to 5 (*Always*). A higher score indicates better general mental health. Internal consistencies of the scale in this study were $\alpha = 0.88$ (Pre) and 0.87 (Post) for the face-to-face group and $\alpha = 0.90$ (Pre) and 0.80 (Post) for the video-conferencing group.

Insomnia

The Insomnia Severity Index (Bastien et al., 2001) was used to measure participants' perceived severity of insomnia symptoms over the past 2 weeks. The index consists of seven items (e.g., "difficulty staying asleep"). Participants rated the items on a 5-point Likert scale from 1 (*Not at all*) to 5 (*Very severe*). A higher score indicates more severe insomnia. Internal consistencies of the scale in this study were

$\alpha = 0.85$ (Pre) and 0.82 (Post) for the face-to-face group and $\alpha = 0.91$ (Pre) and 0.86 (Post) for the video-conferencing group.

Stress

The Perceived Stress Scale (Cohen et al., 1983) was used to measure participants' perceived stress in daily life. The scale consists of 10 items (e.g., "unable to control the important things in my life"). Participants rated how frequently they had the experience in the past month on a 5-point Likert scale from 1 (*Never*) to 5 (*Always*). A higher score indicates a greater level of stress. Internal consistencies of the scale in this study were $\alpha = 0.88$ (Pre) and 0.86 (Post) for the face-to-face group and $\alpha = 0.91$ (Pre) and 0.86 (Post) for the video-conferencing group.

Positive and Negative Affect

Four positive emotional states ("happy," "attentive," "calm," and "determined") and four negative emotional states ("nervous," "angry," "upset," and "guilty") from the Positive and Negative Affect Scale (PANAS; Watson et al., 1988) were used to measure participants' positive and negative affect. These emotional states were chosen because of their relevancy with mindfulness. A higher score indicates more positive or negative affect. Internal consistencies of the positive affect scale were $\alpha = 0.74$ (Pre) and 0.71 (Post) for the face-to-face group and $\alpha = 0.81$ (Pre) and 0.80 (Post) for the video-conferencing group. Internal consistencies of the negative affect scale were $\alpha = 0.74$ (Pre) and 0.70 (Post) for the face-to-face group and $\alpha = 0.67$ (Pre) and 0.56 (Post) for the video-conferencing group.

Life Satisfaction

The Satisfaction with Life Scale (Diener et al., 1985) was used to measure participants' subjective quality of life. The scale consists of five items (e.g., "I am satisfied with my life"). Participants rated how frequently they had the experience in the past month on a 5-point Likert scale from 1 (*Never*) to 5 (*Always*). A higher score indicates a higher level of life satisfaction. Internal consistencies of the scale in this study were $\alpha = 0.90$ (Pre) and 0.90 (Post) for the face-to-face group and $\alpha = 0.93$ (Pre) and 0.92 (Post) for the video-conferencing group.

Completion Rate

Only participants who attended at least six out of the eight weekly sessions of the course (i.e., achieving an attendance rate of 75% or higher) were considered to have completed the course and were included in the analyses.

Program Acceptability

In the post-intervention survey, participants rated the extent to which they knew more about mindfulness, gained better self-understanding, experienced improved health, thought the course had a positive life influence on them, and would recommend the course to others on a 5-point Likert scale from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*).

Intervention Fidelity

At the end of each session, one participant in each group was randomly invited without replacement to complete an intervention fidelity questionnaire. Participants indicated if the core themes and practices were covered during the session ("yes" or "no") and rated whether the mindfulness trainer's instruction was clear on a 4-point Likert scale from 1 (*Strongly Disagree*) to 4 (*Strongly Agree*).

Home Practice Compliance

In the post-intervention survey, participants in both interventions were asked to report how much they agreed that they "practiced mindfulness daily during the course" on a 5-point Likert scale from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*).

Qualitative Outcomes

To identify topics that the participants were concerned about but were not included in the quantitative measures (O'Cathain & Thomas, 2004), we also collected qualitative data in the post-program survey with an open-ended question: "Do you have any suggestions or comments on this course?" Their feedback would be informative to address the third research question about the differences in experience between the two modes of delivery.

Data Analyses

Quantitative Analyses

To examine whether the two groups were comparable, baseline comparisons were conducted to examine the differences between the face-to-face and video-conferencing groups in demographic characteristics and pre-intervention measures. To address the first research question about effectiveness, we used paired-sample *t*-tests to compare the pre- and post-intervention scores for the two groups separately. To address the second research question about the comparison of two modalities, analysis of covariance (ANCOVA) was conducted to examine if there were differences between the two groups on the outcome measures at post-intervention,

with pre-intervention score as the covariate (Tu et al., 2005). Levene's tests were conducted to check the homogeneity of variance assumption. To address the third research question about the differences in treatment experience, independent sample *t*-tests were used to compare the intervention fidelity, program acceptability, and home practice compliance of the two groups.

Qualitative Analysis

We used the single-coder approach to conduct a comparative thematic analysis of the qualitative data (Guest et al., 2012). The qualitative feedback was analyzed using an inductive approach, following the step-by-step guide to reflexive thematic analysis outlined in Nowell et al. (2017). Given the exploratory nature of our third research question, we chose the single-coder approach for the thematic analysis (McDonald et al., 2019). The second co-first author was responsible for the coding process, given his extensive understanding of the qualitative feedback dataset. After thoroughly reading all the responses, he generated a set of initial codes with clear definitions by labeling and grouping recurring semantics. During an iterative coding process, individual responses were coded using the initial codes, while new codes were developed when needed. As the coding scheme developed, codes were merged or redefined to maximize the homogeneity of responses within each code and the distinctiveness among codes. After three rounds of the coding process, the coder derived themes from the code list by grouping codes with overlapping abstract concepts. Since the single-coder approach was used, the calculation of interrater reliability was not applicable.

To further address the third research question about the differences in experience, a comparative analysis was conducted by comparing the feedback of the two groups, according to the method described by Guest et al. (2012). For the quantitative comparison, the relative theme frequencies for each group were calculated as percentages by dividing the theme counts by the total number of responses from each group. The qualitative comparison was conducted by comparing the expression of themes presented in both groups or only in one group but not the other.

Results

Intervention Fidelity and Home Practice Compliance

Across all the training sessions, 99.50% of respondents in face-to-face group and 100% in video-conferencing group indicated that all the core themes and practices were covered in the sessions. All respondents (100%) in both groups agreed or strongly agreed that the instruction of the trainers

was clear, and no significant differences were found across different trainers.

As presented in Table 1, the video-conferencing group had a higher self-reported home practice compliance than the face-to-face group, $t(163.84) = -2.37$, $p = 0.02$, $d = -0.35$, 95%CI [−0.66, −0.05]. Figure 2 presents the rate of home practice record submission across the course. Initially, the submission rate of the face-to-face group (64.89%) was higher than that of the video-conferencing group (43.40%). The submission rate of home practice records decreased to 12.77% at the end of the course for face-to-face group, while the submission rate for the video-conferencing group gradually dropped to 32.89% at the end of the course.

Completion Rate and Program Acceptability

All the participants in both groups had attended at least six of the eight weekly sessions and therefore were included in the analysis. The post-intervention survey showed that most of the participants agreed or strongly agreed that they were able to "know more about mindfulness" (face-to-face group: 96.70%, video-conferencing group: 100.00%), "gain better self-understanding" (face-to-face group: 95.70%; video-conferencing group: 90.80%), "improve health" (face-to-face group: 89.30%; video-conferencing group: 84.20%), and "have experienced positive life influence" (face-to-face group: 96.70%, video-conferencing group: 93.50%). In addition, 96.80% of participants in the face-to-face group and 100% in the video-conferencing group would recommend the 8-week mindfulness course to others. Independent sample t-tests indicated no significant differences between the two groups on all the above ratings (Table 2). The completion rate and program acceptability in this study were comparable to those observed in previous face-to-face MBIs for teachers (e.g., Beshai et al., 2016).
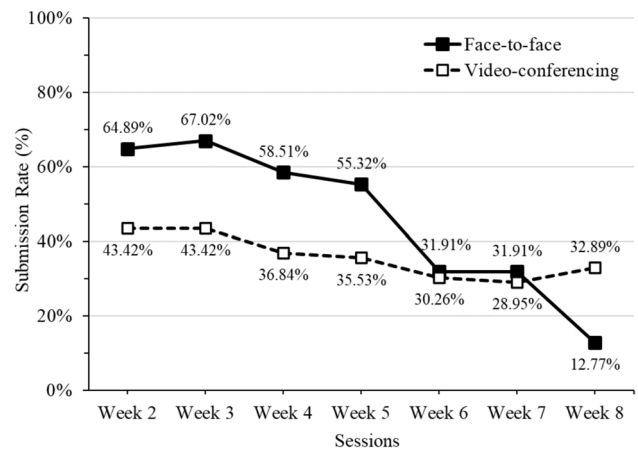

Fig. 2 Home practice record submission rate of the face-to-face group and video-conferencing group across sessions

Effectiveness of Face-to-Face and Video-Conferencing Interventions

Table 1 summarizes the demographic characteristics of the participants in the two groups. Results of the *Chi-square* test and independent sample *t*-tests indicated no significant differences in demographic characteristics between the two groups. Table 3 presents the descriptive statistics of the outcome measures. Results of independent sample *t*-tests indicated no significant differences between the two groups on any pre-intervention measures.

As shown in Table 3, paired-sample *t*-tests result indicated that participants in both groups reported a significantly higher level of mindfulness after the 8-week training. The effect sizes were comparable (Cohen's $d = 0.31$ for face-to-face group vs. Cohen's $d = 0.32$ for video-conferencing group). Similarly, participants in both groups reported

Demographics	Face-to-face ($n = 94$)			Video-conferencing ($n = 76$)			Group comparison
	N	%	M (SD)	N	%	M (SD)	
Gender							
Male	27	28.72%		22	28.95%		$\chi^2(1) = 0.00$
Female	67	71.28%		54	71.05%		$p = 0.97$
Age in years			39.74 (9.41)			39.25 (9.38)	$t(167) = 0.34$ $p = 0.74$
Years of work experience in school			15.00 (9.73)			14.05 (9.56)	$t(164) = 0.63$ $p = 0.53$
Self-reported home practice compliance[a]			3.26 (0.99)			3.57 (0.70)	$t(163.84) = -2.37$ $p = 0.02*$

Table 1 Participants' demographics by group

[a]Self-reported home practice compliance = Agreement scores of the statement "I practiced mindfulness daily during the course." (range 1–5 from *strongly disagree* to *strongly agree*)

Table 2 Program acceptability by group

After the program,	Face-to-face (n = 94)	Video-conferencing (n = 76)	t [a]	df [b]	p [c]
	M (SD)	M (SD)			
Know more about mindfulness	4.43 (0.56)	4.33 (0.47)	1.27	167	0.21
Gain better self-understanding	4.22 (0.51)	4.08 (0.51)	1.73	167	0.09
Experience improved health	4.06 (0.57)	3.96 (0.53)	1.22	167	0.22
Have a positive life influence	4.26 (0.51)	4.14 (0.51)	1.44	167	0.15
Recommend the program to others	4.37 (0.55)	4.20 (0.57)	1.96	167	0.05

Participants responded on a 5-point Likert scale from 1 ("Strongly Disagree") to 5 ("Strongly Agree") in the post-intervention survey

[a] t-statistic was based on independent-sample t tests

[b] df, degrees of freedom

[c] p, p-value; ***p < 0.001, **p < 0.01, *p < 0.05

Table 3 Effects on mental health outcome measures by group

Outcome measures	Group [a]	Pre [b] M (SD)	α [c]	ω [d]	Post M (SD)	α [c]	ω [d]	t [e]	df [f]	d [g] 95% CI [LL UL]
Mindfulness	F2F	3.29 (0.43)	0.82	0.83	3.42 (0.37)	0.79	0.80	−2.98**	92	0.31 [0.10 0.52]
	VC	3.27 (0.44)	0.87	0.88	3.39 (0.33)	0.76	0.78	−2.81**	75	0.32 [0.09 0.55]
General mental health	F2F	3.53 (0.51)	0.88	0.89	3.68 (0.47)	0.87	0.88	−4.08***	93	0.42 [0.21 0.63]
	VC	3.49 (0.50)	0.90	0.90	3.67 (0.36)	0.80	0.80	−3.50**	75	0.40 [0.17 0.63]
Insomnia	F2F	2.22 (0.69)	0.85	0.86	1.91 (0.52)	0.82	0.83	4.83***	91	−0.50 [−0.72 −0.29]
	VC	2.11 (0.71)	0.91	0.91	1.96 (0.60)	0.86	0.87	2.06*	75	−0.24 [−0.46 −0.01]
Stress	F2F	2.70 (0.52)	0.88	0.88	2.55 (0.44)	0.85	0.86	3.55**	93	−0.37 [−0.58 −0.16]
	VC	2.76 (0.52)	0.91	0.91	2.52 (0.44)	0.85	0.86	4.31***	75	−0.49 [−0.73 −0.26]
Negative affect	F2F	2.82 (0.66)	0.74	0.75	2.59 (0.51)	0.70	0.71	4.03***	92	−0.42 [−0.63 −0.21]
	VC	2.78 (0.55)	0.67	0.68	2.43 (0.48)	0.56	0.58	5.65***	75	−0.65 [−0.88 −0.39]
Positive affect	F2F	3.36 (0.55)	0.74	0.75	3.58 (0.51)	0.71	0.72	−3.84***	92	−0.40 [−0.61 −0.19]
	VC	3.32 (0.59)	0.81	0.82	3.58 (0.50)	0.80	0.80	−4.32***	75	0.50 [0.26 0.73]
Life satisfaction	F2F	3.45 (0.71)	0.90	0.91	3.65 (0.67)	0.90	0.91	−3.27**	92	0.34 [0.13 0.55]
	VC	3.38 (0.73)	0.93	0.93	3.55 (0.59)	0.82	0.92	−2.52*	75	0.29 [0.06 0.52]

Participants responded on a 5-point Likert scale from 1 (*Never*) to 5 (*Always*)

[a] Face-to-face (F2F) MBI (n = 94) was conducted in October to December 2019; video-conferencing (VC) MBI (n = 76) was conducted in March to May 2020

[b] No significant pre-intervention differences between the two groups for any outcome measures

[c] α, Cronbach's alpha

[d] ω, McDonald's Omega

[e] t-statistic was based on within-subject paired-sample t-test. ***p < 0.001, **p < 0.01, *p < 0.05

[f] df, degrees of freedom

[g] Effect size (Cohen's d): small effect = 0.2; medium effect = 0.5; large effect = 0.8

significantly better general mental health, more positive affect, higher life satisfaction, and significantly lower levels of insomnia, stress, and negative affect after the training. The effect sizes ranged from small to medium (Cohen's ds ranging from 0.24 to 0.65). These results suggested the benefits of mindfulness training on participants' well-being in both face-to-face and video-conferencing modes.

ANCOVA results indicated that participants in the video-conferencing group reported a significantly lower level of negative affect at post-intervention than their counterparts in the face-to-face group after controlling for the pre-intervention score, $F_{(1,166)} = 4.67$, $p = 0.03$, $\eta_p^2 = 0.03$. No significant ANCOVA results were found for the other measures, suggesting the two modes of MBI are equally effective in

improving participants' well-being. Levene's tests showed that the homogeneity of variances assumption was met.

Themes of the Qualitative Feedback

The response rates for the open-ended question on comments and suggestions were 70.20% ($n = 66$) in the face-to-face group and 79% ($n = 60$) in the video-conferencing group, with no significant difference between groups, χ^2 (1, 170) = 1.67, $p = 0.20$, Cramer's $V = 0.10$. We identified six themes in the answers: general perception of the course, course design, trainer, learning outcomes, group process, and accessibility (Table 4). The relative theme counts, i.e., percentage of the total response under the theme, of each group were shown in brackets.

Theme 1 — General Perception of the Course

This theme included general comments that did not pertain to specific aspects of the course. Both face-to-face and video-conferencing groups praised the course (face-to-face: 21%; video-conferencing: 17%), expressed gratitude (face-to-face: 17%; video-conferencing: 12%), reported having a positive experience (face-to-face: 11%; video-conferencing: 12%), and thought the course to be beneficial (face-to-face: 9%; video-conferencing: 3%). Despite the overall positive impression, we also identified a subtheme, "feeling about video-conferencing mode," related to the perception of the video-conferencing mode unique to that group. Most of these comments indicated a negative impression of video-conferencing mode or a preference for the face-to-face format (15%). However, there were also a few comments that expressed a preference for the video-conferencing mode (7%).

Theme 2 — Course Design

This theme included comments on various aspects of the course design, such as content and dosage. Compared with the video-conferencing group (17%), there were more comments on course design from the face-to-face group (27%). These comments indicated that the course was "comprehensive," "well-designed," "well-organized," "suitable for educators," and "had integrated theory with practice." Among the comments on dosage, over half of them indicated that eight 1.5-hr sessions were "appropriate" (face-to-face: 5%; video-conferencing: 5%). Three comments from the face-to-face group (5%) suggested more and longer sessions, and one comment from the video-conferencing group (2%) suggested having shorter sessions.

Theme 3 — Trainer

Two subthemes were identified: trainer's teaching and trainer's personal quality. There was no notable difference between the two groups regarding how the participants perceived the trainers' teaching (face-to-face: 14%; video-conferencing: 13%). Comments that frequently appeared were "well-prepared," "professional," and "gave clear guidance." There were more reports of trainer's personal qualities from the video-conferencing group (17%) than the face-to-face group (9%). Comments from both groups indicated that the trainers were "patient," "supportive," and "kind."

Theme 4 – Learning Outcomes

Around one-fifth of the comments were about the benefits of joining the course (face-to-face: 18%; video-conferencing: 20%). Although comments from both groups indicated some shared learning outcomes, such as "self-understanding", "mindfulness knowledge," "self-compassion," and "mental health in general," the most frequently reported outcomes were different between groups. While more comments from the face-to-face group indicated the course helped them "deal with stress and emotion" (face-to-face: 42%; video-conferencing: 17%), more comments from the video-conferencing group indicated enhancement of "awareness" of body, thoughts, and the present moment experience (face-to-face: 8%; video-conferencing: 33%).

Theme 5 — Group Process

Around 7% of the comments related to group process (face-to-face group: 7.50%, video-conferencing group: 6.70%). Although comments from both groups indicated that there were group sharing and discussion in the sessions, the impressions differed between groups. All the comments from the face-to-face group were positive, e.g., "engagement in group activities" and "sense of shared journey." There were also requests to build an online chat group in messaging applications, indicating a strong sense of community within the face-to-face groups. In contrast, three comments from the video-conferencing groups indicated reduced interaction due to the video-conferencing mode. Only one comment indicated that the interaction was unaffected. It is noteworthy that one participant in the video-conferencing group reported a negative experience in group activity, stating that:

> It's hard to remind other groupmates to do practice as one of my partners did not respond, which frustrated me. I hope that I would not be grouped with someone who ignored me.

Table 4 Thematic analysis of open-ended feedback

Theme	Subtheme	Definition and examples
General perception of the course	Positive experience	**Definition:** Comments related to their experience in class "I enjoyed the lessons." "A very fruitful learning experience." "Very relaxing"
	Beneficial	**Definition:** Comments related to the utility of the course "Very useful" "A helpful course for me" "I gained a lot from the course."
	Grateful	**Definition:** Expression of gratitude toward the experience, the instructors, or unspecified "I am thankful for the opportunity to participate." "Thank you very much." "Thanks to the teacher for her patient teaching."
	Unspecified compliment	**Definition:** Compliment that is unspecified "Good" "Very nice" "Would recommend it to my colleagues."
	Feeling about video-conferencing mode	**Definition:** Comments related to modality of the course "It would be better if it were held face-to-face." "Although it was held via Zoom, it did not affect our learning." "Although the sessions were held via Zoom, the classroom learning was not affected."
Course design	Course content	**Definition:** Comments related to the content within the course; specifics includes topics covered and activities in class "The course is well-designed." "Equal emphasis on theory and practice." "Suitable for educators." "More practical exercise."
	Dosage	**Definition:** Comments on the dosage of intervention, such as course length (9 sessions) and duration of each session (90 min) "This is an appropriate dosage as an introductory course." "The session duration could increase from 1.5 to 2 hr." "Shorten each lesson to an hour"
Trainer	Trainers' guidance	**Definition:** Comment on trainers' teaching and guidance, including preparation, instructions, facilitation skills, etc. "Trainer's guidance is professional and effective." "Expressed the content clearly and lightheartedly." "Trainer prepared each session with great care."
	Trainers' personal quality	**Definition:** Comment on trainers' personal quality "Trainer is very patient." "I like the kind and peaceful attitude of the trainer." "The instructor is friendly and patient, and her language is encouraging."
Learning outcomes		**Definition:** Comment about the specific benefits gained from joining the course "Help myself to deal with stress" "This course allows me to gain more knowledge and understanding of mindfulness." "This course made me more focused on the present moment than before and pay more attention to myself, including what I taste and see."

Table 4 (continued)

Theme	Subtheme	Definition and examples
Group process	Group activities	**Definition:** Comment on group activities, including group practice, group discussion and sharing "Can allow more group practice and sharing." "It would be nice if we can build a WhatsApp group to share our practice and remind each other." "… the course and lessons are well structured with group and class activities and discussions even though they are done via Zoom."
	Group engagement	**Definition:** Reported experience within the group, like engagement, sense of community "To share with trainer and group members and the feeling of walking together are wonderful." "Although the course was conducted online, I don't feel a weaker bond among the trainer and the students." "As it was conducted in Zoom, it seemed to affect the group interaction and peer sharing."
Accessibility	Date and time	**Definition:** Comments or suggestion on the date and time of the course "It would be better if it was held on Wednesday." "It's such a pity it was held after busy workday, making it difficult to concentrate." "Suggest to hold the course on Friday night or Saturday."
	Space	**Definition:** Comments or suggestion on where the participant attended the session "It would be better if the location is in the urban area." "Save lots of travelling time." "Difficult to find a completely quiet place to attend the session."

Theme 6 — Accessibility

There were only a few comments on the accessibility of the course from both groups (face-to-face group: 6%, video-conferencing group: 10%), and the two groups diverged in their contents. Comments from the face-to-face group were related to the course's date, time, and location, e.g., asking for more options for timeslots and locations in the downtown area. These comments indicated that interventions conducted face-to-face were subject to time and space constraints. In contrast, comments from the video-conferencing group indicated that the online mode could spare participants from the trouble of travelling and allow them to learn in a safe and familiar space. However, one participant reported having difficulty finding a quiet place to attend the course online.

Summary of Results

In sum, both face-to-face and video-conferencing formats of MBI were equally effective in improving participants' well-being. The two groups also showed comparable adherence, intervention fidelity, and program acceptability. However, qualitative results showed that while video-conferencing MBI provided better accessibility for participants, it might be weaker in the group process.

Discussion

With reference to our first and second research questions, we found that both modes led to significant reductions in negative affect, insomnia symptoms, and stress, as well as significant improvements in positive affect, general health, and life satisfaction in teachers at post-intervention. The moderate effect sizes on mood-related outcomes (e.g., negative affect, positive affect) and stress symptoms found in the video-conferencing group were similar to those reported by Zernicke et al. (2014) who delivered online MBI to a group of cancer survivors. The intervention effects were mostly comparable between the two delivery modes in our study, and the medium effect sizes were similar to those observed in previous studies of face-to face MBIs for teachers (Emerson et al., 2017). The results of the present study suggested that video-conferencing MBI could be a viable alternative to face-to-face MBI, offering a cost-effective and convenient solution for mental health services for schoolteachers.

The measure of program acceptability and the qualitative comments indicated that both video-conferencing and face-to-face courses were positively received by the participants. Still, some participants of the video-conferencing group believed that the course would be better if it were delivered face-to-face. Such opinions on the

video-conferencing format were commonly reported by participants of online learning (Atwa et al., 2022; Johnson et al., 2000; Wright, 2017), despite no differences in the actual outcome. The results also showed that video-conferencing mode did not affect the delivery of course content, evidenced by the fidelity check and shared learning outcomes.

Although the video-conferencing group shared identical course structure and content with the face-to-face group, the former had a different group process from the latter. The qualitative data suggested weaker interaction and sense of community in the video-conferencing group, an observation that was reported by Lopez et al. (2020). This phenomenon is commonly observed in online learning (Mather & Sarkans, 2018). Although participants were strongly encouraged to turn on their cameras, not all participants did so during the session due to different reasons such as privacy concerns and potential interruption. Such reservation was unfavorable to building an open atmosphere. The lack of out-of-curriculum interaction may also contribute to an unfavorable group atmosphere. The casual social conversations among the group members before and after the face-to-face group sessions may also contribute to the "shared experience" and in itself help reduce stress and negative emotions experienced by the group members. The need for these casual social conversations or in-person exchanges was particularly salient during the initial stages and peak of the COVID-19 pandemic.

Accessibility appeared to be one of the biggest advantages of video-conferencing MBI over face-to-face MBI. The qualitative data indicated that video-conferencing mode saved the participants' travel time and cost. Some participants mentioned that the video-conferencing mode allowed them to learn mindfulness in a safe and familiar space. Without the distraction of the other group members, the participants might be more attentive to their own subjective experience, as evidenced by more reports of awareness experience in the qualitative data from the video-conferencing group. Participants in the video-conferencing group might also be more attentive to trainers' personal qualities. This could be a result of the "Speaker View" feature of the video-conferencing software, which always puts the trainers at the center of attention.

The association between home practice and outcomes is not conclusive although a small number of studies have reported that home practice predicted improvement in outcomes (Lloyd et al., 2018). The video-conferencing group had better self-reported home practice compliance than the face-to-face group. However, the home practice record cannot validate this finding due to the low overall submission rate, which may imply weak compliance. Figure 2 indicates that the submission rate of home practice records dramatically decreased across sessions for the face-to-face group

and the submission rate for the video-conferencing group remained at a relatively low rate. As such, the potential impacts of video-conferencing mode on home practice compliance are yet to be explored. Whether video-conferencing mode affects home practice compliance needs further investigation with a more accurate and user-friendly measurement of home practice, such as electronic trackers (Gross et al., 2011) or phone applications (Keng et al., 2022). Potential action plans can also be implemented to ensure home practice compliance under weak supervision (e.g., Galla et al., 2016).

Limitations and Future Research

Several limitations of this study should be noted. First, because of the non-parallel group design, the two groups were subject to different contextual factors at the time of the delivery of the respective intervention. The face-to-face intervention was conducted from October to December 2019 during the unusual protests in Hong Kong sparked by the anti-extradition bill movement, whereas the video-conferencing intervention was conducted from March to May 2020 during the first wave of the unprecedented COVID-19 pandemic. Moreover, there was a lack of control condition (i.e., non-mindfulness condition) to allow for a comparison with the two active intervention groups. Future research with a parallel group design is needed to confirm the observed differences between video-conferencing and face-to-face modes.

Second, there remained a possibility of self-selection bias in the video-conferencing mindfulness group because those participants who were unable to commit to the intervention already withdrew ($n = 16$, 17.40%) before the commencement of the online training due to the change in delivery mode or personal reasons (Fig. 1).

Third, the intervention fidelity was only measured by fidelity checklists completed by participants, which might be subject to response bias. Future studies may consider using the *Treatment Fidelity Tool for MBIs* developed by Kechter et al. (2019) according to the guidelines of the National Institutes of Health's Behavior Change Consortium. To ensure the fidelity of delivery, they suggested that researchers can audio- or video-record all program sessions and have the sessions rated by independent observers (e.g., researchers, psychologists, or other instructors) using a standardized codebook.

Fourth, since the qualitative analysis was intended to be explorative instead of confirmative, we chose the single-coder approach due to the time-consuming reflexive coding process of the dataset. The replicability of codes and themes could be a subject of question without the agreement of multiple coders. In addition, only the responses to the open-ended feedback question were used as the source

of information. Therefore, our results should be taken as preliminary but not conclusive.

Last but not least, the outcome measures in this study were also based on participants' self-report. In future studies, objective and corroborative measures should be considered to evaluate the outcomes of MBIs. These measures could include physiological markers such as heart rate variability, pulse wave variability, and respiration (Voss et al., 2020), or behavioral ratings incorporating inputs from other informants such as external observers and students taught by the participants (Rickert et al., 2020).

Our study offers empirical support for the effectiveness of video-conferencing MBI. Its effectiveness is comparable to that of face-to-face MBI, implying that participants can access MBIs with relatively fewer obstacles, such as limited availability of mindfulness trainers, travelling constraints, scheduling difficulties, and even social distancing during the COVID-19 pandemic. These are encouraging findings for teacher mental health and well-being, particularly in the context of unprecedented challenges during the pandemic. Video-conferencing MBIs are accessible and effective mental health services to teachers who are in need of support during this difficult time. However, it is noteworthy that video-conferencing MBIs may fare less well than face-to-face MBIs on group process despite their attractive potentials. Further research is required to investigate methods for enhancing group process in video-conferencing MBIs, a cost-effective delivery mode that is highly accessible for teachers.

Data Availability The quantitative data that support the findings of this study are available on https://osf.io/sx64j/?view_only=6fe70ec8f1914184883a0cfe5e76ec4f. The qualitative data contains names of individual teachers and are not publicly available because of privacy or ethical restrictions.

Declarations

Ethics Approval This study was approved by the University of Hong Kong's Human Research Ethics Committee (reference number: EA1908007).

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare no competing interests.

Use of Artificial Intelligence Artificial intelligence was not used.

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