EFFICACY OF INTERACTIVE AUDIO-BASED MINDFULNESS CHATGPT-POWERED INTERVENTION ON WELL-BEING

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Introduction

Brief mindfulness intervention, also known as short-duration practice, is typically delivered for around 30 minutes or less (Howarth et al., 2019). Empirical findings on the efficacy of brief mindfulness interventions are inconsistent: some studies reported positive effects (Alberts & Thewissen, 2011; Sass et al., 2019), whereas others find no evidence of effect (Quek et al., 2021). Such inconsistencies may be due to several current limitations of brief mindfulness interventions. First, the duration of the intervention tends to be relatively short; such duration may preclude the level of immersion and depth afforded by traditional programmes. Secondly, many brief interventions are delivered in audio-only format, which is largely passive and can limit engagement. Third, app-based deliveries typically adopt a self-help model that may reduce commitment and adherence. Moreover, their reliance on pre-recorded audio also removes the teacher-learner interaction, a characteristic found in traditional mindfulness classes.

To address the current limitations within the literature, this study aims to examine the efficacy of an interactive, ChatGPT-powered chatbot for improving well-being. The intervention employs a two-way interaction, whereby participants will speak with and listen to the chatbot delivering a mindfulness or mind wandering exercise. This interaction extends beyond audio-only guidance, designed to promote active engagement and facilitate self-reflection. A between-within-subjects experiment will be conducted where participants will be randomly assigned to one of the three conditions: (1) an interactive brief mindfulness breathing ChatGPT-powered intervention, (2) an interactive mind-wandering ChatGPT-powered control, or (3) a mindfulness breathing audio control. We hypothesize that the brief mindfulness breathing ChatGPT-powered intervention group will have significant improvement in well-being outcomes as compared to the other two control groups.

Methods

Participants

A total of 210 participants will be recruited from a local university in Singapore, where they will be randomly assigned to one of the conditions: Mindfulness Breathing ChatGPT-Powered intervention ($N = 70$), Mind Wandering ChatGPT-Powered intervention ($N = 70$), and listening to the Mindfulness Breathing audio ($N = 70$). The target sample size is adequate, as the sensitivity power analysis G*Power 3.1 (Faul et al., 2009) showed that with a sample size of 210, our study can detect a small effect size of $f = .137$ at 95% power, $f = .124$ at 90% power, and $f = .108$ at 80% power. Participants who completed the entire study will receive one course credit as compensation.

Experimental Design

This study follows a 3 (condition: Mindfulness breathing ChatGPT-Powered Intervention vs. Mind Wandering ChatGPT-Powered Intervention vs. Mindfulness Breathing Audio) x 2 (time: pre-intervention vs. post-intervention) mixed-methods experimental (i.e., between-within subjects) design. A total of 210 participants will be randomly assigned to one of the three conditions using Qualtrics. The within-subjects component was employed to control for individual differences (Baker et al., 2021) and to improve statistical power and the precision of effect size estimates (Brysbaert & Stevens, 2018). While the between-subjects component, in which participants will be assigned to only one of the three conditions, was included to mitigate against demand characteristics, thereby reducing the likelihood of participants inferring the study's hypotheses, and thus, adjusting their responses (Iarygina et al., 2025; Orne, 1958).

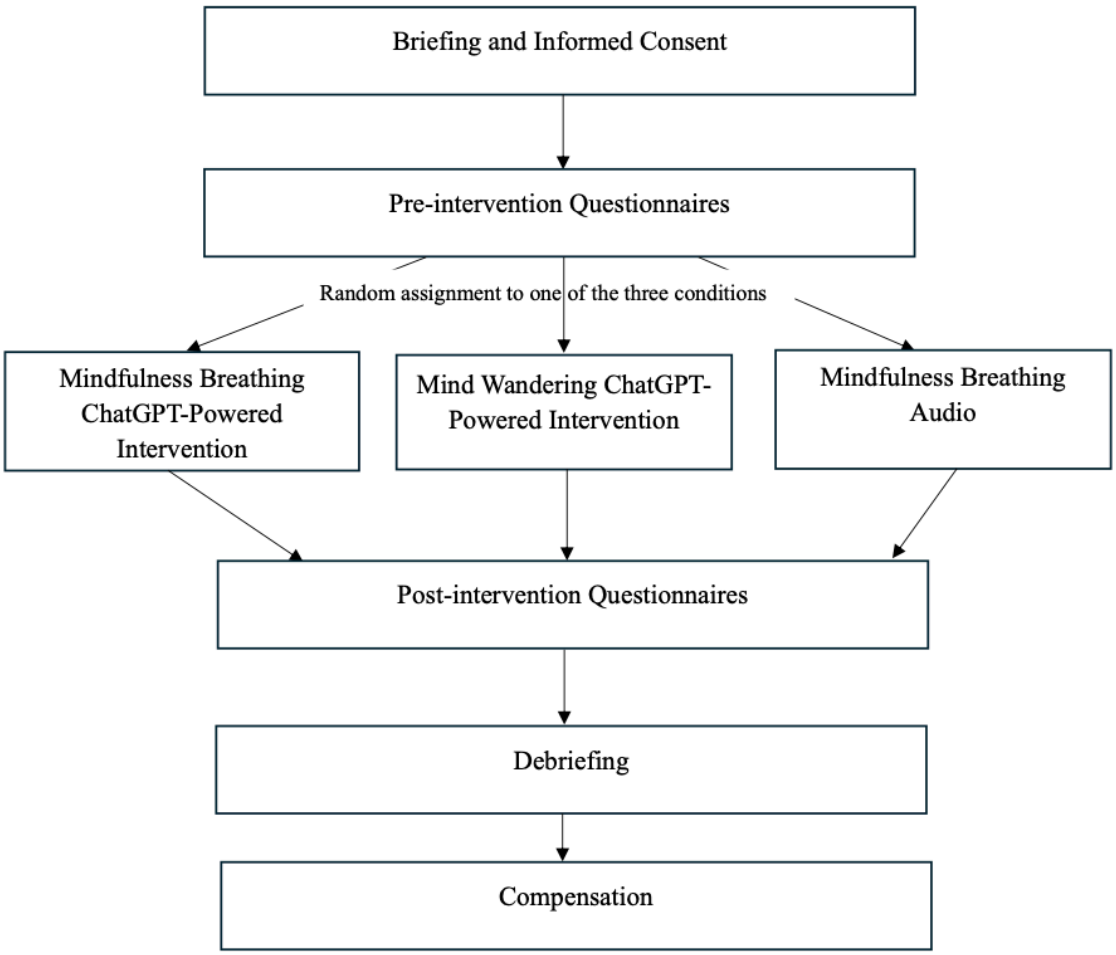
Procedure

Participants will complete the entire study in a laboratory setting, where each individual will be assigned to a private room to minimize distractions. Each session will last

approximately 30 minutes. Before the commencement of the study, participants will be briefed, and informed consent will be obtained. Participants will first complete a series of questionnaires, assessing their perceived stress levels, anxiety, positive and negative affect, self-control capacity, and state level of mindfulness attention. The order of the measures and items will be randomized to mitigate against order effects. Following the completion of the questionnaires, participants will be randomly assigned to one of the three conditions, namely: (1) Interactive Mindfulness Breathing ChatGPT-Powered Intervention, (2) Interactive Mind Wandering ChatGPT-Powered Intervention, or (3) listening to the Mindfulness Breathing Audio. Thereafter, they will complete a series of post-intervention questionnaires upon completion of the intervention (as shown in Figure 1). The study will be delivered via Qualtrics, which will manage the randomization and delivery of all questionnaires and interventions.

Figure 1

Illustration of the Experimental Procedure



In the first condition (i.e., Mindfulness Breathing ChatGPT-Powered Intervention), participants will be instructed to interact verbally with the bot. To ensure adherence and constant engagement, the bot was trained systematically and cautiously, using a 15-minute mindfulness breathing exercise audio (Hafenbrack et al., 2014; Clinton et al. 2018; Arch and Craske., 2006). The 15-minute session will be broken down into one-minute segments: the first minute provides settling instructions (e.g., inviting participants to settle down into a comfortable position), and subsequently, guiding participants through the mindfulness breathing exercise. To foster reflection and encourage active engagement, the chatbot was trained to interact with the participants using interactive prompts. This includes asking

questions, such as " Share what this present moment feel like for you", "What sensations do you notice in your abdomen as you place your hand there?", "Share what stood out to you as you noticed your thoughts, feelings, or sensations just now.". These interactions encouraged active engagement with the chatbot, and at the same time, allowed participants the opportunity to reflect on and introspect on their thoughts.

Beyond the delivery of the mindfulness breathing exercise, additional design elements (e.g., the tone, pace, and language used by the chatbot) were incorporated to ensure that the two-way interaction remained human-like, natural, and consistent. For instance, the chatbot was trained to: (1) maintain a calm, respectful, friendly, and compassionate tone while interacting with the participant, (2) slow down their pace so that participants could reflect on what they think and respond when they are ready, and (3) understand Singapore English (Singlish), including common colloquial used such as "lah", "lor", "leh", so that participants can speak naturally. However, the bot was designed not to reply in Singlish, to maintain a professional and consistent tone while delivering a structured intervention.

Secondly, in the second condition (i.e., Mind Wandering ChatGPT-Powered Intervention), participants will be instructed to interact verbally with the bot, guided by a 15-minute mind-wandering exercise (Hafenbrack et al., 2014; Clinton et al. 2018; Arch and Craske., 2006). Similar to the aforementioned condition, the 15-minute session will be broken down into one-minute segments: the first minute provides settling instructions (i.e., asking participants to find a comfortable position), and subsequently, guiding participants through a mind-wandering exercise. We also replaced the silent pauses with interactive prompts to allow a continuous flow of conversation. During the mind-wandering exercise, the bot will first provide instructions to participants (e.g., telling participants to let their mind wander and allow their thoughts to wander wherever they may go), followed by presenting an interactive prompt (e.g., asking participants "where did your attention drift to just now?", "did your

thoughts return to something from earlier, or did they explore something new?"). Likewise, it was designed to allow participants to reflect and introspect about their thoughts and feelings. Beyond delivering the mind-wandering exercise, the chatbot incorporated similar design elements as the mindfulness breathing bot, including the tone, pace, and language used when interacting with the participants.

Lastly, in the third condition (i.e., Mindfulness Breathing Audio), participants will be asked to listen to a 15-minute mindfulness breathing audio without engaging in any verbal interaction. They will not be tasked to verbalize their thoughts and feelings during the session.

Upon completion of the respective interventions, a manipulation will be conducted to assess whether participants are absorbed in the interactive mindfulness breathing ChatGPT-powered intervention. Participants will be asked to rate the extent to which they feel absorbed in the present moment, focusing on two main aspects, namely, their breathing and physical sensations related to their breathing, on a 7-point Likert scale (1 = *Not at all absorbed*, 7 = *Extremely absorbed*). Higher scores represented greater absorption of the mindfulness breathing intervention.

Thereafter, participants will be redirected back to Qualtrics, where they will be tasked to complete a series of post-intervention questionnaires assessing their levels of perceived stress, anxiety, positive and negative affect, and state level of mindfulness attention. Demographic information, such as age, sex, subjective socio-economic status, household income, and parents' education levels, will also be collected. Following this, participants will be debriefed about the true purpose of the study and will be compensated with one course credit for their participation.

Measures

Stress. Participants' current stress levels will be measured with a single item ("How stressed do you feel right now?"), rated on an 11-point scale (0 = *No stress*, 10 = *Extreme stress*).

Positive and Negative Affect. Participants' affective states will be measured using the 18-item Circumplex Model of Affect Scale (Russell, 1980), which assesses emotional states across two separate dimensions: positive affect (PA) and negative affect (NA). Participants are required to indicate the extent to which they currently experience each emotion on a 5-point Likert scale (1 = *Not at all*, 5 = *Extremely*), in response to the question, "Overall, how do you feel right now?"**.**

Anxiety. Participants' state anxiety levels will be measured with the 6-item Spielberger State-Trait Anxiety Inventory (STAI; Marteau & Bekker, 1992), rated on a 4-point Likert scale (1 = *Not at all*, 4 = *Very much*). Participants are required to rate how they generally feel in response to statements presented (e.g., "I feel calm", "I am tense", "I feel upset").

Self-control Capacity. Participants' self-control capacity will be measured with the 5-item Brief State Self-Control Capacity Scale (SMS-5; Ciarocco et al., 2009; Linder et al., 2015), rated on a 7-point Likert scale (1 = *Very untrue of me*, 7 = *Very true of me)*. Participants are required to rate how they feel in response to the statements presented (e.g., "I feel drained now", "I feel lazy now", "I feel like my willpower is gone now").

Mindful Attention State. Participants' state mindfulness attention levels will be measured with the 21-item State Mindfulness Scale (SMS; Tanya & Bernstein, 2013; Ruimi et al., 2022), on a 5-point Likert scale (1 = *Not at all*, 5 = *Very well*). Participants are required to rate how they feel in response to the statements presented (e.g., "I was aware of different emotions that arose in me", "I noticed many small details of my experience", "I felt that I was experiencing the present moment fully").

Data analysis

A mixed factorial ANOVA will be conducted to examine both between-subject (condition) and within-subject (time) effects. We will examine the condition (i.e., Interactive Mindfulness Breathing ChatGPT-Powered Intervention, Interactive Mind Wandering ChatGPT-Powered Intervention, and Mindfulness Breathing Audio Condition) x time (i.e., pre- and post-intervention) interaction, which examines whether changes in well-being outcomes (e.g., stress, anxiety) from pre- to post-intervention differ across the three conditions. If an interaction effect is detected, simple slope analysis will be conducted.

References

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