



The effectiveness of a brief mobile phone-based mindfulness intervention: effects on stress, emotion regulation and life satisfaction in teachers

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ABSTRACT

Research has frequently identified teaching as one of the most stressful of occupations, often due to high job demands and busy work schedules. With such detrimental effects to well-being caused by negative stress, intervention is essential. Mindfulness has offered promising results for stress reduction, however the duration of typical mindfulness interventions is impractical to most. The present study explored the effectiveness of a brief mobile phone-based mindfulness intervention. Thirty-nine secondary school teachers were randomly allocated to either a mindfulness group ($n = 22$) or active control group ($n = 17$) to establish the effectiveness of an atypical mindfulness intervention in increasing trait mindfulness, reducing stress, reducing difficulties in emotion regulation and improving life satisfaction over a ten-day period. The mindfulness group experienced significant increases in self-reported trait mindfulness and declines in stress and emotion regulatory difficulties. Self-reported life satisfaction failed to significantly increase from pre to post intervention. Non-significant changes were observed for all the tested variables in the control group. The present study contributes to the limited research of mobile phone-based interventions whilst addressing implications and directions for future research.

KEY WORDS:	BRIEF INTERVENTION	TRAIT MINDFULNESS	STRESS	EMOTION REGULATION	LIFE SATISFACTION
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Introduction

Mindfulness is the focus of mind-body medicine that derives from Buddhist traditions to address health and well-being (Kabat-Zinn, 2011; McCown et al., 2011). Mindfulness involves the learning of directing one's focus of attention and awareness to the present moment non-judgementally with open-mindedness and acceptance (Kabat-Zinn, 1996). After the studying and training of mindfulness, Jon Kabat-Zinn adapted these Buddhist traditions by applying them to scientific frameworks and western psychology thus founding mindfulness-based stress reduction (MBSR) interventions (Kabat-Zinn, 1982). MBSR interventions typically involve an intensive eight to ten-week program that often involve a number of mindfulness-based activities such as mental body scanning, breathing exercises, meditation and yoga with the intention to alleviate stress and improve well-being (Kabat-Zinn, 2003; Carlson and Garland, 2005). Those undergoing MBSR interventions are encouraged to incorporate mindfulness techniques into their everyday life in the hope to modify maladaptive patterns of thinking and behaviour (Keng et al., 2011).

For an individual to be mindful, one must be attentive to the present moment, in the 'here and now' (Herndon, 2008:32), as opposed to being ruminative about the past or future (Kabat-Zinn, 1996). Being mindful also involves being attentive to internal and external phenomena. Internal phenomena referring to physiological sensations and external phenomena referring to the environment (Dane, 2011). There are many definitions regarding the concept of mindfulness. Some have argued it to be a dual concept of both a process and outcome (Shapiro and Carlson, 2009), the process being mindful practice and the outcome being the acquisition of skills from practice to be mindful. Others have proposed mindfulness to be a two-component model involving the self-regulation of attention to the present moment and the orientation to experience with curiosity and acceptance (Bishop et al., 2004).

Mindfulness has been conceptualised as both a state, from mindfulness practice (Lau et al., 2006), and a trait, acquired from being mindful in everyday life (Germer et al., 2005). Although both state and trait mindfulness has shown to improve psychological well-being (Brown and Ryan, 2003; Josefsson et al., 2011), research has failed to determine a significant interaction between state and trait mindfulness and therefore suggesting it should be considered and measured individually as two separate constructs (Thompson and Waltz, 2007). However, research has suggested that state mindfulness in time, with efficient mindful practice, can develop as an effortless trait (Siegel, 2007).

Regarding the measurement of mindfulness, a common method includes the use of self-reported questionnaires (Grossman, 2011). Several self-report measures have been devised to measure mindfulness, popular measures include the Toronto Mindfulness Scale (Lau et al., 2006), the Five Facet Mindfulness Questionnaire (Baer et al., 2006), and the Mindful Attention Awareness Scale (Brown and Ryan, 2003). However, the construction of mindfulness scales is often challenged as the content of measures can differ widely depending on the definition and conceptualisation of mindfulness that the deviser chooses to adopt (Grossman, 2011). Despite other issues, such as response biases (Paulhus and Vazire, 2007), self-reported questionnaires are often employed due to their time and cost efficiency (Nelson et al., 2010). Alternatively, qualitative methods, such as interviews, have also been found successful in measuring mindfulness (Teasdale et al., 2002).

Moreover, research has documented that those with high levels of trait mindfulness exhibit the tendency to direct their attention and awareness to present experiences non-judgementally which has shown to positively affect the way an individual reacts to stress-related stimuli (Garland et al., 2010). It is through mindfulness training and practice that an individual will demonstrate an increase of trait mindfulness (Robins et al., 2012). High levels of trait mindfulness has also been associated with lower perceived stress, greater psychological well-being and improved life satisfaction (Brown and Ryan, 2003; Falkenstrom, 2010; Khoury et al., 2013). It is by the direction of one's attention and awareness to the present moment that mindfulness can reduce cognitive vulnerabilities that are thought to contribute to maladaptive behaviours (Bishop et al., 2004).

Stress is a common area of interest in mindfulness research due its harmful effects on psychological well-being and health, particularly to those in the teaching profession (Kyriacou, 2001; Bowers, 2004; McCormick and Barnett, 2011). Roeser et al. (2012) explains this stress to be a product of the large number of demands placed upon teachers that they are required to meet. Karasek et al. (1998) further explains a high quantity of demands causes an individual to feel a loss of control. It is by this loss of control that causes the greatest levels of stress. Defining stress is often difficult due to the vast number of definitions that vary widely (Beehr, 2014). However, Sincero (2012) offers stress to be the physical and psychological response to stress-related stimuli, often referred to as stressors. With much research noting the negative ways in which stress affects well-being (Cooper et al., 2001; Kessler et al., 2005), stress reduction interventions are essential (Gold and Roth, 2013).

The transactional model of stress (Lazarus and Folkman, 1984) explains stress to be a person-situation interaction that is an outcome dependent on a person's appraisal of a situation and their access to resources to cope with the situation. Lazarus (1991) further explained the process of stress by primary and secondary appraisal. When confronted with a stressor, a person evaluates the likely threat of the situation, this is known as primary appraisal (Lazarus, 1991). Following this, secondary appraisal involves the evaluation of one's coping resources or options of how to best deal with the situation thus determining the occurrence or absence of a stress response. This model takes a dynamic perspective by suggesting one's appraisals can change at any time also accepting individual differences in that the appraisal of a situation varies from person to person, therefore explaining why some experience stress and others do not (Lazarus and Folkman, 1984). Supporting the assumption that one's appraisals can change as Lazarus and Folkman (1984) suggest, mindfulness teaches the attention to variability allowing people to change their outlook of a particular situation through their alternative mindful perspective (Langer, 2014).

Statistics have revealed that over 80% of those in the teaching profession have experienced depression and stress-related issues caused by their job (Nation Union of Teachers, 2013). In addition, Johnson et al. (2005) applied a stress measurement tool across twenty-six occupations to determine which of these occupations involves the most stress and negative psychological well-being. The measurement tool identified teachers as experiencing above average stress and the poorest well-being. McCarthy et al. (2009) supports these findings and contributes that this stress often leads to burnout for teachers. Burnout signifies the impairment of one's ability and functioning in their job or workplace (Leiter and Maslach, 2003). The negative well-being caused by stress can be detrimental to workplaces, as the Health and Safety

Executive (2015) statistics reveal that workplace stress accounts for up to 43% of workdays lost in 2014-2015. Curry and O'Brien (2012) argue a possibly useful way of reducing the stress associated within the teaching profession includes the practice of mindfulness due to the promising results it is beginning to display in improving well-being (Halliwell, 2010).

As mindfulness is proposed to alter maladaptive emotional over-engagement or suppression (Hayes and Feldman, 2004), research has investigated the extent to which mindfulness can positively affect emotion regulation. Gross (1998:275) explains emotion regulation to be 'the process by which individuals influence which emotions they have, when they have them, and how they experience and express [them]'. It is the process of modulation of emotions and responses (Chambers et al., 2009). High levels of stress has been found to impact successful emotion regulation as emotional reactions, often caused by stress, effects the way in which emotions are regulated (Wang and Saudino, 2011). Therefore, if stress is not dealt with efficiently, this can be disruptive to the regulation of emotion (Hargreaves, 2000). As teaching is said to be an emotionally taxing profession, adaptive emotion regulation and mental flexibility is an important skill for teachers to acquire (Schutz and Zembylas, 2009).

Moreover, mindfulness is thought to aid successful emotion regulation by helping individuals realise that troubling thoughts and emotions are not accurately representative of reality (Coffey and Hartman, 2008; Williams, 2010). However, research in support of this in non-clinical studies is lacking. For instance, Goldin and Gross (2010) measured the effects of a MBSR on participants with social anxiety disorder. Changes in brain indices for emotion regulation were measured during a functional magnetic resonance imaging scan whilst being presented with negative self-belief stimuli. This same procedure was completed after participants attended an eight-week MBSR. The researchers found that the MBSR successfully reduced emotional reactivity whilst improving emotion regulation. However, this research is limited by the absence of a control group that may have provided stronger inferences regarding the process of MBSR in reducing difficulties in emotion regulation.

Research has continuously noted the damaging effects stress has on one's satisfaction with life (Extremera et al., 2009; Abolghasemi and Varaniyab, 2010; Bano and Malik, 2014). Life satisfaction has been defined as 'the assessment that a person makes of their life, comparing what they have obtained with what they hoped to obtain' (Mendieta and Rivas, 2011:233). Some recent studies have also found high trait mindfulness to be correlated with life-satisfaction (Schutte and Malouff, 2011; Khoury et al., 2013). Supporting this, Harnett et al. (2010) assessed changes in self-reported trait mindfulness and life satisfaction from pre to post a MBSR intervention. The intervention consisted of two-hour sessions over a three-day period involving mindful body scans, breathing exercises and various meditation techniques. Participants were also encouraged to incorporate exercises into everyday life and activities. The results observed significant interactions between trait mindfulness and greater life satisfaction therefore suggesting mindfulness-based interventions, with short durations, may be effective in improving one's satisfaction with life. However, evidence is lacking in explaining exactly how much mindfulness practice is required in order for beneficial outcomes to occur (Harnett et al., 2010).

The current study therefore aimed to investigate the usefulness of a brief ten-day mindfulness intervention in improving the psychological well-being of a teacher population suggested to be in need of short-term interventions by much literature. Self-report base-line measures of trait mindfulness, stress, emotion regulation and life satisfaction were completed by all participant's pre and post intervention in order to identify potential changes. Participants were randomly allocated to either a mindfulness group or active control group. Differing from a typical MBSR, the present intervention was communicated through a mobile phone-based application due to its user-friendliness and accessibility. This form of intervention is largely unexplored (Plaza et al., 2013; Spadaro and Hunker, 2016). Research regarding the minimal duration required for mindfulness to benefit well-being is also unclear (Harnett et al., 2010), therefore the current investigation assessed the effectiveness of ten-minute daily activities. Lastly, as typical MBSR interventions are eight to ten week programs, this lengthy duration may be impractical to those with busy occupations and often busy lives therefore a brief MBSR was essential (Williams, 2010).

Hypothesis One

It was firstly hypothesised that the mindfulness group will report significant increases of trait mindfulness from pre to post mindfulness intervention.

Hypothesis Two

Secondly, it was hypothesised that the mindfulness group will report significant decreases in stress from pre to post mindfulness intervention.

Hypothesis Three

Thirdly, it was hypothesised that difficulties in emotion regulation for the mindfulness group will significantly decrease from pre to post mindfulness intervention.

Hypothesis Four

Fourthly, it was hypothesised that the mindfulness group will report significant increases of life satisfaction from pre to post mindfulness intervention.

Hypothesis Five

Lastly, it was expected that the control group would demonstrate no significant differences between any variables from pre to post control group activities.

Methodology

Research Design

The design of this experiment involved a 2 x 2 mixed factorial design where the between-subjects independent variable was group type (mindfulness vs. control) and the within-subjects independent variable was assessment time (pre intervention vs. post intervention). There were four dependent variables for this research including participant scores of trait mindfulness, stress, emotion regulation and life satisfaction. All of which were measured by self-report questionnaires for a time and cost efficient data collection.

Participants

Participants for this research were opportunely obtained from a Warrington based secondary school by invitation (Appendix 1). Participants were also given information letters containing details of what their involvement entailed (Appendix 2). Separate information sheets were provided to the control group that contained different information regarding the experiments intentions so that participants were unaware of another group completing other activities (Appendix 3).

To determine how many participants would be needed for this research, a power analysis (Appendix 4) using G*Power 3.1 (Faul et al., 2007) was conducted to suggest a minimum of 36 participants would be required¹. The mindfulness group involved twenty-two participants ($n = 22$) and the control group involved seventeen participants ($n = 17$).

Inclusion criteria for participants was that they must currently work within the teaching profession so that participants were not relying on previous experiences of the variables being measured when completing questionnaires. All participants were teachers of secondary level education. Furthermore, teachers are amongst the most stressed of occupations (Johnson et al., 2005; McCarthy et al., 2009) therefore a brief intervention if successful may prove useful to a busy and stressed population.

Participants were not matched for scores on any of the measures used before the experiment began. This experiment was interested in measuring differences from pre to post intervention or activities, irrespective of scores pre intervention. It would also be difficult to match participants by their levels of all four variables due to the variance of scores that would be expected.

Measures

Self-Report Questionnaires (Appendices 5-8)

The Mindful Attention Awareness Scale (MAAS; Brown and Ryan, 2003) is a single-factor 15-item questionnaire and a common measure of trait mindfulness that has been suggested to be the most valid and empirical measure of trait mindfulness (Black et al., 2012). Items are rated across a 6-point Likert scale (1 = Almost Always, to 6 = Almost Never). With a mean score of the 15-items calculated, the higher the score reflects a higher level of trait mindfulness, the highest score being 90 and the lowest being 15. This scale has demonstrated good overall internal consistency based on Nunnally's (1978) acceptable level of internal consistency of reliability as 0.7, Brown and Ryan (2003) found an alpha level of .82.

The Depression Anxiety and Stress Scale (DASS; Lovibond and Lovibond, 1995) is originally a 42-item questionnaire comprising of three subscales devised to measure depression, anxiety and stress. However, for the purposes of this research only the stress subscale was used. Using subscales as individual measures is acceptable according to the authors (Lovibond and Lovibond, 1995). The stress subscale comprises of 14-items that are reported on a 4-point Likert scale ranging from 0-3 (0 = Did not apply to me at all, to 3 = Applied to me very much). The higher the score indicates greater levels of stress with the highest score being 42 and the lowest score

¹ Calculated using a significance level of .05, power of .8, and a small effect size (Cohen's $d = 0.25$).

being 0. The authors have found the stress subscale to have high internal consistency with a Cronbach's alpha of .90 (Lovibond and Lovibond, 1995). Nieuwenhuijsen (2003), who found an alpha level of .93, can also support the high internal consistency of this measure.

The Difficulties in Emotion Regulation Scale (DERS; Gratz and Roemer, 2004) is a 36-item questionnaire designed to assess multiple facets of emotion regulation and dysregulation. Items are rated on a 5-point Likert scale ranging from 1-5 (1 = Almost Never, to 5 = Almost Always). The DERS also comprises of six subscales including nonacceptance of emotional responses, difficulties engaging in goal-orientated behaviours, difficulty controlling impulses, lack of emotion awareness, lack of access to emotion regulation strategies and lack of emotional clarity. The higher the score represents greater difficulties in emotion regulation, the highest score being 180 and the lowest being 36. This scale has demonstrated high internal consistency with a Cronbach's alpha level of .90 (Gratz and Roemer, 2004).

The Satisfaction with Life Scale (SWLS; Diener et al., 1985) is a 5-item questionnaire that is scored on a 7-point Likert scale (1 = Strongly Disagree, to 7 = Strongly Agree). The higher the total recorded scores represents a greater satisfaction with life. The highest score being 35 and the lowest being 5. The authors have found a good level of internal consistency for this questionnaire reporting a Cronbach's alpha level of .87 (Diener et al., 1985). This questionnaire has also demonstrated a good test-retest reliability of .82 (Diener et al., 1985).

Permission was not required to be obtained to use the above measures as all scales are within the public domain free to access and use.

Intervention and Podcasts

Participants within the mindfulness group were required to complete ten-minute daily activities for the duration of ten days. These activities were completed in participants' own time on the free to download mobile phone application (app) Headspace. This particular app was chosen for its user-friendliness and ability to be adapted around potentially busy lives. Additionally, research on mobile phone-based interventions is lacking (Plaza et al., 2013; Spadaro and Hunker, 2016).

Permission to use this app was gained from contact with Headspace developers (Appendix 9). Participants completed the 'Take 10' feature of the app that involved daily sessions of audio-guided mindfulness techniques such as mental body scanning, breathing exercises and meditation. These activities are similar to techniques used within the previously discussed research (Harnett et al., 2010). Furthermore, to ensure participant engagement, the integrated 'buddy system' was employed as a manipulation check to monitor participant engagement.

The control group were provided with daily podcasts that were required to be watched or listened to for the duration of ten days. The podcasts involved TED Talks that ranged from 9-11 minutes in duration. Following the completion of each daily podcast, participants were required to complete three short questions relating to content of the podcast to ensure participant engagement (Appendix 10). Furthermore, control group activities were made similar in length and duration to imitate the structure of the mindfulness group. All podcast content was unrelated to mindfulness or relaxation to

prevent non-specific effects from influencing participants' scores in the control group (Chiesa and Serretti, 2009).

Procedure

After signing their consent, participants were randomly allocated to either a mindfulness group or active control group. All participants, irrespective of condition, were to complete the same base-line measures of the variables trait mindfulness, stress, emotion regulation and life satisfaction both pre and post intervention.

Once the completion of the questionnaires, the mindfulness condition was given details of how to access the Headspace app in which they were required to complete ten-minute daily mindfulness activities for a period of ten days. Participants were informed they could complete activities at a time in the day most convenient for themselves.

Participants in the control group were informed the research was interested in how informational talks effect personal characteristics so that they were unaware of another group completing different activities. Once the control group completed the same base-line measures for all variables, instructions were provided as how to access the podcasts. Podcasts were a variety of informational Ted Talks all with different content, unrelated to mindfulness, that were required to be watched once a day for ten days. To follow the structure of the mindfulness group, podcasts were between nine and eleven minutes in duration. Participants were also required to answer three short questions regarding the content of the podcast to ensure the participant engagement.

Following the completion of all group activities, all participants completed the same base-line measures of trait mindfulness, stress, emotion regulation and life satisfaction.

Ethical Considerations

All potential ethical issues were taken into consideration by the researcher following the British Psychological Society (BPS) code of ethics and conduct guidelines (BPS, 2009). Ethical approval was completed by the researcher and approved by the research supervisor prior to any experimental procedure (Appendix 11).

Signed consent was obtained from all participants prior to any completion of questionnaires or activities (Appendix 12). Information letters were also provided to containing further information regarding the participant's involvement. Participants were debriefed once all data was collected (Appendix 13). Furthermore, anonymity ensued throughout as participants created unique identification codes and data was kept secured.

A major ethical issue of this research is that whilst participants in the mindfulness group were completing a potentially beneficial intervention, the control group were completing activities that required the same amount of engagement time that was hypothesised to have no beneficial impact on well-being. However, within the debrief of the control group (Appendix 14), participants were informed as how to access the intervention.

Results

Preparation of Data

Raw data collected from the responses of the mindfulness ($n = 22$) and control group ($n = 17$) were entered into IBM SPSS Statistics 22.0 (SPSS, 2013) for analysis. The SPSS output of all reported data can be found in Appendix 15. Following data input, reverse item questions within the DERS scale were reversed for scoring (items 1, 2, 6, 7, 8, 10, 17, 20, 22, 24, and 34) as recommended by the author. Score totals were then calculated for all scales at both pre and post stages of the intervention. To check the internal consistency of reliability, Cronbach's alpha coefficients were conducted on all scales. Following Nunnally's (1978) acceptable alpha (α) level of over 0.7, all scales were above this acceptable level demonstrating internal consistency of reliability. This is displayed in Table 1.

Table 1

The Internal Consistency of Reliability of all Measures Used Conducted by Using Cronbach's Alpha

Measure	Number of Items in measure	Reliability	95% Confidence Interval for Alpha	
		α	Lower Level	Upper Level
Pre MAAS	15	.72	.57	.83
Post MAAS	15	.73	.58	.84
Pre DASS	14	.85***	.76	.91
Post DASS	14	.87***	.80	.92
Pre DERS	36	.93***	.90	.96
Post DERS	36	.92***	.88	.95
Pre SWLS	5	.79	.67	.88
Post SWLS	5	.79	.67	.88

Note: F test with true value = 0.7, * $p < .05$. ** $p < .01$. *** $p < .001$

Hypotheses One

To determine whether trait mindfulness significantly increased from pre to post intervention, scores of trait mindfulness from all MAAS responses, for both mindfulness and control groups, were measured pre and post intervention. The means (M) and standard deviations (SD) of MAAS scores for both mindfulness and control groups pre and post intervention are presented in Table 2.

Table 2

Descriptive Statistics of Means and Standard Deviations of MAAS Scores at Pre and Post Intervention

Participant Group							
	Mindfulness (<i>n</i> = 22)		Control (<i>n</i> = 17)		Overall (<i>n</i> = 39)		
Assessment Time	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Pre MAAS	45.23	8.87	48.18	9.02	46.51	8.94	
Post MAAS	60.95	5.75	48.65	7.21	55.59	8.85	

A 2 x 2 mixed factorial ANOVA was conducted with a between-subjects independent variable of group (mindfulness vs control) and a within-subjects variable of assessment time (pre intervention vs post intervention). The dependent variable was scores of trait mindfulness from MAAS responses. Sphericity was assumed as Mauchly's test was non-significant. A non-significant main effect was found for group, $F(1, 37) = 3.92, p = .055, \eta_p^2 = .096$. A significant main effect was found for assessment time, $F(1, 37) = 90.33, p < .001, \eta_p^2 = .709$. Lastly, a significant interaction was found between assessment time and group, $F(1, 37) = 80.14, p < .001, \eta_p^2 = .684$. Figure 1 demonstrates this significant interaction.

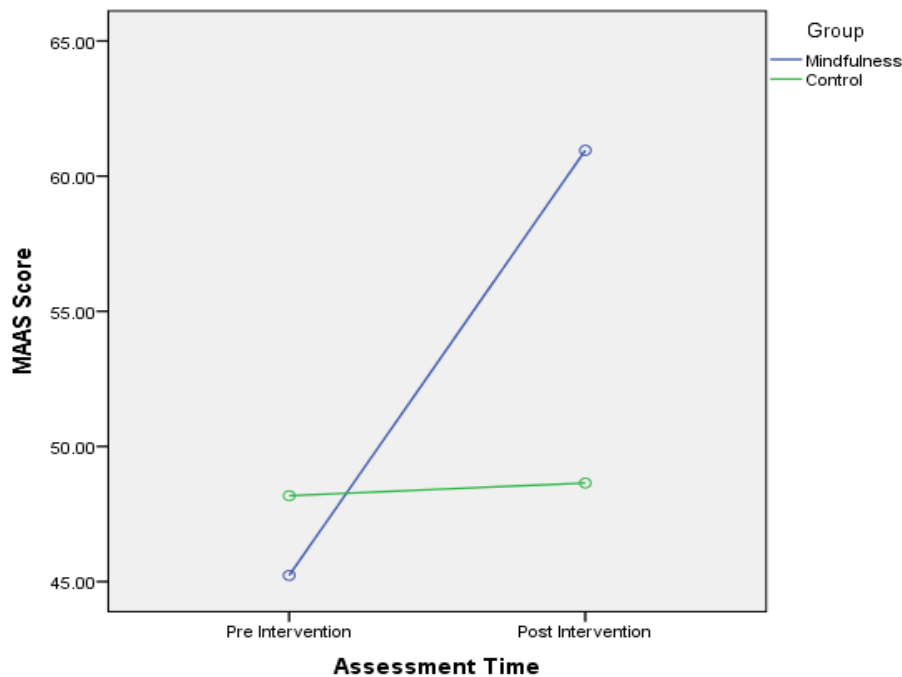


Figure 1: A plot of means to display the significant interaction between assessment time (pre intervention vs. post intervention) and group (mindfulness vs. control) for MAAS scores

Post-hoc Test

The significant interaction between assessment time and group for MAAS scores was further investigated by post-hoc analysis using a two paired sample t-test to determine the source of the significance. This was conducted with a Bonferroni correction ($.05 \div 2 = .025$) to control for type 1 errors. The paired sample t-test was conducted on both groups (mindfulness vs. control) where the independent variable was assessment time (pre intervention vs. post intervention) and the dependent variable was participants' scores on the MAAS. A significant increase of MAAS scores was observed from pre ($M = 45.23$, $SD = 8.87$) to post ($M = 60.95$, $SD = 5.75$) mindfulness intervention, $t(21) = -11.42$, $p = < .001$, but not for the control group pre ($M = 48.18$, $SD = 9.02$) to post intervention ($M = 48.65$, $SD = 7.21$), $t(16) = -.63$, $p = .541$.

Hypothesis Two

To determine whether stress significantly decreased from pre to post intervention, scores of stress from all DASS responses were measured, for both mindfulness and control group, pre and post intervention. The means (M) and standard deviations (SD) of DASS scores for both mindfulness and control groups pre and post intervention are presented in Table 3.

Table 3

Descriptive Statistics of Means and Standard Deviations of DASS Scores at Pre and Post Intervention

Participant Group		Mindfulness (<i>n</i> = 22)		Control (<i>n</i> = 17)		Overall (<i>n</i> = 39)	
Assessment Time	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Pre DASS	23.00	5.90	21.82	7.58	22.49	6.62	
Post DASS	14.59	5.09	22.29	5.59	17.95	6.51	

A 2 x 2 mixed factorial ANOVA was conducted with a between-subjects independent variable of group (mindfulness vs control) and a within-subjects variable of assessment time (pre intervention vs post intervention). The dependent variable was scores of stress from DASS responses. Sphericity was assumed as Mauchly's test was non-significant. A non-significant main effect was found for group, $F(1, 37) = 3.12$, $p = .085$, $\eta_p^2 = .078$. Significant main effects were found for assessment time, $F(1, 37) = 40.99$, $p < .001$, $\eta_p^2 = .526$. Lastly, a significant interaction was identified between assessment time and group, $F(1, 37) = 51.28$, $p < .001$, $\eta_p^2 = .581$. Figure 2 displays this significant interaction.

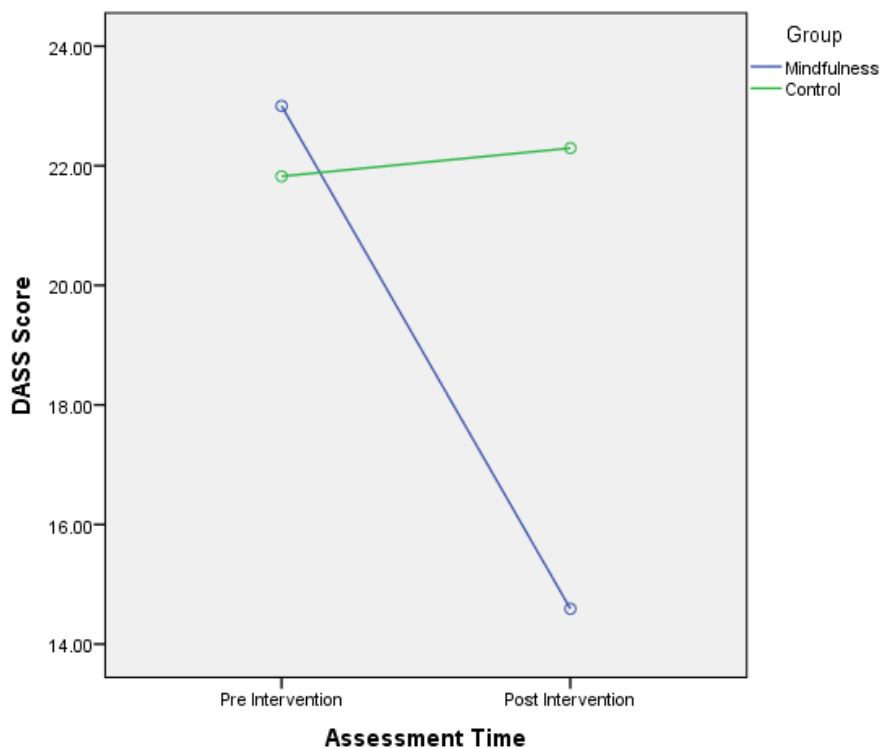


Figure 2: A plot of means to display the significant interaction between assessment time (pre intervention vs. post intervention) and group (mindfulness vs. control) for DASS scores

Post-hoc Test

The significant interaction between assessment time and group for DASS scores was assessed by post-hoc analysis using a two paired sample t-test. The was conducted with a Bonferroni correct ($.05 \div 2 = .025$) to control for type 1 errors. The paired sample t-test was conducted on both groups (mindfulness vs. control) where the independent variable was assessment time (pre intervention vs. post intervention) and the dependent variable was participants' scores on the DASS. A significant decrease of DASS scores was observed from pre ($M = 23.00$, $SD = 5.90$) to post ($M = 14.59$, $SD = 5.09$) mindfulness intervention, $t(21) = 9.21$, $p < .001$, but was not found for the control group pre ($M = 21.82$, $SD = 7.58$) to post ($M = 22.29$, $SD = 5.59$) intervention, $t(16) = -.61$, $p = .548$.

Hypothesis Three

To determine whether difficulties in emotion regulation significantly decreased from pre to post intervention, scores from all DERS responses were measured, for both mindfulness and control groups, pre and post intervention. The means (M) and standard deviations (SD) of DERS scores for both mindfulness and control groups pre and post intervention are presented in Table 4.

Table 4

Descriptive Statistics of Means and Standard Deviations of DERS Scores at Pre and Post Intervention

Participant Group							
		Mindfulness (<i>n</i> = 22)		Control (<i>n</i> = 17)		Overall (<i>n</i> = 39)	
Assessment Time	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Pre DERS	95.36	21.26	89.18	19.56	92.67	20.51	
Post DERS	77.59	17.69	89.00	16.55	82.56	17.92	

A 2 x 2 mixed factorial ANOVA was conducted with a between-subjects independent variable of group (mindfulness vs control) and a within-subjects variable of assessment time (pre intervention vs post intervention). The dependent variable was scores of emotion regulation from DERS responses. Sphericity was assumed as Mauchly's test was non-significant. A non-significant main effect was found for group, $F(1, 37) = .21, p = .652, \eta_p^2 = .006$. Significant main effects were found for assessment time, $F(1, 37) = 17.71, p < .001, \eta_p^2 = .324$. A significant interaction was also identified between assessment time and group, $F(1, 37) = 17.02, p < .001, \eta_p^2 = .315$. Figure 3 displays this significant interaction.

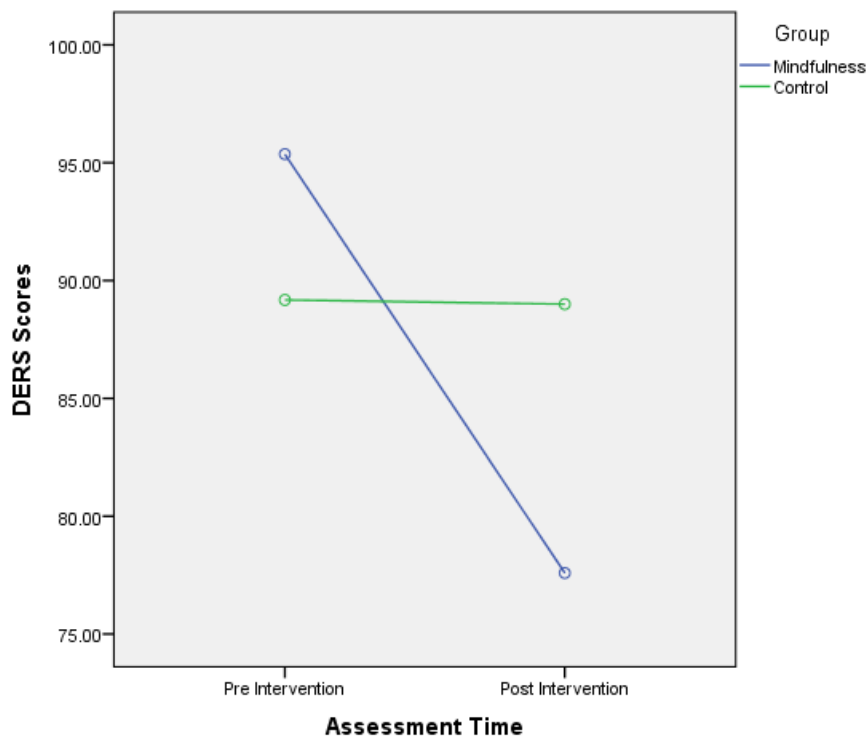


Figure 3: A plot of means to display the significant interaction between assessment time (pre intervention vs. post intervention) and group (mindfulness vs. control) for DERS scores

Post-hoc Test

The significant interaction between assessment time and group for DERS scores was assessed by post-hoc analysis using a two paired sample t-test. The was conducted with a Bonferroni correct ($.05 \div 2 = .025$) to control for type 1 errors. The paired sample t-test was conducted on both groups (mindfulness vs. control) where the independent variable was assessment time (pre intervention vs. post intervention) and the dependent variable was participants' scores on the DERS. A significant decrease in difficulties of emotion regulation was observed from pre ($M = 95.36$, $SD = 21.26$) to post ($M = 77.59$, $SD = 17.69$) mindfulness intervention, $t(21) = 4.94$, $p < .001$, but was not found for the control group pre ($M = 89.18$, $SD = 19.56$) to post ($M = 89.00$, $SD = 16.55$) intervention, $t(16) = .13$, $p = .896$.

Hypothesis Four

To determine whether life satisfaction had increased significantly from pre to post intervention, SWLS scores were measured, for both mindfulness and control groups, pre and post intervention. The means (M) and standard deviations (SD) of SWLS scores for both mindfulness and control conditions pre and post intervention are presented in Table 5.

Table 5

Descriptive Statistics of Means and Standard Deviations of SWLS Scores at Pre and Post Intervention

Participant Group		Mindfulness (<i>n</i> = 22)		Control (<i>n</i> = 17)		Overall (<i>n</i> = 39)	
Assessment Time	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Pre SWLS	25.82	4.16	26.00	5.43	25.90	4.69	
Post SWLS	25.95	3.63	25.88	4.41	25.92	3.94	

A 2 x 2 mixed factorial analysis of variance (ANOVA) was conducted with a between-subjects independent variable of group (mindfulness vs control) and a within-subjects variable of assessment time (pre intervention vs post intervention). The dependent variable was scores of life satisfaction from SWLS responses. Sphericity was assumed as Mauchly's test was non-significant. A non-significant main effect was found for group, $F(1, 37) = .00$, $p = .969$, $\eta_p^2 = .000$, or assessment time, $F(1, 37) = .00$, $p = .972$, $\eta_p^2 = .000$. A non-significant interaction was found between assessment time and group, $F(1, 37) = .23$, $p = .632$, $\eta_p^2 = .006$. No post-hoc tests were required as no significant effects or interactions were identified. Figure 4 displays this non-significant interaction. Means scores of life satisfaction for the mindfulness group marginally increased from pre ($M = 25.82$) to post ($M = 25.95$) intervention as opposed to the control group where mean scores marginally decreased from pre ($M = 26.00$) to post ($M = 25.88$) intervention, both of which provide non-significant effects.

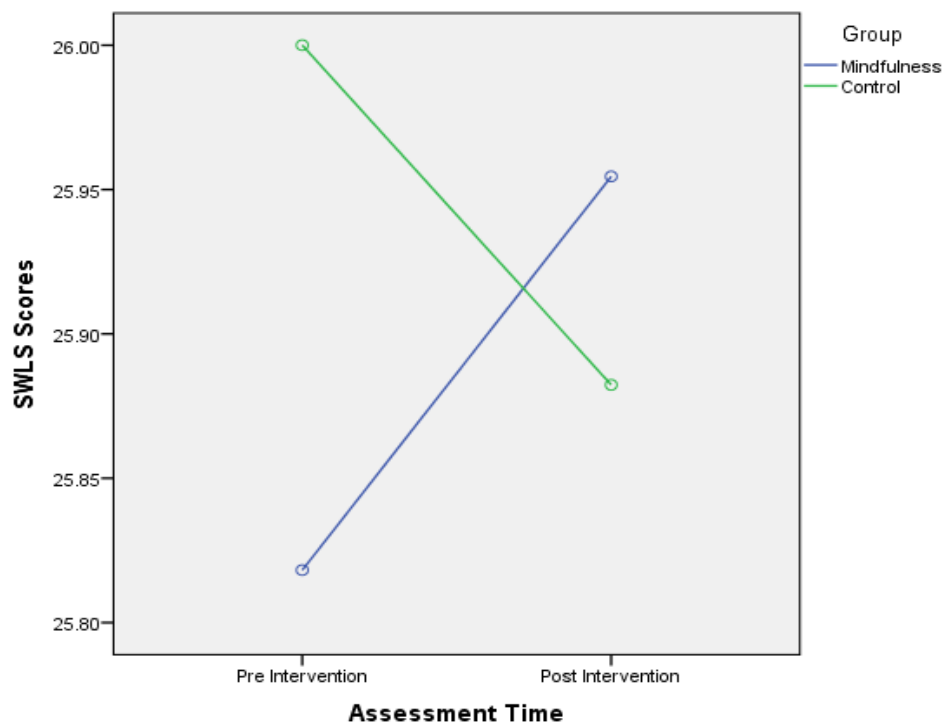


Figure 4: A plot of means to display the non-significant interaction between assessment time (pre intervention vs. post intervention) and group (mindfulness vs. control) for SWLS scores

Hypothesis Five

Lastly, non-significant findings were identified in the control group from pre to post control group activities. Findings were addressed in each of the above ANOVA's for all tested variables.

Discussion

This research was interested in assessing the effectiveness of a brief ten-day mobile phone-based mindfulness intervention on trait mindfulness, stress, emotion regulation and life satisfaction as compared to an active control group. The findings observed supported the hypothesis for trait mindfulness, stress and emotion regulation. However, the hypothesis that self-reported life satisfaction would be significantly improved from pre to post mindfulness intervention was not supported. Lastly as predicted, non-significant findings were observed for the control group from pre to post control tasks therefore supporting hypothesis five.

Hypothesis One: Trait Mindfulness

As hypothesised, it was found that scores of trait mindfulness, as measured by MAAS responses, significantly increased from pre to post intervention in the mindfulness group, but not in the control group. These findings support the assumption of Siegel (2007) who suggests that with sufficient mindfulness practice, trait mindfulness will increase. Robins et al. (2012) found that after an eight week MBSR intervention trait mindfulness had significantly increased. The current finding suggests that a

mindfulness intervention as brief as ten days can significantly increase trait mindfulness.

By making use of the integrated buddy system within the Headspace app, this helped to ensure that participants were engaging with the daily mindfulness activities. It is therefore more appropriate to suggest that the significant increases of trait mindfulness found within the mindfulness group is attributable to the mindfulness intervention.

Hypothesis Two: Stress

As predicted, findings indicated that self-reported scores of stress, as measured by the DASS, had significantly decreased from pre to post intervention for the mindfulness group, but not for the control group. This finding supports the many research that has found mindfulness to be efficacious tool of stress reduction (Kabat-Zinn, 2003; Carlson and Garland, 2005; Garland et al., 2010).

This finding again supports the use of brief mindfulness interventions in improving well-being. Those completing typical MBSR interventions endure intensive eight to ten week programs, which for many this duration may be impractical, particularly for those in professions faced with the high number of demands as teachers do (Roeser et al., 2012), therefore the present intervention may prove useful. Furthermore, this finding supports Curry and O'Brien's (2012) suggestion that mindfulness may be a potentially useful resource for reducing the stress that many teachers experience.

According to Lovibond and Lovibond's (1995) classifications of stress scores, the current sample displayed moderate levels of stress pre intervention, as demonstrated by the overall mean scores of stress pre intervention ($M = 22.49$). Mean scores post intervention, for the mindfulness group, indicate that on average participants dropped to display a mild level of stress following the intervention ($M = 14.59$).

Hypothesis Three: Emotion Regulation

As hypothesised it was found that difficulties in emotion regulation, as measured by the DERS, had significantly decreased from pre to post mindfulness intervention, but not the for the control group. Contrasting from Goldin and Gross' (2010) research, the present study employed an active control group to provide stronger inferences that identified a significant interaction between mindfulness and emotion regulation, as did Goldin and Gross (2010) even with the absence of a control group. Therefore, this finding further supports the role of mindfulness in the regulation of emotions as found within previous research (Goldin and Gross, 2010; Williams, 2010).

As previous research has found stress to play a significant role in the mediation of emotion regulation (Hargreaves, 2000; Wang and Saudino, 2011), further research should investigate whether the decrease in difficulties of emotion regulation identified is attributable to a reduction of stress, or due to the increase of trait mindfulness.

Hypothesis Four: Life Satisfaction

Lastly, the present study found that self-reported life satisfaction, as measured by the SWLS, did not significantly improve from pre to post intervention in either the mindfulness or control group, therefore opposing its expected effect for the mindfulness group. Mean scores of life satisfaction from pre to post intervention for the mindfulness group increased to a marginal extent. This finding opposes a number

of research that has found mindfulness to significantly improve life satisfaction (Brown and Ryan, 2003; Falkenstrom, 2010; Harnett et al., 2010; Schutte and Malouff, 2011; Khoury et al., 2013).

As the present study utilised an atypical mindfulness intervention, communicated via a mobile phone app, the quality and delivery of the mindfulness techniques may not be as superior as those used in typical MBSR interventions conducted in previous research. For instance, although Harnett et al. (2010) also conducted a relatively brief intervention in comparison to typical MBSR's, self-reported life satisfaction still improved from pre to post mindfulness intervention. However, their intervention was conducted in group sessions and involved physical mindfulness exercises such as mindful walking and mindful eating which may suggest why previous research has found significant increases in life satisfaction and the present study did not.

Hypothesis Five: Control Group

Finally, the present study observed no significant differences from pre to post control group activities suggesting that podcast activities had no significant influence on the facets of well-being understudy.

Strengths and Limitations

A key strength of the current research includes the use of an integrated buddy system as a manipulation check that assessed participant engagement to mediate issues of internal consistency. A successful and time efficient intervention that could be adapted around busy lives was essential for this research and with successful participant engagement identified, and significant benefits to well-being observed, this objective was accomplished.

A second strength of this research includes the use of an active control group with a similar structure as the mindfulness group. With control group participants completing activities unrelated to mindfulness or relaxation for the same length and duration as the mindfulness group, this allowed to control for non-specific effects influencing participant scores (Chiesa and Serretti, 2009). Thus, making it more appropriate to suggest that the changes identified in the mindfulness group is resultant of the mindfulness intervention.

However, this research is not without its limitations. Firstly, although significant differences and interactions were identified across three of the four variables understudy, the mindfulness intervention failed to significantly improve participants' self-reported life satisfaction. As previously discussed, this is possibly due to the short duration and quality of the intervention in that the present study overestimated. However, research remains unclear regarding the minimal duration required for mindfulness interventions to improve facets of psychological well-being (Harnett et al., 2010).

Moreover, a second limitation may include the reliance of self-reported measures for the assessment of variables. Research has documented the tendency for people to respond to questions in a way that they would like to be, as opposed to how they truly are (Paulhus and Vazire, 2007). Future research could benefit by adopting alternative measures such as assessing the psychological and physiological changes associated with the practice of mindfulness (Grossman, 2011). Qualitative methods, such as

interviews, have also proved successful in the measurement of mindfulness (Teasdale et al., 2002).

The present study also could have benefited by further exploring the cause of the decrease in emotion regulation difficulties. It is unknown if this decrease in difficulties is a result of the mindfulness intervention, or a consequence of stress reduction. Previous research has suggested emotion regulation to be a mediator of stress and mindfulness (Wang and Saudino, 2011) therefore inferences regarding the source of this decrease in emotion regulation may be limited.

Implications and Future Research

While there has been considerable development in establishing the effectiveness of MBSR interventions in recent years, research is lacking in exploring the efficacy of mobile phone-based mindfulness interventions and the minimum duration required for interventions to improve well-being. The present study offers a practicable alternative to traditional MBSR methods by eliciting benefits to stress and emotion regulation whilst increasing trait mindfulness following a brief duration of ten-minute activities over a ten-day period.

With this identified, businesses may benefit from subscribing to such interventions to improve the well-being of its staff. In doing so, the number of sicknesses and workdays lost, as reported by the Health and Safety Executive (2015), may reduce by the beneficial impact on well-being as this intervention demonstrated. Furthermore, as teaching is an emotionally taxing job, by employing the use of this intervention this may offer an effective short-term method of eliciting an adaptive regulation of emotions, which is important for teachers to maintain. However, the extent to which the positive effects of the intervention are long-term requires further study.

Conclusion

Contributing to the limited research of mobile phone-based interventions, the present study offers the effectiveness of a mobile phone-based mindfulness intervention feasible in duration in increasing trait mindfulness, reducing stress and reducing difficulties in emotion regulation in teachers. This intervention may prove useful for those in stressful occupations in need of short-term interventions. However, the intervention failed to significantly increase life satisfaction. Thus, research to determine the minimum duration and quality required for a mindfulness intervention to improve life satisfaction is warranted. In summary, with findings demonstrating benefits to stress and emotion regulation, this offers a rationale for businesses to utilise such interventions in order to improve the well-being of its workforce in a time efficient manner.

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