

Mindfulness

A pilot randomized controlled trial for a videoconference-delivered mindfulness-based group intervention in a nonclinical setting

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Abstract:	<p>Technology is increasingly being integrated into the provision of therapy and mental health interventions. While the evidence base for technology-led delivery of mindfulness-based interventions is growing, one approach to understanding the effects of technology-delivered elements includes programs that retain some aspects of traditional face-to-face interaction. This arrangement offers unique practical advantages, and also enables researchers to isolate variables that may be underlying the effects of technology-delivered interventions. The present study reports on a pilot videoconference-delivered mindfulness-based group intervention offered to university students and staff members with wait-list controls. Apart from the first session of the six-week course, the main facilitator guided evening classes remotely via online videoconferencing, with follow-up exercises via email. Participants were taught a</p>	

	<p>variety of mindfulness-based exercises such as meditation, breathing exercises, mindful tasting, as well as the concepts underpinning such practice. Participants completed pre- and post-intervention questionnaires on depression, anxiety, repetitive negative thinking, dysfunctional attitudes, positive and negative affect, self-compassion, compassion for others, and mindfulness. For participants who attended at least five of the six sessions, scores on all outcome measures improved significantly post intervention and remained stable at three-week follow up. The videoconference-delivered mindfulness-based group intervention appears to provide a viable alternative format to standard mindfulness programs where the facilitator and participants need to live in close physical proximity with each other.</p>
Response to Reviewers:	<p>Dear Prof. Singh,</p> <p>Thank you for the opportunity to submit a revised version of our manuscript. We have taken the latest feedback on board. After carefully reading through the manuscript a couple more times, we have also made some additional minor modifications, such as correcting some minor typographical and grammatical issues.</p> <p>Best wishes Chris</p>

A pilot randomized controlled trial for a videoconference-delivered mindfulness-based group intervention in a nonclinical setting

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Abstract

Technology is increasingly being integrated into the provision of therapy and mental health interventions. While the evidence base for technology-led delivery of mindfulness-based interventions is growing, one approach to understanding the effects of technology-delivered elements includes programs that retain some aspects of traditional face-to-face interaction. This arrangement offers unique practical advantages, and also enables researchers to isolate variables that may be underlying the effects of technology-delivered interventions. The present study reports on a pilot videoconference-delivered mindfulness-based group intervention offered to university students and staff members with wait-list controls. Apart from the first session of the six-week course, the main facilitator guided evening classes remotely via online videoconferencing, with follow-up exercises via email. Participants were taught a variety of mindfulness-based exercises such as meditation, breathing exercises, mindful tasting, as well as the concepts underpinning such practice. Participants completed pre- and post-intervention questionnaires on depression, anxiety, repetitive negative thinking, dysfunctional attitudes, positive and negative affect, self-compassion, compassion for others, and mindfulness. For participants who attended at least five of the six sessions, scores on all outcome measures improved significantly post intervention and remained stable at three-week follow up. The videoconference-delivered mindfulness-based group intervention appears to provide a viable alternative format to standard mindfulness programs where the facilitator and participants need to live in close physical proximity with each other.

Key words: mindfulness-based intervention; group intervention; videoconference; pilot study; nonclinical; university;

Authors' Contributions: RS led the funding application for this project. AS, CK, GW, RS, and WW planned and designed the study. The mindfulness intervention was delivered by GR, with assistance of RC, TT, JR, and CK. TT coordinated recruitment and data collection. DA, JR and OM assisted in the coordination of the study. Data were analyzed by OM, TT, CK, and NP. The majority of the write up was completed by CK, with help by OM and NP. All authors contributed to the manuscript and approved the final version.

Conflict of Interest: GR provides mindfulness-based interventions in educational settings as part of a business. These interventions currently do not follow the videoconference-delivered approach reported here, but may in the future.

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A pilot randomized controlled trial for a videoconference-delivered mindfulness-based group intervention in a nonclinical setting

Abstract

Technology is increasingly being integrated into the provision of therapy and mental health interventions. While the evidence base for technology-led delivery of mindfulness-based interventions is growing, one approach to understanding the effects of technology-delivered elements includes programs that retain some aspects of traditional face-to-face interaction. This arrangement offers unique practical advantages, and also enables researchers to isolate variables that may be underlying the effects of technology-delivered interventions. The present study reports on a pilot videoconference-delivered mindfulness-based group intervention offered to university students and staff members with wait-list controls. Apart from the first session of the six-week course, the main facilitator guided evening classes remotely via online videoconferencing, with follow-up exercises via email. Participants were taught a variety of mindfulness-based exercises such as meditation, breathing exercises, mindful tasting, as well as the concepts underpinning such practice. Participants completed pre- and post-intervention questionnaires on depression, anxiety, repetitive negative thinking, dysfunctional attitudes, positive and negative affect, self-compassion, compassion for others, and mindfulness. For participants who attended at least five of the six sessions, scores on all outcome measures improved significantly post intervention and remained stable at three-week follow up. The videoconference-delivered mindfulness-based group intervention appears to provide a viable alternative format to standard mindfulness programs where the facilitator and participants need to live in close physical proximity with each other.

Key words: mindfulness-based intervention; group intervention; videoconference; pilot study; nonclinical; university;

Introduction

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4 Recent advances in technology have rapidly transformed the way individuals communicate or
5 interact with others, either directly or collectively as a community (Kirk 2013). Use of communication
6 technology has increasingly been applied to deliver mindfulness interventions or support mindfulness
7 practice. This includes a variety of approaches, ranging from phone-delivered mindfulness training
8 sessions (Salmoirago-Blotcher et al. 2012) and mindfulness-based mobile applications (Plaza et al.
9 2013; van Emmerick et al. 2018), to mindfulness in self-help interventions delivered through websites
10 (Gu et al. 2018) or mindfulness taught using a combination of a virtual online classroom and website
11 (Aikens et al. 2014).
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24 A recent meta-analysis by Spijkerman et al. (2016) examined the effectiveness of 15 online
25 mindfulness-based interventions (MBIs) to improve mental health. Eight of the fifteen studies
26 delivered a mindfulness-based stress reduction (MBSR; Kabat-Zinn 1990) program, two mindfulness-
27 based cognitive therapy (MBCT; Williams et al. 2007), and five an acceptance and commitment
28 therapy (ACT; Hayes et al. 1999) intervention. Guidance from a therapist was given during the
29 interventions in nine studies, and in five of these, participants were given feedback and individual
30 coaching (e.g. positive encouragement, answering questions) through email, telephone or encrypted
31 webpages. In three studies, guidance was given weekly in 1- or 2-hour online classes (group-based),
32 with one also providing supplementary (pre-programmed) individual email coaching. MBIs were
33 predominantly delivered through websites ($n=14$). Further delivery modes included a smartphone
34 application ($n=1$) and also a virtual online classroom ($n=2$). Intervention durations varied from 2 to 12
35 weeks, and the sessions were usually conducted weekly. Overall, the meta-analysis found small but
36 significant effect sizes for anxiety, depression, stress, well-being, and mindfulness (Spijkerman et al.
37 2016). Although previous research has demonstrated that online psychological interventions are
38 equivalent to traditional face-to-face interventions in terms of effectiveness (Barak et al. 2008), the
39 effect sizes observed in this meta-analysis were found to be generally lower than those of face-to-face
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MBIs (Abbott et al. 2014; Cavanagh et al. 2014; Gotink et al. 2015). This may suggest that, as of yet, online MBIs are not as effective as traditional face-to-face interventions.

While mechanisms underlying the effectiveness of online MBIs are still being proposed and tested (Cavanagh et al. 2018), another avenue of research is through so-named *blended* web-based mindfulness programs. Montero-Marín et al. (2018) combined traditional face-to-face interaction with online-based practice sessions. During an initial four-hour face-to-face group session, general medical practitioners were introduced to the theoretical background of mindfulness, its usefulness for their professional practice, and how to implement this practice into their daily lives. The program was modelled on MBSR, but was designed to be brief and thus did not contain a full-day workshop as is typical for MBSR. Subsequent to this face-to-face session, participants were provided with four 45-min sessions of online training. These were to be completed within a period of two weeks and presented participants with audio, video, and text material for guided practice and further theoretical description. However, during this online phase, participants received no supervision or feedback from the instructor or any of the researchers. Only 30 of the 290 participants completed two or more of the weekly practices, and, for those participants, significant improvement in positive affect (moderate effect size) and mindfulness (small effect size) was noted. There were no significant effects on secondary outcome measures such as negative affect, resilience, or burnout.

A limitation of the study by Montero-Marín et al. (2018) was the low practice adherence, which may be expected for health professionals such as general practitioners who are frequently reported to have a very high workload (Thompson and Walter 2016). However, the blended approach of combining face-to-face and online delivery of mindfulness intervention has the potential to offer unique advantages and thus warrants further investigation and development. Compared to purely online-based MBIs, blended programs will not pose such a stark contrast to conventional face-to-face delivery facilitating the acceptability of such interventions for participants who may not be particularly comfortable with fully online group programs. Blended programs may thus be perceived as a compromise between the two extremes. For others who are happy with online formats, some may

1 additionally appreciate having met the facilitator in person before continuing with the program online.
2 Additionally, the use of blended programs allows researchers to restrict the number of variables that
3 are manipulated when introducing online elements into delivery of MBIs, which may help isolate
4 variables that are associated with treatment effectiveness.
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10 A different type of blended approach was taken by Magtibay et al. (2017) – in this case
11 blended learning, where participants were able to choose the format that met their learning styles and
12 goals. Fifty nurses self-selected to participate in an intervention for mindfulness and resilience to
13 address stress and burnout, which had been identified as common issues in this target population.
14 Depending on personal preference, participants could choose between various options for learning the
15 content: online-based formats, independent reading, facilitation, or a combination of those. There was
16 no requirement to complete the exercises within a specified time period, although participants were
17 encouraged to complete the online-based portion within eight weeks. At Weeks 8 and 12, sessions
18 were conducted face to face, and by telephone during Weeks 16 and 20. During some of these weeks
19 and at follow up, participants also completed a number of questionnaires to assess stress, burnout,
20 happiness, and mindfulness. While attendance at these follow-up sessions was poor (20, 15, 2, and 1
21 in Weeks 8, 12, 16, and 20, respectively), completion rates for the survey were substantially higher
22 (50, 45, 40, and 33 for baseline, Weeks 8, 12, and 24, respectively). Each outcome measure changed
23 at each assessment point in the expected direction. Although effect sizes were not presented, these can
24 be calculated (comparing baseline with Week 24) from the data provided: small effect size for
25 resilience (Cohen's $d=0.43$); medium effect sizes for happiness ($d=0.61$), client-related burnout
26 ($d=0.68$), and perceived stress ($d=0.74$); and large effect sizes for mindfulness ($d=0.80$), generalized
27 anxiety disorder ($d=0.87$), work-related burnout ($d=0.88$), and personal burnout ($d=0.89$).
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53 The present article reports on a pilot study of a videoconference-delivered mindfulness-based
54 group intervention – thus a blend between a traditional group format and a technology-delivered
55 program. This program was delivered in a university setting as it likely ensures higher treatment
56 adherence than in previous studies of blended approaches (Magtibay et al. 2017; Montero-Marin et al.
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1 2018). Additionally, university environments are known to be demanding and stressful where
2 maintaining well-being and a healthy lifestyle can be challenging for both staff and students, making
3 this a population that could benefit particularly well from MBIs (Henning et al. 2018). Unlike the
4 study by Montero-Marin et al. (2018), the mindfulness program delivered in the present study retained
5 the group format of standard MBIs such as MBSR and MBCT. The program reported here thus
6 provides an approach to investigating the effects of specific aspects of technology-facilitated content
7 delivery as opposed to offering an experience that differs from standard MBI on a number of
8 dimensions. In our case, the technology-facilitated element was limited to the facilitator who
9 delivered the group MBI remotely from the second session onward. The study participants thus met
10 the facilitator in person during the first session, which allowed them to build initial rapport.

11 The primary purpose of this pilot study was to test the feasibility of a videoconference
12 approach to delivering a mindfulness-based group intervention, which included gaining information
13 about recruitment and treatment adherence. Prior power calculation is not necessarily a feature of
14 such pilot work (Arain et al. 2010; Thabane et al. 2010), although the purpose of the study was to
15 explore expected effect sizes for various outcome measures of interest. As this videoconference-based
16 mindfulness program was delivered in a group format, it was expected that effect sizes may be
17 comparable to the moderate effect sizes found for group MBIs in nonclinical settings (Khoury et al.
18 2015). It was thus hypothesized that the participants will exhibit post-intervention increases in
19 outcome measures related to psychological well-being, such depression, anxiety, dysfunctional
20 attitudes, or positive and negative affect.

21 **Method**

22 **Participants**

23 Participants were individuals either studying or working at Auckland University of
24 Technology, New Zealand. The study was advertised to students and staff through posters, emails

1 delivered through various university communication channels, Facebook pages specifically set up for
2 the study, and presentations to students at the beginning of their classes. A total of 204 individuals
3 expressed their interest in participating in the research, of which three did not meet the inclusion
4 criteria of absence of psychological condition requiring ongoing medication, absence of epilepsy or
5 brain injury, and no alcohol or substance abuse. The remaining 201 interested individuals were
6 randomly allocated to either Group 1 or Group 2 (waitlist control group with delayed start) and then
7 contacted via email and/or telephone to confirm their participation. Of those, 42 initially confirmed
8 their participation in the study, but a further ten were not able to continue. The number of participants
9 attending at least one session was 15 for Group 1 and 17 for Group 2. Figure 1 shows an overview of
10 the participant allocation outlined above.
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29 Of these 32 participants, 24 were undergraduate students, 6 were enrolled in post-graduate
30 studies, and 2 were staff. Eleven identified as male (34%) and 21 as female (66%). The mean age
31 was 30.06 years, with a standard deviation of 10.94 and a range of 18 to 58 years. The ethnic makeup
32 was diverse, including New Zealand European ($n=14$; 44%), Asian ($n=6$; 19%), Indian ($n=3$; 9%),
33 Māori ($n=1$; 3%), Pacific Islander ($n=1$; 3%), and others or not specified ($n=7$; 22%). There were no
34 notable differences in terms of demographic profile across Groups 1 (immediate start) and 2 (wait list
35 control with delayed start).
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46 Procedure 47

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51 Mindfulness sessions took place in a quiet classroom between 17:00 to 19:00 hours. At all
52 times, a clinical psychologist was present who also participated in the exercises but who identified
53 herself as staff who was able to help if any of the students were to experience any psychological
54 distress. Typically, one additional researcher was also present who helped set up the room and tidied
55 up afterwards and also made sure that the videoconferencing technology was working.
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2 A desktop computer was at the front of the class, adjacent to a projector screen, which
3 showed the main mindfulness facilitator who joined remotely from Session 2. A unit containing a
4 speaker and microphone was situated next to the desktop computer. Two cameras, one mounted to the
5 back wall of the classroom and one in the corner, allowed the facilitator joining via videoconferencing
6 to view the participants. The pictures from both cameras could be viewed either simultaneously or one
7 at a time. The software used for the videoconference was provided by the commercially available
8 service from GoToMeeting™ (GTM). GTM allows real-time audiovisual interaction between several
9 parties. In this study, the main facilitator, who was located in a different city (from Session 2), sent an
10 email invitation to join a GTM meeting. The same software has been used previously in a study of
11 videoconferencing intervention for individuals with traumatic brain injury (Tsaousides et al. 2014).
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24 The mindfulness sessions were conducted weekly for 90 to 110 minutes. Session 1 was
25 delivered in person by the main facilitator. The purpose of this was to ensure that the participants and
26 main facilitator were able to build good rapport. The first session consisted of an introductory ice-
27 breaker exercise on well-being, discussion of the purpose of this course, and a 10-minute guided
28 meditation exercise. A detailed outline of the program content session by session is presented in Table
29 1. This program was adapted from an educational mindfulness program called *Pause, Breathe, Smile*
30 (Devcich et al. 2017). For the purposes of the present study, the child-centered focus of the original
31 program was modified to an adult-centered delivery style. The facilitator had his own personal long-
32 term practice of mindfulness for more than 20 years and was the developer of the *Pause, Breathe,*
33 *Smile* program.
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53 From Session 2, the facilitator guided the sessions via videoconferencing using GTM. The
54 second session comprised of a 10 to 15-minute breathing meditation exercise, a physical movement
55 exercise similar to Taijiquan, and a slideshow presentation on mindfulness and the brain. The session
56 concluded with a brief guided meditation exercise and a mindful tasting exercise. Session 3 also
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1 included the physical exercise as well as guided breathing meditation. A slideshow presentation was
2 given by the main facilitator on types of awareness, negative bias, and advantages of walking
3 meditation. Session 4 included physical breathing exercises, breathing meditation, and a 45-minute
4 meditation. Session 4 included physical breathing exercises, breathing meditation, and a 45-minute
5 talk on the foundations of mindfulness and emotion. The session similarly concluded with a
6 meditation exercise, which focused on observing sound, body, and emotions. Session 5 contained the
7 physical movement exercise, concentration meditation, and a talk on accepting and regulating
8 emotion. Session 6 involved physical movement and a breathing exercise, meditation practice, as well
9 as a discussion on the four foundations of mindfulness and its purpose. The facilitator also discussed
10 loving kindness meditation, and explained it as involving repeating mantras to mentally send warmth,
11 goodwill, and kindness to others.
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24 At various stages during the face-to-face session and the sessions delivered via
25 videoconferencing, the facilitator encouraged interaction with and among the participants. This could
26 be in the form of a discussion but also as brief feedback. For example, immediately after the guided
27 meditation session in Session 3, participants were asked to describe with one word how they felt. All
28 sessions concluded with questions and answers.
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38 Group 1 started the six-week mindfulness program three weeks prior to Group 2. As there
39 was a three-week overlap period, the groups met on different days of the week. The sessions in Group
40 2 followed the same outline. However, the program occasionally had some minor variations, in
41 response to questions by participants such as requests to elaborate on certain material or exercises.
42 Due to logistical reasons, the mindful tasting exercise was conducted for Group 2 during Session 3
43 and not Session 2. Any other differences in session content were minimal. Apart from technical
44 problems occurring in one of the sessions, which delayed the start by 15 minutes, there were no
45 noteworthy issues with the equipment.
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58 Participants were encouraged to practice for at least 15 minutes per day. Exercises to be
59 practiced were either those covered in class or those shown by following a link to audio or video files
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1 sent to the participants after each session. A day before the start of the next session, participants were
2 sent a reminder email as well as a link to an online questionnaire inquiring about their home practice
3 during that week. This included questions about frequency of practice during the week and average
4 length of practice.
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10 For both groups, baseline measures were taken during the week immediately prior to
11 commencement of the mindfulness program. As Group 2 started the mindfulness program three weeks
12 after Group 1, there was an opportunity to collect baseline measures twice, which served as a means
13 to control for history effects as well as learning effects from repeated assessment. For both groups, a
14 post-intervention measure was obtained during the first week following the final session of the
15 mindfulness program. As Group 1 finished their program three weeks prior to Group 2, a second post-
16 intervention measure could be obtained for Group 1, which served as a three-week follow-up
17 measure. The timeline is illustrated in Table 2. Out of 15 participants in Group 1 who completed at
18 least one mindfulness sessions, 13 completed the questionnaires. Twelve participants in Group 1
19 completed the first post-intervention measure, of which eight participants had completed at least five
20 of the total of six sessions. For Group 2, the number of participants who completed at least five
21 sessions was also eight.
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37 Ethical approval was obtained from the authors' institutional ethics committee, and written
38 informed consent was given by all participants. This study was part of a larger trial that investigated
39 the effects of mindfulness on brain function and biomarkers. Some baseline data relating to
40 biomarkers have already been published elsewhere (Wang et al. 2017).
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55 Measures 56 57 58 59 60 61 62 63 64 65

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As part of the larger study investigating the relationship between self-report measures of mindfulness, depressive symptoms, anxiety, compassion, and self-compassion with brain function and biomarkers, participants made appointments with one of the researchers to complete a variety of tests. This was scheduled according to the availability of the participants as it included several other behavioral and physiological assessments. The following psychometric instruments were completed online using the software Qualtrics. Respondents were required to answer all items in each questionnaire.

Depression. Participants completed the Beck Depression Inventory II (BDI; Beck et al. 1961, 1996). This questionnaire has 21 items where each item presents four statements from which the respondent needs to select one. The four statements are scored 0, 1, 2, or 3, and a higher score reflects a greater degree of depression. For example, one item lists the word “Sadness” followed by the options “I do not feel sad”, “I feel sad much of the time”, “I am sad all of the time”, and “I am so sad or unhappy that I can’t stand it”. The BDI-II has been used with samples including university students (de Sá Junior et al. 2018), and there is also good psychometric evidence for the use of a single general score (de Sá Junior et al. 2018; Siegert et al. 2009), which was used in the present study.

Anxiety. The Beck Anxiety Inventory (BAI; Beck et al. 1988) presented 21 items that describe symptoms of anxiety (e.g., “Numbness or tingling”). Respondents rate each item on a four-point Likert scale ranging from “Not at all” to “Severely (I could barely stand it)”, which are added to a summary score, where higher scores represent higher levels of anxiety. The BAI has been used with a variety of populations including university students, with good psychometric properties including Cronbach’s alpha above .90 (Julian 2011).

Dysfunctional attitudes. Dysfunctional attitudes linked to vulnerability to depression were measured using one of the short forms of the Dysfunctional Attitudes Scale (DAS-SF₁; Beevers et al. 2007). The nine items of this scale (e.g., “If I don’t set the highest standard for myself, I am likely to

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end up a second-rate person.”) were presented using a four-point Likert scale (ranging from “Totally agree” to “Totally disagree”). Individual item scores were summed together to yield a summary score where a higher score indicates a lower level of dysfunctional attitudes. The scale was originally developed using university student samples and shows good psychometric properties including Cronbach’s alpha above .80 (Beevers et al. 2007).

Repetitive negative thinking. The Perseverative Thinking Questionnaire (PTQ; Ehring et al. 2011) presents 15 items (e.g., “The same thoughts keep going through my mind again and again.”) on a five-point Likert scale ranging from “Never” to “Almost always”. Items are summed together to a total score, where a higher score indicates a higher level of repetitive negative thinking. The scale was originally developed and validated with samples that included university students, with good psychometric properties such as Cronbach’s alpha above .90 (Ehring et al. 2011).

Positive and Negative affect. The 20-item Positive and Negative Affect Schedule (PANAS; Watson et al. 1988) lists 20 adjectives (e.g., “Interested”, “Distressed”, “Excited”, and “Upset”) and asks the participant to indicate on a five-point Likert scale (ranging from “Very slightly or not at all” to “Extremely”) the extent to which each adjective indicates how much they currently feel this way. The scores of ten items are summed to generate a total score of positive affect (PA), and the remaining ten indicate level of negative affect (NA). The original development and validation work of the scale included samples of university students, which demonstration good psychometric properties such as Cronbach’s alpha above .80 (Watson et al. 1988).

Self-compassion. The 12-item short form of the self-compassion scale (Raes et al. 2011) was used to measure self-compassion. Unlike the full-length self-compassion scale (Neff 2003), which contains six sub-scales, the short form produces a single score of self-compassion. The short form presents two items from each of the six sub-scales using a five-point Likert format (“Almost never” to “Almost always”). An example item is “When I fail at something important to me, I become consumed by feelings of inadequacy” (*over-identification* sub-scale). Items from the sub-scales

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isolation, over-identification, and self-judgment are reverse coded before adding all items together to a single score, where a higher score represents a higher level of self-compassion. The 12-item short form has been validated in samples with university students, with Cronbach’s alpha exceeding .80 (Raes et al. 2011).

Compassion. The compassion scale (Pommier 2010) contains 24 items presented in a five-point Likert scale format (“Almost never” to “Almost always”). Items are grouped into six sub-scales of four items each. An example item is “When people cry in front of me, I often don’t feel anything at all” (*disengagement* sub-scale). After reverse coding items from three of the sub-scales (*disengagement, indifference, and separation*), a total score can be calculated by summing all items so that a higher score represents a higher level of compassion. The original validation work of the scale included university student samples, with Cronbach’s alpha for the total score reported as exceeding .80 (Pommier 2010).

Mindfulness. The 39-item Five Facet Mindfulness Questionnaire (FFMQ; Baer et al. 2006) assesses aspects of mindfulness grouped into one of five sub-scales: Act (e.g., “I am easily distracted”), Describe (e.g., “I am good at describing the words to describe my feelings”), Nonjudge (e.g., “I criticize myself for having irrational or inappropriate emotions”), Nonreact (e.g., “I perceive my feelings and emotions without having to react to them”), and Observe (e.g., “When I am walking, I deliberately notice the sensations of my body moving”). Questions are scored on a five-point Likert scale ranging from “Never or very rarely” to “Very often or always true”. After recoding negatively worded items, higher scores indicate a higher level of mindfulness. Data were converted from ordinal to interval-level scores for each sub-scale according to the algorithms recommended by Medvedev et al. (2017). These conversion algorithms were based on validation work that included university student samples. Reliability of this scale was measured using person separation index (PSI), which is interpreted in a similar way to Cronbach’s alpha (Tennant and Conaghan 2007). Reliability was acceptable, with PSI values of the five sub-scales ranging from .76 to .89.

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2 **Data analyses**
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6 Analyses were conducted using the software SPSS v25. Given the small sample size,
7 nonparametric tests were conducted, namely paired-samples Wilcoxon rank-sum test for within-group
8 comparisons (such as pre- versus post-intervention scores) and Mann-Whitney U test for between-
9 group comparisons such as when comparing baseline scores of Groups 1 and 2. Analyses of this pilot
10 study explored patterns of change such as movement of all measures in expected directions. A
11 nonparametric sign test was conducted to test whether movement in scores was significantly in one
12 direction (Siegel and Castellan 1988). Therefore, if the overall movement of scores in the expected
13 direction was significant according to this sign test, it can be concluded that this change was unlikely
14 due to inflation of Type-1 error rate.
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31 **Results**
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36 The baseline scores of Groups 1 and 2 were comparable for all measures. Even though there
37 were 15 participants in Group 1 who took part in at least one of the mindfulness sessions, only 13 of
38 those completed the Pre1 questionnaires immediately prior to the intervention (Table 2). In contrast,
39 all participants in Group 2 completed the Pre1 questionnaires. Comparing the Pre1 scores across
40 groups, the only significant differences were for NA (Group 1 mean=25.00, SD=8.24, Group 2
41 mean=19.31, SD=7.89, $U=56.50$, $p<.05$) and the Nonjudge sub-scale of the FFMQ (Group 1
42 mean=23.21, SD=5.83, Group 2 mean=26.80, SD=3.75, $U=41.00$, $p<.01$). When comparing the Pre0
43 scores of Group 2 with the Pre1 scores of Group 1 (both of which were collected during the same
44 week), only the scores for Nonjudge were significantly different ($U=60.50$, $p<.05$). At Pre0, the mean
45 Nonjudge score for Group 2 was 25.02 (SD=2.58). The comparisons of Pre0 scores with Pre1 scores
46 indicated that the baseline scores for Group 2 remained stable. The only significant difference
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2 between these two time points was noted for BDI ($z=-2.67$, $p<.01$), which increased from 7.19
3 (SD=6.18) to 10.12 (SD=7.32).
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6 Table 3 shows attendance at each mindfulness session of Groups 1 and 2. Attendance dropped
7 steadily throughout the six-week course. The lowest number of participants was in Sessions 4 and 5,
8 but attendance increased again for the final session. Four of the initial 32 participants attended only
9 one ($n=1$) or two sessions ($n=3$) and were not available for post-intervention assessment. Of the
10 remaining 28 participants, six participants each attended three and four sessions, while eight
11 participants each attended either five or six sessions. Of the 12 participants who came to either three
12 or four sessions, seven provided Pre1 and Post1 data, and for the 16 participants who attended either
13 five or six sessions, Pre1 and Post1 data were available for 15 participants.
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31 The pre- and post-intervention results for all measures are shown in Table 4. Results are presented
32 separately for the entire sample of 22 participants for whom pre- and post-interventions scores were
33 available ($n=22$), those participants who only attended three or four of the six sessions ($n=7$), and
34 those who attended either five or six sessions ($n=15$). However, the pre-post comparisons did not
35 reach statistical significance for those who only attended three out of four sessions. While the effect
36 sizes were clearly smaller for this sub-group, the lack of statistical significance is very likely also due
37 to the small sample size.
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53 For the participants who completed five or six sessions, scores changed significantly for all
54 scales except for positive affect (PA), compassion for others (CS), FFMQ Describe, and FFMQ
55 Observe. All significant changes were in the expected directions, with negative change for depression
56 (BDI), anxiety (BAI), repetitive negative thinking (PTQ), negative affect (NA) and positive change
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2 for self-compassion (SCS), total mindfulness score (FFMQ total), acting with awareness (FFMQ Act),
3 nonjudging (FFMQ Nonjudge), and nonreactivity (FFMQ Nonreact). Also note that the DAS scores
4 increased significantly, and here a higher score indicates lower levels of dysfunctional attitudes.
5 Effect sizes for these changes ranged from small (Cohen's $d \geq 0.20$) for BAI, DAS, PTQ, and FFMQ
6 Nonreact, medium (Cohen's $d \geq 0.50$) for NA and FFMQ Nonjudge, to large (Cohen's $d \geq 0.80$) for
7 BDI, SCS, and FFMQ total. Not considering the FFMQ total scores as they are not independent of the
8 sub-scale scores, all of the nine significant changes in outcomes measures were in expected directions
9 (BDI, BAI, DAS, PTQ, NA, SCS, FFMQ Act, FFMQ Nonjudge, and FFMQ Nonreact). According to
10 a sign test, a movement of nine out of nine scores in one direction is statistically significant (two-
11 tailed, $p < .02$).
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24 The second post-intervention data collection (Post2) for Group 1 allows an assessment of
25 post-intervention follow-up. Comparing the Post1 scores with Post2 scores of the participants who
26 completed at least five mindfulness sessions ($n=7$; $n=6$ for DAS), only two significant differences
27 were noted: The decrease in the PTQ mean from Post1 ($M=30.29$, $SD=7.74$) to Post2 ($M=26.71$,
28 $SD=10.14$) was significant ($z=-2.00$, $p < .05$) as well as the increase in FFMQ Nonreact ($z=-2.00$,
29 $p < .05$) from 16.43 ($SD=2.87$) to 17.88 ($SD=2.95$).
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40 Data on home practice was relatively incomplete as the overall response rate to questions
41 about home practice was 58%. However, of those 15 participants who completed at least five
42 sessions, 14 participants provided data for at least four of the five times they were asked. For those 14
43 participants, the average frequency of practice and average length of practice was calculated for the
44 six-day period since the last mindfulness session. Excluding one outlier who indicated practicing
45 50.00 min per day, the median frequency was 2.50 and median length of daily practice time was 14.00
46 min (range 5.00 to 18.80 min). Average frequency of practice was not correlated (Spearman's rho)
47 with change scores of any of the outcome measures. For length of practice per day, significant
48 correlations were found for only two of the outcomes measures, and in both cases in unexpected
49 directions: Pre1-to-Post1 change scores of the FFMQ Describe were negatively correlated ($\rho = -.58$,
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2 $p < .05$) with practice length, and also for FFMQ Nonreact ($\rho = -.59, p < .05$). However, given the small
3 sample size and limited range of variability in scores, these results need to be interpreted with caution.
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10 **Discussion**

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15 The present study reported on a pilot videoconference-delivered group MBI in a nonclinical
16 setting. For participants who attended at least five of the six sessions of the mindfulness program,
17 significant reductions of depression, anxiety, repetitive negative thinking, negative affect and
18 dysfunctional attitudes and significant increases of self-compassion, total mindfulness, acting with
19 awareness, nonjudging, and nonreactivity were evident. The changes were particularly large for
20 depression, self-compassion, and overall mindfulness, as indicated by effects sizes above 0.80.
21 Overall, this approach of delivering a mindfulness intervention program was effective and brought
22 about positive change in participants that is higher than those reported in online-based MBIs
23 (Spijkerman et al. 2016) and more comparable to those found in face-to-face group MBIs in
24 nonclinical settings (Khoury et al. 2015). The limited evidence from the follow-up data indicated that
25 the effects remained for at least three weeks after the intervention.
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42 The similarity of the results of the present study with those of traditional face-to-face group
43 MBIs rather than online formats might be related to the fact that the facilitator in our study was
44 present during the first session, which allowed participants to build rapport. When introducing himself
45 to the group, the facilitator provided background about his own personal mindfulness practice, thus
46 potentially establishing himself as a role model for course participants. The importance of so-called
47 embodiment of mindfulness practice by the teacher has increasingly been recognized in the literature
48 as an important variable that could affect the effectiveness of an MBI (Broderick et al. 2018). Future
49 studies might deliberately arrange different conditions that enhance or diminish such embodiment as
50 perceived by the participants.
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2 In the present study, no changes were found for positive affect, FFMQ Observe, and FFMQ
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4 Describe. The lack of an effect of the present intervention on the Observe sub-scale of the FFMQ may
5 not be entirely surprising given the fact that it has frequently been reported to present with unexpected
6 relationships with variables of psychological well-being (Rudkin et al. 2018). Similarly, the FFMQ
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Out of the initial 32 participants, only 23 remained during the final session of the six-week program, and only 15 participants attended at least five sessions. This attrition rate is not dissimilar to those found in eTherapy. Richards and Richardson (2012) published a meta-analysis of 40 studies on computer-based psychological interventions. The dropout rate for unsupported treatments was almost 75%, compared to 38% for those with administrative support, and 28% for those with therapist support. Even values for conventional face-to-face psychological therapy range from 30 to 60% (Richards and Richardson 2012). Forbes et al. (2018) provided a detailed analysis of adherence rates for an online-based MBI for university students. After the first meditation exercise, 16.5% of participants dropped out, followed by a steady decline to around 50% after the 10th daily meditation. Other reports of attrition rates include ranges from 8% to more than 50% for MBIs delivered via technology with no facilitator involvement (Fish et al. 2016).

Poor adherence will likely decrease the effectiveness of the intervention, which may be particularly the case in mindfulness training, as regular practice is considered essential in acquiring mindfulness skills (Lacaille et al. 2017; Spijkerman et al. 2016). Because the studies in the meta-

1 analysis by Spijkerman et al. (2016) used diverse definitions of adherence and often lacked
2 clarification of how adherence was measured, the authors did not rule out that non-optimal adherence
3 rates may have prevented the full potential of online MBIs. This poses the question of how adherence
4 can be enhanced in online MBIs. Prior research has suggested that providing support has a positive
5 influence on adherence and also enhances the effectiveness of online interventions (Andersson and
6 Cuijpers 2009). On the other hand, there may be aspects of the delivery format that cannot be easily
7 addressed in program designs as participants may have particular preference due to a variety of
8 reasons. As reported by Lauricella (2014), for example, about half of the university students in their
9 sample preferred a face-to-face mindfulness exercise, while a quarter preferred digital practice. As
10 individuals gain more familiarity with online formats, their preference may either shift more in favor
11 of these approaches, or individuals may self-select for these types of individuals with more realistic
12 expectations. Increasing adherence is an important goal as it is often individuals with higher baseline
13 levels of depressive rumination that tend to drop out of MBIs (Banerjee et al. 2018), and these
14 individuals are particularly in need of this intervention.
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33 The results of the present pilot study provide useful information about the extent of
34 recruitment activities that might be required for a future full trial. In response to the first wave of
35 advertisement for this pilot study, 201 individuals registered interest in the program. Of those, 42
36 confirmed their continued willingness to participate when contacted by the researchers with more
37 details, and 32 individuals formally took part by attending the first session. This result can be seen as
38 an indication of the extent of recruitment required to meet target sample sizes. It is therefore not a
39 conservative estimate to expect only 15% of those expressing initial willingness to participate in a
40 MBI of that type to convert into an actual participant. Future studies may explore in more detail the
41 barriers for participating as well as the characteristics of individuals who tend to express initial
42 willingness to participate in contrast to those that eventually do participate.
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58 **Limitations**

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1 The participants were required to complete a number of questionnaires, which may have
2 contributed to response fatigue. To limit this response burden, no measure of therapeutic alliance was
3 included in the present study. However, for online interventions, issues of trust and alliance are likely
4 to be equally important as for more traditional face-to-face formats, and more data on the challenges
5 to building therapeutic alliance in online contexts will be necessary to understand the mechanism for
6 treatment effectiveness and potential reason for non-adherence. Such research could explore the
7 unique context of online environments for miscommunication and develop new strategies to address
8 and avoid misunderstandings (Lee 2010). Even though the present study was not conducted in a
9 therapeutic setting, the relationship between the course participants and the facilitator may still have
10 been an important factor in the participants' motivations to attend sessions and conduct home
11 practice.
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27 The effect sizes reported here need to be interpreted in comparison with related programs that
28 may be affected by the same kinds of self-selection biases that could have applied here. Reasons for
29 practicing mindfulness can be very varied (Pepping et al. 2016), and it appears that intention to
30 practice is related to the perceived benefits of meditation, rather than perceived severity of stress-
31 related problems (Rizer et al. 2016). Due to the low response rate and limited range of variability in
32 scores, frequency and length of home practice could not be used in the present study as a co-variate.
33 Additionally, the empirical evidence for the benefits of home practice is mixed (Lloyd et al. 2018;
34 Ribeiro et al. 2018), and other ways of assessing practice, such as quality, may be necessary.
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47 While the results highlight that the pilot videoconference-delivered mindfulness group
48 program was effective in increasing mindfulness and producing significant positive changes on
49 several relevant outcome measures, it is unclear how long-lasting these effects are likely to have been.
50 Due to limited resources and the requirement to fit in with the schedule of concurrent studies on
51 mindfulness and brain function (Wang et al. 2017), it was only possible to include one follow-up data
52 collection point. This follow-up was conducted for only one of the groups and was conducted
53 relatively soon, namely three weeks after the first post-intervention data collection. Effects from
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1 online therapy approaches may certainly decrease over time (Richard and Richardson 2012), and
2 booster sessions may be beneficial. However, the present study highlighted that a videoconference-
3 delivered group format may provide a viable alternative if the main facilitator is located too far away
4 to enable face-to-face contact. Certainly, the program still required the presence of locally based
5 researchers to organize sessions, set up the equipment, and to be available to solve technical issues. It
6 was not the intention to simulate a fully automated online intervention but only to explore to what
7 extent the intervention may still work if the main facilitator is joining in part via videoconferencing.
8 The results also indicate that having guest lecturers join via videoconferencing may not necessarily
9 result in loss of effectiveness of MBIs. The online group format may also be useful for training
10 purposes where the main facilitator and/or mentor may be located in another city or even country.
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24 **Compliance with Ethical Standards**

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28 All procedures performed in this study involving human participants were in accordance with
29 the ethical standards of the institutional ethics committee of Auckland University of Technology, New
30 Zealand, and with the 1964 Helsinki declaration and its later amendments or comparable ethical
31 standards. Informed consent was obtained from all individual participants included in the study.
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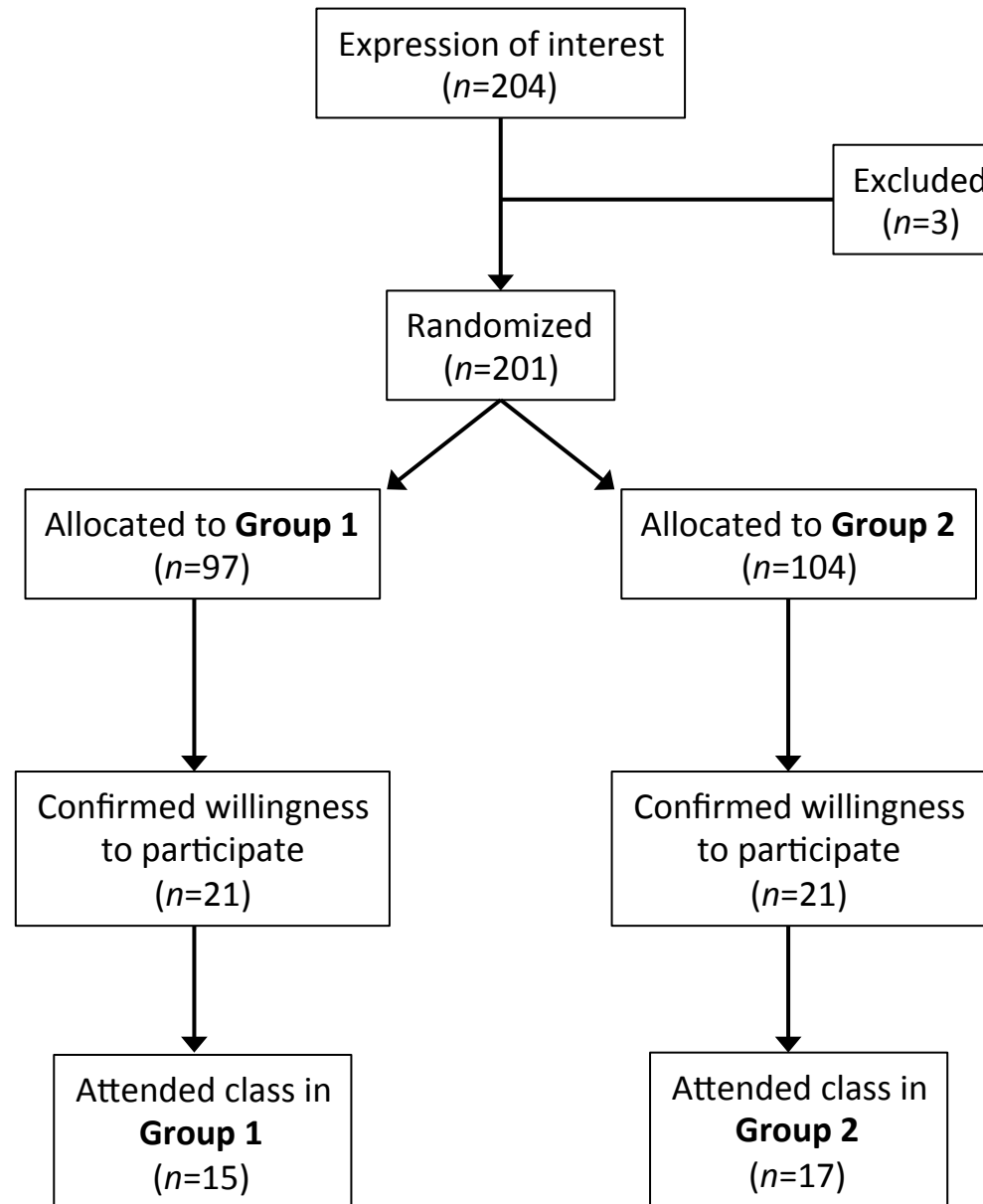


Table 1 Session-by-session outline of the videoconference-delivered mindfulness-based group program.

Session 1 (face to face)	<p>“Already here, always now”</p> <p>Introductory ice-breaker exercise on wellbeing</p> <p>Facilitator introduced himself and spoke about his personal mindfulness practice</p> <p>Guided meditation focusing on breathing</p>
Session 2	<p>“Shifting the auto-pilot”</p> <p>Guided breathing meditation</p> <p>Mindful tasting</p> <p>Powerpoint presentation and discussion: mindfulness and neuroscience</p> <p>Physical exercises with focus on breathing</p> <p>Guided breathing meditation</p>
Session 3	<p>“Alright right now”</p> <p>Physical exercises with focus on breathing</p> <p>Mindfulness meditation</p> <p>Guided breathing exercise</p> <p>Body scan</p> <p>Powerpoint presentation and discussion: negativity bias, types of awareness, narratives when learning to meditate, walking meditation</p> <p>Loving kindness meditation</p> <p>Discussion</p>
Session 4	<p>“Making space”</p> <p>Concentration meditation focusing on breathing</p> <p>Powerpoint presentation and discussion: four foundations of mindfulness, urge surfing, transience of emotions, throwing out your anchor</p> <p>Physical exercises with focus on breathing</p> <p>Guided meditation with instructions to observe sounds, body, and emotions</p> <p>Questions and answers</p>
Session 5	<p>“Awareness, pure and simple”</p> <p>Concentration meditation focusing on breathing</p> <p>Powerpoint presentation and discussion: mindfulness and dealing with emotions</p> <p>Physical exercises with focus on breathing</p> <p>Concentration meditation focusing on breathing</p> <p>Questions and answers</p>
Session 6	<p>“Heart in mind”</p> <p>Physical exercises with focus on breathing</p> <p>Concentration meditation</p> <p>Powerpoint presentation and discussion: more on four foundations of mindfulness, mindfulness of mind objects, loving kindness meditation</p> <p>Questions and answers</p> <p>Feedback and discussion</p>

Table 2 Overview of experimental timeline and measurement points. Pre1 refers to the baseline measure taken immediately prior to the interventions in Groups 1 and 2, while Pre0 refers to the first of the two baseline measures taken for Group 2. Post1 is the first post-intervention measure immediately after the intervention for Groups 1 and 2, and Post2 refers to the follow-up measure for Group 1.

Week	Group 1	Group 2
1	Pre1 baseline measure (<i>n</i> =13)	Pre0 baseline measure (<i>n</i> =17)
2	1 st week of mindfulness program	
3	2 nd week of mindfulness program	
4	3 rd week of mindfulness program	Pre1 baseline measure (<i>n</i> =16)
5	4 th week of mindfulness program	1 st week of mindfulness program
6	5 th week of mindfulness program	2 nd week of mindfulness program
7	6 th week of mindfulness program	3 rd week of mindfulness program
8	Post1 post-intervention measure (<i>n</i> =12)	4 th week of mindfulness program
9		5 th week of mindfulness program
10		6 th week of mindfulness program
11	Post2 post-intervention measure (<i>n</i> =11)*	Post1 post-intervention measure (<i>n</i> =11)

*At Post2 for Group 1, only 10 participants completed the DAS.

Table 3 Course attendance by session (*n* and %), shown separately for Groups 1 and 2.

	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
Group 1 (<i>n</i> =15)	15 (100%)	14 (93%)	12 (80%)	6 (40%)	7 (47%)	10 (67%)
Group 2 (<i>n</i> =17)	15 (88%)	15 (88%)	12 (71%)	9 (53%)	9 (53%)	13 (76%)

Table 4 Means (M) and standard deviations (SD) for each of the outcomes measures, presented separately for the full sample of participants with Pre1 and Post1 scores ($n=22$), those who only attended three or four sessions of the mindfulness program ($n=7$) and those who attended five or six sessions ($n=15$). Cohen's d effect sizes refer to Pre1-to-Post1 comparisons.

Outcome Measure	Pre1 all ($n=22$)			Pre1 for 3 or 4 sess. ($n=7$)			Pre1 for 5 or 6 sess. ($n=15$)		
	M (SD)	M (SD)	d	M (SD)	M (SD)	d	M (SD)	M (SD)	d
BDI	11.64 (9.46)	6.00 (4.93)	-0.75**	7.14 (4.88)	4.71 (4.96)	-0.49	13.73 (10.46)	6.60 (4.97)	-0.87**
BAI	8.59 (6.77)	7.55 (7.01)	-0.15	5.57 (2.99)	7.71 (9.29)	0.31	10.00 (7.63)	7.47 (6.06)	-0.37*
DAS	24.32 (5.12)	26.00 (3.92)	0.37*	25.00 (2.77)	26.00 (2.83)	0.36	24.00 (5.98)	26.00 (4.47)	0.38*
PTQ	31.77 (14.40)	26.41 (8.20)	-0.46*	28.86 (15.36)	23.86 (5.58)	-0.43	33.13 (14.27)	27.60 (9.09)	-0.46*
PA	33.59 (8.80)	33.45 (8.77)	-0.02	37.43 (7.28)	33.14 (8.36)	-0.55	31.80 (9.09)	33.60 (9.23)	0.20
NA	22.86 (8.43)	18.64 (5.64)	-0.59*	21.14 (6.31)	19.00 (6.30)	-0.34	23.67 (9.34)	18.47 (5.53)	-0.68*
SCS	31.18 (9.45)	37.41 (7.70)	0.72**	34.71 (7.46)	37.57 (4.83)	0.46	29.53 (10.04)	37.33 (8.88)	0.82**
CS	94.82 (11.24)	95.95 (14.20)	0.09	87.71 (13.05)	82.57 (12.25)	-0.41	98.13 (8.91)	102.20 (10.34)	0.42
FFMQ total	112.78 (7.80)	116.71 (5.75)	0.57**	113.55 (7.74)	113.47 (2.64)	-0.01	112.43 (8.07)	118.22 (6.25)	0.80**
FFMQ Act	24.58 (3.23)	26.15 (3.06)	0.50	25.04 (1.95)	24.85 (3.21)	-0.07	24.36 (3.73)	26.75 (2.91)	0.71**
FFMQ Describe	21.14 (5.23)	22.08 (3.36)	0.21	22.71 (3.03)	22.38 (2.80)	-0.11	20.41 (5.95)	21.95 (3.67)	0.31
FFMQ Nonjudge	25.12 (5.27)	27.56 (5.30)	0.46*	25.28 (7.22)	25.78 (2.89)	0.09	25.05 (4.39)	28.39 (6.02)	0.63*
FFMQ Nonreact	16.60 (3.29)	17.27 (2.47)	0.23	17.90 (3.16)	17.51 (2.23)	-0.14	15.99 (3.27)	17.16 (2.64)	0.39*
FFMQ Observe	24.64 (2.90)	25.34 (2.84)	0.24	23.20 (3.17)	23.04 (3.30)	-0.05	25.31 (2.60)	26.41 (1.87)	0.49

* $p < .05$, ** $p < .01$