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Cultivating emotional well-being in students: Effects of a brief mindfulness meditation intervention on everyday mindfulness, emotion regulation and affective states

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ABSTRACT

Undergraduate students are vulnerable to mental health problems throughout their academic studies (Bewick *et al.*, 2010). Research suggests that the manner in which individuals respond to and modulate emotion (emotion regulation; ER) plays an important role in the development and maintenance of emotional disorders such as anxiety and depression (Chambers *et al.*, 2009). Shapiro (2009) proposes that mindfulness meditation (MM) is one method of teaching students how to adaptively regulate their emotions, however, research has yet to elucidate the mechanisms of action through which MM exerts its beneficial effects. This study randomised forty undergraduate students aged 18-24 to three weekly sessions of MM or an active control condition. Concomitant changes in self-reported everyday mindfulness, ER difficulties, and positive and negative affect were assessed. Despite no condition effects on self-reported negative affect, meditators reported significant increases in everyday mindfulness and positive affect and significantly reduced ER difficulties. Research exploring the short-term effects of MM on ER and affective states is new but promising. This research demonstrates that MM can enhance the emotional well-being of students and thus supports theoretical stances claiming that MM may initially exerts its effects by increasing positive affect and reducing difficulties in ER (Garland et al., 2010).

KEY WORDS:	MINDFULNESS MEDITATION	STUDENT MENTAL HEALTH	EVERYDAY MINDFULNESS	EMOTION REGULATIOON	AFFECTIIVE STATES

Introduction

Mindfulness and mindfulness-based stress reduction

Scientific interest in mindfulness meditation (MM) has burgeoned within the last decade. Originating within Buddhist spiritual practices, mindfulness is a multi-faceted construct operationalised as: 'non-elaborative, non-judgemental, present-centred awareness in which each thought, feeling or sensation that arises in the attentional field is acknowledged and accepted as it is' (Bishop, 2004, p.8). Research has primarily explored mindfulness as a skill developed through practice but also as a state and a disposition (Williams, 2010). Meditation is defined as attentional training that involves openly monitoring ones present experience and all objects within that experience (Chambers *et al.*, 2009) and thus MM is the practice of cultivating a mindful state within meditative practice. So far, research has primarily focused on the Mindfulness-Based Stress Reduction (MBSR) program - a group program teaching MM within a structured, experiential format over eight weeks (Kabat-Zinn, 2003). In clinical populations, MBSR and its derivatives are an efficacious treatment for a wide range of mental illnesses including mood (Teasdale *et al.*, 2000) and anxiety disorders (Miller *et al.,* 1995). For example, in a meta-analysis of twenty empirical studies, Grossman *et al.* (2004) found that MBSR programs produced consistent salutary effects with the selected studies showing a mean effect size of $d = 0.49$.

Everyday mindfulness

Many claim that the beneficial outcomes of MBSR programs are due to increases in everyday mindfulness (Nyklíček *et al.,* 2008) – distinct from sitting MM practice (Thompson & Waltz, 2007) and correlated with improved psychological well-being (Brown & Ryan, 2003). For example, Carmody and Baer (2008) conducted a survey of 174 MBSR participants and found that from pre- to post-intervention increased scores of everyday mindfulness mediated the relationship between MM and improved psychological well-being. This study established the benefit of conceptualising everyday mindfulness as a multi-faceted construct involving observing internal and external stimuli, describing or labelling experiences, acting with awareness, non-judging of inner experience and non-reactivity to inner experience (Baer *et al.*, 2007). Furthermore, despite the use of a very selective sample, this research also established the importance of regular MM home practice throughout the MBSR intervention.

Emotion regulation

More recently, a major focus of MM research has been emotion and emotion regulation (ER). Facets of ER include emotional awareness, emotional clarity, and acceptance of emotional states (Gratz & Roemer, 2004). ER is therefore defined as 'the process of modulating one or more aspects of an emotional experience or response' (Chambers *et al.*, 2009, p.564) and can be adaptive or maladaptive depending upon which ER strategies are utilised and the context within which they are employed (Gross, 1998). Maladaptive ER strategies usually entail avoidance strategies such as suppression, distraction, and rumination (John & Gross, 2004), and have at their core experiential avoidance - believed to be at the heart of psychopathology in general (Hayes & Wilson, 1994). As maladaptive ER strategies

are significantly correlated with a vast array of psychological disorders (e.g. Aldao *et al.*, 2010; Augustine & Hemenover, 2009) and found to underlie the development and maintenance of such disorders (Berking, 2008), it is imperative to formulate interventions that can cultivate adaptive ER strategies. As MM cultivates acceptance and awareness, it is an ideal intervention for such purposes (Brown *et al.*, 2007). In a review of MM and ER literature, Chambers *et al.* (2009, p.569) suggested the conceptual integration of Mindful Emotion Regulation (MER) as 'the capacity to remain mindfully aware at all times, irrespective of the apparent valence or magnitude of any emotion that is experienced'.

Mindful emotion regulation and affective states

An example of MER research is provided by Goldin and Gross (2010) who assessed participants with social anxiety disorder pre- and post-MBSR training. Participants underwent functional MRI scanning post-MBSR whilst reacting to negative self-beliefs and regulating their emotions by use of either a distraction or a meditative task. The meditation task was associated with decreases in reported negative affect and corresponding reductions in amygdala activity – known to play a pivotal role in the neural underpinning of negative emotional processing (Fletcher, 2010). Whilst experimenter selection of emotional stimuli may have reduced the ecological validity of this study, the results indicate that mindfulness-related changes can occur at the emotion-based processing level. This is further supported by long-awaited rigorously controlled methodological findings that MBSR participants show changes in gray matter concentration within brain regions involved in emotion regulation (Holzel, 2011).

Identifying the mechanisms of change within MBSR programs has been problematic as the effects of training are difficult to separate from non-specific effects of the intervention leading to positive outcomes such as social support and positive expectations (Davidson, 2010). A frequent lack of active control groups also makes it difficult to discern whether increases in mindfulness directly produce the beneficial outcomes observed (Nyklíček *et al.,* 2008; Shapiro, Carlson *et al.*, 2005). As longitudinal studies are often not amenable to use of a control condition, alternative studies have sought to utilise modified forms of the MBSR – extracting key MM practices in an attempt to elucidate the short-term processes involved in MER. Such research suggests that enhanced MER and improvements in other cognitive processes can occur after only brief MM training. For example, 4-day MM training has been associated with improved working memory and sustained attention (e.g. Tang *et al.*, 2007; Zeidan *et al.,* 2010) and the 45-minute 'body scan' meditation from the MBSR program has shown beneficial physiological effects after only two 45-minute sessions (Ditto *et al.,* 2006).

Erisman and Roemer (2010) extended previous studies by randomly assigning participants with ER difficulties to a 10-minute MM or active control group. Participants watched a fixed series of negative, positive and then affectively mixed film clips and reported positive and negative affect and state ER difficulties after each clip. Contrary to prediction, the meditation group did not report significantly reduced ER difficulties or negative affect after the negatively valenced film clip but did however report higher levels of positive affect in response to the positive film clip. The authors concluded that the MM was too brief to influence responses to the

negative clip, however the participants' ability to experience greater positive affect after viewing the distressing clip was taken to indicate adaptive emotional responding to aversive stimuli (Erisman and Roemer, 2010). Generalising these results to the effects of MM on ER is difficult due to the artificial stimuli adopted, the short MM session and the disruption caused by using self-report measures throughout film viewing. However, the study highlights previous findings that brief MM may initially exert its effects by increasing positive emotions rather than directly influencing negative emotions or ER strategies at the earlier stages (e.g. Arch & Craske, 2006; Farb, 2010). In a review of such research, Garland et al. (2010) proposed that MM triggers positive emotions which in turn broaden thought-action repertoires that consequently promote behavioural flexibility and broadened cognition. Put simply, frequent positive affect may be a hallmark of well-being that engenders mental states that promote durable personal resources which eventually lead to enduring changes in trait affective responses and ER (Lyubomirsky et al., 2005). This is based upon the 'broaden-and-build theory of positive emotions' (Fredrickson, 1998) and parallels findings that negative emotions lead to narrowed attention and thought-action repertoires (Baumeister et al., 2001). For example, a negativity-bias toward stimuli and events is shown to decrease after MM interventions in which reported positive emotions have increased (e.g. Orzech et al., 2009; Shallcross, 2010), suggesting that an incremental increase in positive emotion counteracts the adverse effects of negative emotion (e.g. Fredrickson & Levenson, 1998; Fredrickson et al., 2000). Garland et al. (2010) and others (eg. Pressman & Cohen, 2005) conclude that this in turn supports adaptive ER. However, there are disagreements with regard to the role of positive emotions with some arguing that MM should not increase positive affect but promote instead balanced levels of affect (Brown & Cordon, 2009). This may explain contradictory findings of decreased positive affect but increased negative affect in some MM interventions (eg. Thompson & Waltz, 2007).

Students and mindfulness meditation

Such research has reinforced arguments within positive psychology that mental health interventions should be implemented within vulnerable populations to protect against mental health problems (Seligman et al., 2005; Shapiro et al., 2002). One population of interest is undergraduate students who have been found to be vulnerable to anxiety and depression throughout their academic studies (Shapiro et al., 1998; 2007). For example, mental health difficulties in students increased 169% from 1999-2004 (Bewick et al., 2010) and recent figures show that they are continuing to rise (Higher Education Statistics Agency, 2011). Although university counselling services can provide support, they are often not utilised for a variety of reasons (Eisenberg et al., 2007) and students may instead turn to avoidance strategies such as binge drinking (Wicki et al., 2010) and consequently become accustomed to maladaptive ER strategies that may cause later mental health problems (Shapiro et al., 2008). Improved ER may prevent the development of emotion-related disorders, thereby providing students with resilience-building coping mechanisms (Sin & Lyubomirsky 2009). Furthermore, increased positive affect can enhance cognitive processes relevant to students, for example, processing and retaining new information and thinking in flexible and creative ways (Fredrickson et al., 2008).

Following this, Jain *et al.* (2007) randomly assigned students to a one month MM, relaxation or control group using a derivative of MBSR training for the MM group. Participants were assessed on measures of affect and two maladaptive ER strategies - rumination and distraction. The MM group reported increased positive affect and reductions in maladaptive ER. Whilst such results are promising, as specific ER strategies were assessed it is unknown whether ER was generally improved (Broderick, 2005) and the use of group exercises may have compounded the findings by promoting social support.

The present study

Research has indicated that MM might be beneficial for students by increasing everyday mindfulness which can in turn promote adaptive ER and improve affective states (Jimenez *et al.,* 2010). The aim of the present study is to assess whether a brief MM intervention can enhance student emotional well-being and to investigate to what extent 3 MM sessions can influence everyday mindfulness, ER, and positive and negative affect. A brief intervention is warranted as lengthy MBSR interventions or short laboratory studies are not suited to explore the short-term effects of MM (Williams, 2010). A quasi-experimental design is used with meditation-naive students matched for ER difficulties and then randomly assigned to 3 weekly sessions of MM or an active control condition. Self-report measures are used to assess everyday mindfulness, ER difficulties and positive and negative affect pre- and post-intervention and further weekly reports of ER difficulties and affective states are collected for week-by-week measurement. To overcome previous limitations the present study implements the MM sessions in an individual format using audio-recordings and makes use of an active control group to ensure that any effects are more likely to be the result of MM training (Davidson, 2010).

In line with previous research (Carmody & Baer, 2008) it is firstly hypothesised that from pre- to post-intervention, MM sessions will increase self-reported everyday mindfulness (H1). Secondly, following Jain *et al.* (2007), it is expected that 3 MM sessions will reduce self-reported ER difficulties (H2). Based on Garland *et al.*'s (2010) review, it is thirdly hypothesised that 3 MM sessions will increase self-reported positive affect (H3) and in turn, fourthly hypothesised that it will decrease negative affect (H4).

Methodology

Pre-study

Students were recruited using opportunity sampling via flyers posted around the university campus that asked for participants for research on meditation and careers guidance (Appendix A). Power analyses[1] indicated that a minimum of 14 participants per group (meditation or control) were required (Appendix B; Murphy & Myors, 2004). Eligibility criteria (Appendix C) specified that participants should be meditation-naive, available to attend all sessions and complete all measures, and

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[1] Power analyses were conducted using G*Power3 (Faul *et al.*, 2007) based on normative standard deviations for a primary outcome measure (the DERS-S) at a significance level of .05, a power of .80 and a small effect size (Cohen's *d* = .25) - indicating that 28 participants were required to detect a significant difference between groups.

willing to be randomised into groups. A total of 48 eligible participants volunteered. Eight participants were excluded for non-attendance due to study demands (*N*=4), work commitments (*N*=2) and personal issues (*N*=2). The final sample consisted of 40 participants.

All participants were then directed to an online survey site (Esurveyspro, 2010) to read the research brief (Appendix D), provide informed consent, demographic information (Appendix E), and to complete the Difficulties in Emotion Regulation Scale – State-version (DERS-S; McLaughlin *et al.,* 2007 – see below). Following Erisman and Roemer (2010), the DERS-S scores were stratified to match participants by group to restrict pre-study differences. Independent t-tests were conducted on both groups for DERS-S scores at pre-intervention and no significant differences were found $t(38) = .195$, $p = .85$[2] (see **Table 1** below). Once matched, participants were randomly assigned to groups using a computer-generated random number table.

Design

A 2 x 4 mixed quasi-experimental factorial design is used. The between-subjects independent variable is group type (meditation or control) and the within-subjects independent variable is assessment time (weeks 1, 2, 3 & 4). The dependent variables are the scores for everyday mindfulness, ER difficulties and positive and negative affect – as measured by self-report measures.

Controls

The administration of all measures was counterbalanced at each assessment time. Two experimenters (1 female) blind to the research hypotheses rehearsed standardised instructions (Appendix F) and were subsequently alternated to groups for sessions. Sessions were conducted in controlled psychological laboratories and delivered individually in groups with no inter-participant interaction. The day, time, place and format[3] of sessions was kept constant for both groups.

Following previous researchers (Erisman & Roemer, 2010), the Toronto Mindfulness Scale (TMS, Appendix G; Lau *et al.,* 2006) was administered as a manipulation check post-session to ensure participants were fully engaged in the MM and in an operationalised state of mindfulness. The TMS consists of 13-items that measure state mindfulness and assess Curiousity (of inner experiences) and Decentering (aware but not carried away by experiences). Participants rate on 4-point Likert-type scale (1 = a little, 4 = very much) their perception of what they have just experienced during the MM. Internal consistency has been reported as high (α = .90) and good construct and predictive validity has been shown (Lau *et al.,* 2006). Scores are expected to increase across interventions with successful engagement in MM (Baer *et al.,* 2009).

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[2] Levene's test for equal variances was not significant so equal variances were assumed.

[3] For example, controls and meditators were directed to close their eyes whilst listening to recordings.

Participants

The final sample of 40 participants (20 per group) consisted of 57.5% women with an age range of 18-24 (M = 20.70, SD = 1.54). The ethnicity of the participants was identified as 67.5% White-European. **Table 1** shows the sample characteristics for the meditation and control group and overall sample.

Table 1
Sample characteristics (sample size, age, ethnicity and DERS-S scores) for each groups and the overall sample.

	Sample		
Sample characteristics	Meditation	Control	Overall
Sample size	20	20	40
Mean (*SD*) age in years	20.9 (1.50)	20.6 (1.61)	20.7 (1.54)
Mean (*SD*) DERS-S score	73.60 (13.37)	74.50 (15.75)	74.05 (14.43)
% Women	55	60	57.5
% White-European	60	75	67.5
% Black-Caribbean	25	15	20
% Asian-Indian	15	-	7.5
% Mixed-race	-	10	5

Measures

All dependent variables were measured using self-report measures[4] (see Appendix H-J).

The Five Facet Mindfulness Questionnaire (FFMQ; Baer *et al.*, 2006) is a 39-item measure that assesses five facets of everyday mindfulness: observing internal and external stimuli, describing or labelling experiences, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience. Participants rate on a 5-point Likert-type scale (1 = never, 5 = very often) the extent to which they tend to respond in a non-judgemental and accepting manner. High scores reflect higher levels of everyday mindfulness. Internal consistency ranges from .75 to .91 and test-retest reliability is adequate to good ranging from 0.657 to 0.863 (Baer *et al.,* 2006).

The Difficulties in Emotion Regulation Scale – State-version (DERS-S; McLaughlin *et al.,* 2007) is a 25-item measure taken from the original DERS (Gratz & Roemer, 2004) that measures ER difficulties. This measure uses four subscales: acceptance of emotion, awareness of emotion, ability to access effective ER strategies, and understanding of emotion. Participants rate on a 5-point Likert-type scale (1 = not at all, 5 = completely) to what extent each item has applied to them over the previous

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[4] Permission was obtained to use all measures, all questions can be seen in appendices but due to copyright cannot be uploaded electronically or re-used.

week. Higher scores reflect higher levels of ER difficulties. The DERS-S has shown good internal consistency ($\alpha = .81$).

The Positive and Negative Affect Scale (PANAS; Watson *et al.,* 1988) consists of two 10-item sub-scales measuring positive (eg. interested, inspired) and negative (eg. hostile, afraid) affect. Participants rate on a 5-point Likert-type scale (1 = very slightly, 5 = extremely) to what extent they have experienced each state over the previous week. Higher scores reflect higher levels of positive and negative affect. Overall the internal consistency is high ($\alpha = .87$) and test-retest reliability adequate ($\alpha = .47$).

To summarise, everyday mindfulness was measured using the FFMQ, ER difficulties were measured using the DERS-S and positive and negative affect were measured using the positive affect scale (PAS) and negative affect scale (NAS) respectively.

Data collection procedure

For a schematic overview of the MM intervention see Appendix K. Pre-intervention measures for all variables were administered in week-1 prior to the first session. The FFMQ was used as a measure across the whole intervention at pre- and post-intervention (weeks 1 and 4) as were the DERS-S and PANAS but the latter were also assessed weekly prior to each session to assess retrospective reports of emotional states within the previous week since the last session. The TMS was administered after each session as a manipulation check for the meditation group only.

Materials

All participants listened to recordings using headphones connected to university computers. For meditators, permission was obtained to use audio-recordings of guided meditations from Series-1 of the MBSR program on compact-disc (Kabat-Zinn, 1991). One 45-minute MM was provided in each session in the order recommended in the accompanying CD-series book (Kabat-Zinn, 1990). Week-1 provided 'The Body-Scan', week-2 'Mindfulness of Emotions' and week-3 the 'Sitting Meditation' (Appendix L). These meditations are designed for beginners and direct individuals to focus their awareness on feelings, sensations and thoughts that arise in the present moment. The audio-recordings also advise participants to apply mindful awareness to daily life. Controls listened to educational audio-recordings taken from the Guardian website containing careers-guidance for graduates (Appendix M). The audio-recordings provided information about employability (week-1), the job market (week-2) and job-seeking (week-3). The audio-recordings were vetted to ensure they did not contain content that might be emotionally provocative.

Procedure

Participants were informed of their group allocation by email and given directions to and details of the first session. Upon arrival, experimenters delivered standardised instructions advising participants to complete pre-measures and sit comfortably. Participants were shown how to start the audio-recording and informed to close their eyes whilst listening and follow anything the recording instructions. The meditators

were further advised to complete the manipulation check post-session. Subsequent sessions followed the same framework using the different audio-recordings. All participants completed final post-intervention measures online.
Ethics

This study was conducted in accordance with the British Psychological Society Ethical Guidelines (2009). Ethics forms were approved prior to data collection (Appendix N & O), controls were granted access to all MM materials post-intervention and all participants were fully debriefed (Appendix P).

Results

Preparation of data

All raw data from both the meditation (N = 20) and control (N = 20) groups were entered into SPSS version 16 for Windows (SPSS Inc., 2007) which was used for all computations. All graphs and tables were derived from SPSS outputs (Appendix Q). After data input, the relevant questions from the FFMQ and DERS-S were reverse-scored according to the author's instructions (see Appendix R). Overall scale totals were then computed for both groups for each measure at each assessment time (weeks 1, 2, 3 & 4)[5]. To test assumptions of normality, histograms were generated (Appendix S) and all data were screened for skewness and kurtosis which was found to be satisfactory[6] (Tabachnick & Fidell, 1996; see Appendix T). For each measure at each assessment time all Cronbach's alpha (α) coefficients were above .70 which is generally accepted as satisfactory internal reliability (Nunally, 1978). **Table 2** provides the alpha coefficients for each self-report measure at each assessment time.

To assess the manipulation check, paired-samples t-tests were conducted to ascertain the effectiveness of the meditations to elicit a state of mindfulness - as measured by the TMS. Meditators reported significantly higher TMS scores in week-2 (M = 34.40, SD = 6.19) compared with week-1 (M = 30.80, SD = 5.65), $t(19)$ = .5.03, p < .001, at week-3 (M = 40.10, SD = 3.96) compared with week-2, $t(19)$ = 5.68, p < .001 and across the intervention at week-3 compared to week-1, $t(19)$ = 9.15, p < .001. Following previous research (Erisman & Roemer, 2010), this significant increase in TMS scores can be taken to confirm that the guided meditations were effective at eliciting a state of mindfulness.

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[5] Previous studies have confirmed that all measures can be used as both individual sub-scale scores and overall total scores (Baer *et al.*, 2006).

[6] Tabachnick & Fidell (1996) specify that skewness values greater than two times the standard error are significantly skewed. Accordingly, calculations for the present study revealed that no values were significantly skewed.

Table 2: Alpha coefficients and confidence intervals for each self-report measure at each assessment time.

		95% CI	
Measures	**α**	**Lower**	**Upper**
Five Facet Mindfulness Questionnaire (FFMQ)			
Pre-intervention	.85	.78	.91
Post-intervention	.75	.62	.85
Difficulties in Emotion Regulation Scale – State version (DERS-S)			
Week1*	.86	.79	.92
Week 2	.73	.59	.84
Week 3	.86	.79	.92
Week 4	.79	.68	.87
Positive and Negative Affect Schedule (PANAS)			
Positive Affect Scale (PAS)			
Week 1	.82	.73	.90
Week 2	.70	.55	.82
Week 3	.71	.55	.83
Week 4	.70	.54	.82
Negative Affect Scale (NAS)			
Week 1	.71	.56	.83
Week 2	.81	.70	.89
Week 3	.78	.66	.87
Week 4	.73	.58	.84
Toronto Mindfulness Scale (Manipulation check)			
Week 1	.81	.66	.91
Week 2	.86	.75	.94
Week 3	.72	.50	.87

*Week-1 reflects baselines scores for all reported analyses.

Hypothesis 1: Everyday mindfulness

Descriptive statistics

The FFMQ scores were obtained for both the meditation and control groups at pre- and post-intervention (week-1[7] and 4 respectively). **Table 4** provides the means and standard deviations for the FFMQ scores for each group at pre- and post-intervention.

Table 4
Mean scores and standard deviations on the Five Facet Mindfulness Questionnaire (FFMQ) for each group at pre- and post-intervention.

	Participant Group		
	Meditation (*n* =20)	Control (*n* =20)	Whole sample (*N*=40)
Assessment Time	*M (SD)*	*M (SD)*	*M (SD)*
Pre-intervention	109.65 (19.83)	113.50 (17.36)	111.58 (18.50)
Post-intervention	125.20 (15.27)	113.05 (12.68)	119.13 (15.16)
Overall	117.43 (-)	113.28 (-)	-

Analysis of variance

A 2 x 2 mixed Factorial ANOVA was performed on the data to assess FFMQ scores from pre- to post-intervention. The between-subjects independent variable was participant group (meditation or control), the within-subjects independent variable was assessment time (pre- and post-intervention) and the dependent variable was FFMQ scores. A significant main effect was observed for assessment time, $F(1,38) = 17.86$, $p < .001$[8] but not for participant group $F(1,38) = .72$, $p = .40$. A significant interaction effect was also found, $F(1,38) = 20.05$, $p < .001$. This interaction is illustrated in **Figure 1**.

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[7] Week 1 reflects baseline/pre-intervention scores for all analyses.
[8] All significance values reported are two-tailed.
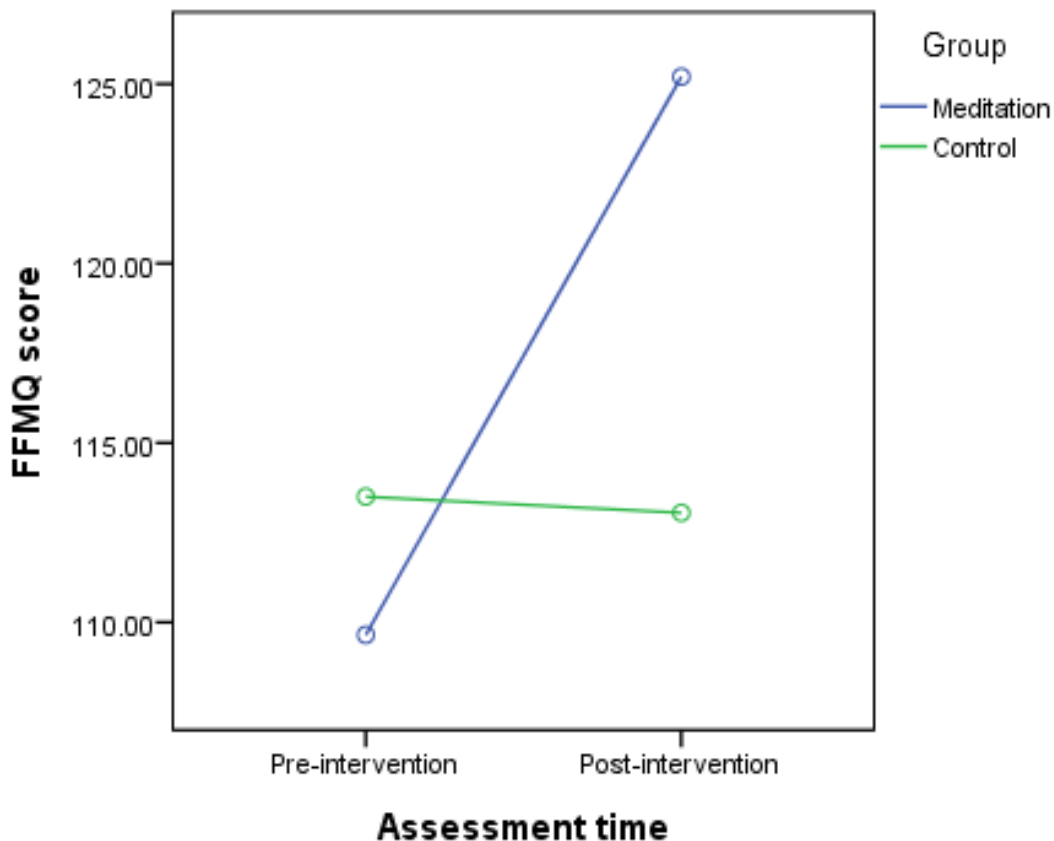
Figure 1: A means plot to illustrate the interaction between participant group (meditation vs. control) and assessment time (pre- and post-intervention).

Post-hoc tests

To further analyse the significant interaction found within the ANOVA, appropriate post-hoc tests were conducted. Two independent t-tests and two paired-samples t-tests were conducted[9]. The first independent t-test was conducted on FFMQ scores pre-intervention where the independent variable was participant group (meditation or control) and the dependent variable was FFMQ scores. FFMQ scores were not significantly different between meditators ($M = 109.65$) and controls ($M = 113.50$) at pre-intervention, $t(38) = .65$, $p = .52$[10]. The second independent t-test was conducted on FFMQ scores post-intervention where the independent variable was participant group (meditation or control) and the dependent variable was FFMQ scores. FFMQ scores were significantly higher for the meditators ($M = 125.25$) compared to controls

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[9] To control for four pairwise comparisons the Bonferroni correction provided a new significance level of $p < .0125$ (.05 / 4 = .0125).

[10] Levene's test for equal variances was not significant so equal variances were assumed.

(M = 113.05) at post-intervention with a large-sized effect, $t(38) = 2.74$, $p = .009$, $d = .87$[11].

Two paired-samples t-tests were then performed separately on both groups. The independent variable was assessment time (pre- or post-intervention) and the dependent variable was FFMQ scores. A significant increase in FFMQ scores was found for the meditators from pre- (M = 109.65) to post-intervention (M = 125.20) with a large-sized effect, $t(19) = 6.58$, $p < .001$, $d = 1.62$. No significant difference was found for the controls, $t(19) = .17$, $p = .87$. Overall, the two groups did not significantly differ in FFMQ scores pre-intervention but did significantly differ at post-intervention with the meditators showing a significant increase in FFMQ scores.

Hypothesis 2: Difficulties in emotion regulation

Descriptive statistics

The DERS-S scores were obtained for both groups at four assessment times (Weeks 1, 2, 3 & 4). **Table 5** provides the means and standard deviations for DERS-S scores for both groups at weekly assessment times.

Table 5
Mean scores and standard deviations on the Difficulties in Emotion Regulation Scale (DERS-S) for each group at weekly assessment times.
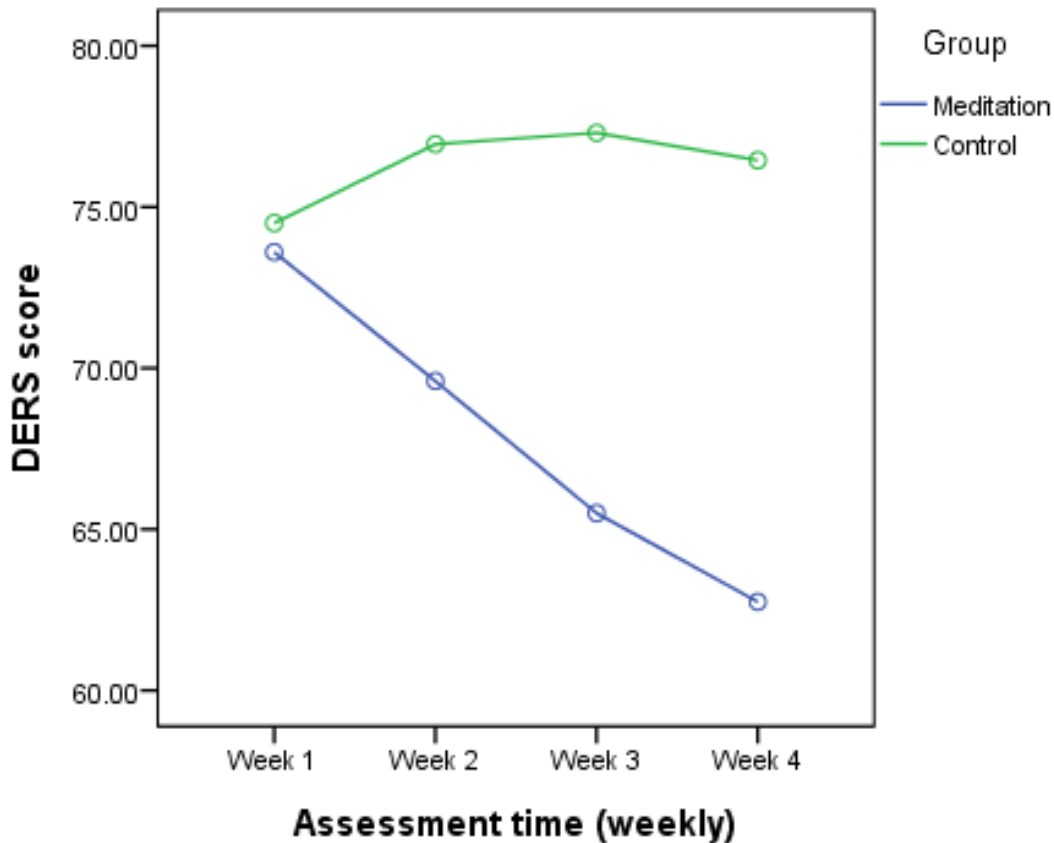
	Participant Group		
Assessment Time	Meditation (n =20) M (SD)	Control (n =20) M (SD)	Whole sample (N =40) M (SD)
Week 1 (baseline)	73.60 (13.37)	74.50 (15.75)	74.05 (14.43)
Week 2	69.60 (8.31)	76.95 (12.34)	73.28 (11.03)
Week 3	65.50 (13.89)	77.30 (12.54)	71.40 (14.36)
Week 4	62.75 (8.77)	76.45 (11.43)	69.60 (12.22)
Overall	67.86 (-)	76.30 (-)	-

Analysis of variance

A 2 x 4 mixed Factorial ANOVA was performed on the data. The between-subjects independent variable was participant group (meditation or control), the within-subjects independent variable was assessment time (weeks 1, 2, 3 and 4) and the

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[11] Levene's test for equal variances was not significant so equal variances were assumed. All effect sizes reported were calculated using an effect size calculator (Effect size links 1 & 2, 2011) and interpreted according to Cohen's guidelines (1992) (small effect size = .20, medium = .50, large = .80).

dependent variable was DERS-S scores. A significant main effect was observed for assessment time, $F(3,114) = 2.84$, $p = .04$[12] and also for participant group $F(1,38) = 6.55$, $p = .02$. A significant interaction effect was also found, $F(3,114) = 5.77$, $p = .001$[13]. This interaction is illustrated in **Figure 2**.

Figure 2: A means plot to illustrate the interaction between participant group (meditation vs. control) and assessment time (weeks 1, 2, 3 and 4).

Post-hoc tests

To further analyse the significant interaction found within the ANOVA, appropriate post-hoc tests were conducted[14]. Firstly, two independent t-tests were conducted on DERS-S scores at assessment time (pre-/post-intervention) with the independent variable as participant group (meditation vs. control) and the dependent variable as DERS-S scores. DERS-S scores were not significantly different between meditators ($M = 73.60$) and controls ($M = 74.50$) at pre-intervention, $t(38) = .20$, $p = .85$[15], but

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[12] Mauchley's test was not significant so sphericity was assumed.

[13] See footnote 12.

[14] To control for eight pairwise comparisons the Bonferonni correction provided a new significance level of $p < .00625$ (.05 / 8 - .00625)

[15] Levene's test for equal variances was not significant so equal variances were assumed.

were significantly different between meditators (M = 62.75) and controls (M = 76.45) at post-intervention with a large-sized effect, $t(38) = 4.25$, $p < .001$, $d = 1.34$[16].

To examine the source of the significance between the groups, one-way repeated-measures ANOVAs were conducted to examine the data for the groups separately. For each group, the independent variable was assessment time (weeks 1, 2, 3 & 4) and the dependent variable was DERS-S scores. DERS-S scores significantly decreased for meditators from pre- (M = 73.60) to post-intervention (M = 62.75) with large-sized effect, $F(2.09,57) = 8.89$, $p = .001$, $d = 1.11$[17]. No significant difference was found for DERS-S scores for the controls across assessment times, $F(2.34,57) = .51$, $p = .63$[18].

A series of paired-samples t-tests were performed in order to investigate the source of the significance of the repeated-measures ANOVA for the meditators. Significant decreases in DERS-S scores were found between baseline (week-1) and weeks-3 and 4 and also between weeks-2 and 4, all with large-sized effects. All t values and effect sizes can be found in **Table 6.** Overall, meditators were significantly different from the controls at post-intervention with significantly lower DERS-S scores in comparison to pre-intervention.

Table 6
Comparisons of mean scores on the Difficulties in Emotion Regulation Scale (DERS-S) for the meditation group between weekly assessment times.

Assessment time	t	df	Cohen's d
Weeks 1 and 2	1.67	19	.41
Weeks 1 and 3	5.60*	19	1.26
Weeks 1 and 4	4.57*	19	1.11
Weeks 2 and 3	1.66	19	.42
Weeks 2 and 4	3.64**	19	.81
Weeks 3 and 4	1.02	19	.25

*p <.001, **p < .006

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[16] Levene's test for equal variances was not significant so equal variances were assumed.

[17] Mauchley's test was significant so Greenhouse-Geisser values were used.

[18] See footnote 17.

Hypothesis 3: Positive affect

Descriptive statistics

The PAS scores were obtained for both groups at four assessment times (Weeks 1, 2, 3 and 4). **Table 7** provides the means and standard deviations for PAS scores for each group at weekly assessment times.

Table 7
Mean scores and standard deviations on the Positive Affect Scale (PAS) for each group at weekly assessment times.
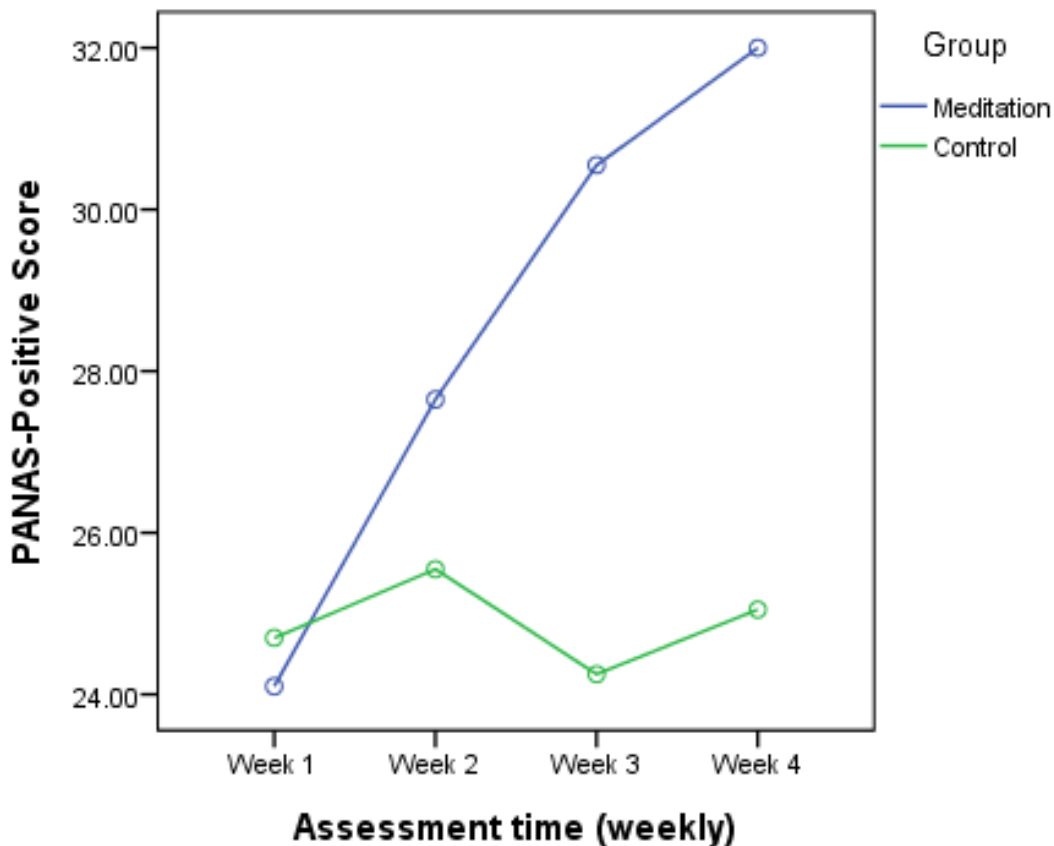
	Participant Group		
Assessment Time	Meditation (n =20) *M (SD)*	Control (n =20) *M (SD)*	Whole sample (N =40) *M (SD)*
Week 1 (baseline)	24.10 (5.63)	24.70 (6.52)	24.40 (6.02)
Week 2	27.65 (4.46)	25.55 (5.35)	26.60 (4.98)
Week 3	30.55 (3.15)	24.25 (4.55)	27.40 (5.01)
Week 4	32.00 (3.77)	25.05 (4.51)	28.53 (5.41)
Overall	28.58 (-)	24.89 (-)	-

Analysis of variance

A 2 x 4 mixed Factorial ANOVA was performed on the data. The between-subjects independent variable was group (meditation or control), the within-subjects independent variable was assessment time (weeks 1, 2, 3 & 4) and the dependent variable was PAS scores. A significant main effect was observed for assessment time, $F_{(2.24,114)}$ = 12.76, $p <$ .001[19] and also for participant group $F_{(1,38)}$ = 8.32, p = .006. A significant interaction effect was also found, $F_{(2.24,114)}$ = 13.42, $p <$001[20]. This interaction is illustrated in **Figure 3**.

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[19] Mauchley's test was significant so Greenhouse-Geisser values were used.
[20] See footnote 19.

Figure 3: A means plot to illustrate the interaction between participant group (meditation or control) and assessment time (Weeks 1, 2, 3 & 4).

Post-hoc tests

To further analyse the significant interaction found within the ANOVA, appropriate post-hoc tests were conducted[21]. Firstly, two independent t-tests were conducted on assessment time (pre-/post-intervention) with the independent variable as participant group (meditation or control) and the dependent variable as PAS scores. PAS scores were not significantly different between meditators ($M = 24.10$) and controls ($M = 24.70$) at pre-intervention $t(38) = .31$, $p = .76$[22] but were significantly different between meditators ($M = 32.00$) and controls ($M = 25.05$) at post- intervention with a large-sized effect, $t(38) = 5.29$, $p < .001$, $d = 1.67$[23].

To examine the source of the significance between the groups, one way repeated-measures ANOVAs were conduced to examine the data for the groups separately. PAS scores significantly increased for the meditators from pre- ($M = 24.10$) to post-intervention ($M = 32.00$) with a large-sized effect, $F(2.18,57) = 29.66$, $p < .001$, $d =$

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[21] To control for eight pairwise comparisons the Bonferroni correction provided a new significance level of $p < .00625$ (.05 / 8 = .00625).

[22] Levene's test for equal variances was not significant so equal variances were assumed.

[23] See footnote 22.

1.83^{24}. No significant difference was found for controls across time assessments, $F(3,57) = .56, p = .65^{25}$.

A series of paired-samples t-tests were performed in order to investigate the source of the significance of the repeated-measures ANOVA for the meditators. Significant increases in PAS scores were found between all weeks except between weeks-3 and 4. Large-sized effects were found for all these significant results except between weeks-1 and 4 which showed a medium-sized effect. All *t* values and effect sizes can be found in **Table 8.** Overall, meditators were significantly different from the controls at post-intervention with significantly higher PAS scores in comparison to pre-intervention.

Table 8
Comparisons of mean scores on the Positive Affect Scale (PAS) for meditators between weekly assessment times.

Assessment time	*t*	*df*	Cohen's *d*
Weeks 1 and 2	4.81*	19	1.14
Weeks 1 and 3	5.83*	19	1.45
Weeks 1 and 4	7.65*	19	.58
Weeks 2 and 3	3.62**	19	.86
Weeks 2 and 4	4.49*	19	1.01
Weeks 3 and 4	2.04	19	.46

*p <.001, **p < .006

Hypothesis 4: Negative affect

Descriptive statistics

The NAS scores were obtained for both groups at four assessment times (Weeks 1, 2, 3 & 4). **Table 9** provides the means and standard deviations for NAS scores for each group at weekly assessment times.

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[24] Mauchley's test was significant so Greenhouse-Geisser values were used.
[25] Mauchley's test was not significant so sphericity was assumed.

Table 9
Mean scores and standard deviations on the Negative Affect Scale (NAS) for each group at weekly assessment times
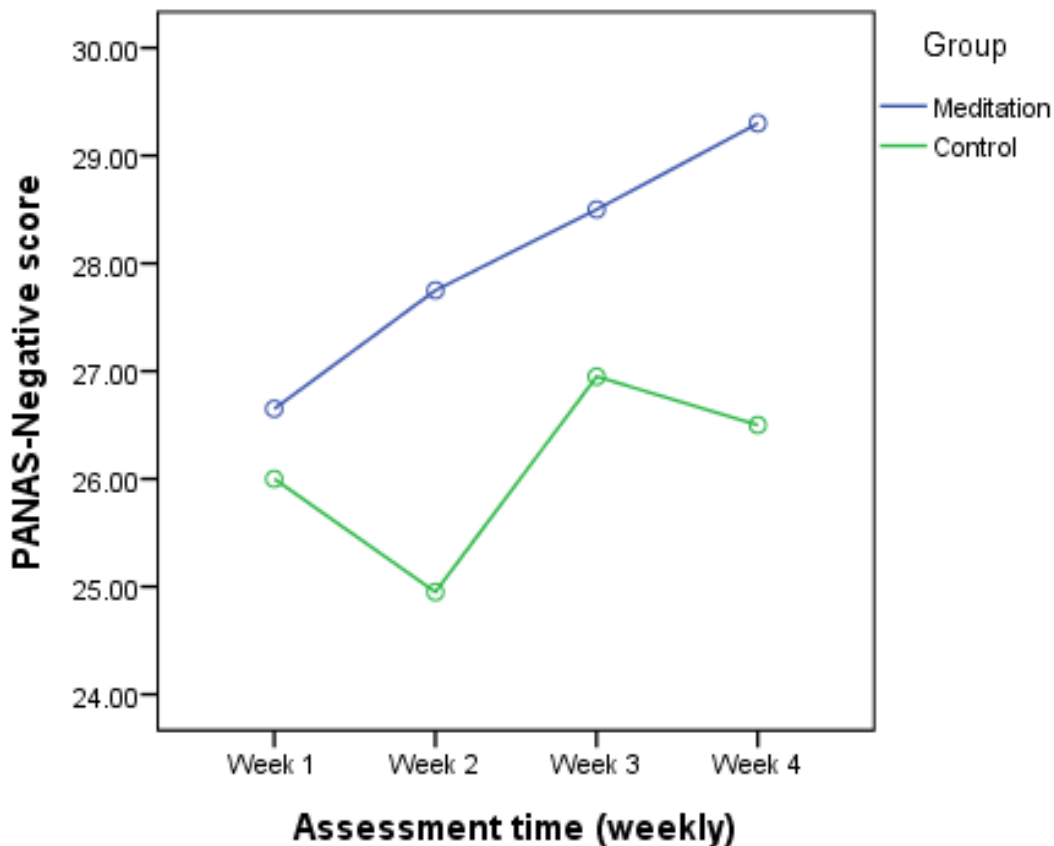
Assessment Time	Participant Group		
	Meditation (n =20) M (SD)	Control (n =20) M (SD)	Whole sample (N =40) M (SD)
Week 1 (baseline)	26.65 (6.36)	26.00 (6.43)	26.33 (6.32)
Week 2	27.75 (7.55)	24.95 (6.35)	26.35 (7.03)
Week 3	28.50 (6.71)	26.95 (5.99)	27.73 (6.32)
Week 4	29.30 (6.49)	26.50 (5.77)	27.90 (6.23)
Overall	28.05 (-)	26.10 (-)	-

Analysis of variance

A 2 x 4 mixed Factorial ANOVA was performed on the data. The between-subjects independent variable was participant group (meditation vs. control), the within-subjects independent variable was assessment time (Weeks 1, 2, 3 & 4). The dependent variable was NAS scores. A significant main effect was observed for assessment time, $F(3,114) = 5.14$, $p = .002$[26], but not for participant group $F(1,38) = 1.01$, $p = .32$. No significant interaction was found, $F(3,114) = 1.93$, $p = .129$[27]. This is illustrated in **Figure 4**.

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[26] Mauchley's test was not significant so sphericity was assumed.
[27] See footnote 26.

Figure 4: A means plot to illustrate a non-significant interaction between participant group (meditation vs. control) and assessment time (weeks 1, 2, 3 & 4).

Discussion

Study aims and hypotheses

The present study aimed to assess the effect of 3 weekly MM sessions on everyday mindfulness, ER difficulties and PA and NA in a student-population in comparison to a control condition. The findings support all hypotheses with the exception of the hypothesis for NA.

Hypothesis 1: Everyday mindfulness

In line with H1, the present study found that 3 MM sessions significantly increased self-reported everyday mindfulness for meditators but not controls from pre- to post-intervention. These findings support those of Carmody and Baer (2008) who found increased everyday mindfulness also using the FFMQ for pre- and post-MBSR. The present study successfully replicated these results but within 3 MM sessions using individually delivered, audio-recorded MMs, indicating that this format is effective as

part of a MM intervention as the majority of MM interventions aim to increase everyday mindfulness (Nyklicek *et al.*, 2008). Furthermore, unlike within the previous study, these results were not dependent on structured MM homework as participants were only instructed to apply mindfulness throughout daily activities. This contributes to understanding the role and importance of structured homework within MM interventions, suggesting that the application of mindful awareness in daily life is an important feature distinct from structured practice (Thompson & Waltz, 2007). However, the present research did not obtain information as to the extent to which participants applied mindfulness throughout daily activities so future research would benefit from asking participants to keep daily logs or by utilising experience sampling (Baer *et al.*, 2009).

Hypothesis 2: Emotion regulation difficulties

In line with H2, the present study found that 3 MM sessions significantly reduced self-reported ER difficulties in meditators but not controls from pre- to post-intervention. These findings are parallel to those of Jain *et al.* (2007) who found that maladaptive ER strategies were reduced following a one-month MM intervention. However, the previous study only assessed specific maladaptive ER strategies whereas this study extends such findings to ER difficulties in general. Furthermore, unlike Jain *et al.*, (2007) this study delivered the MM sessions individually therefore the present results are less likely to be attributable to social support (Davidson, 2010). The present findings also indicated that self-reported ER difficulties only began to significantly decrease after two sessions of MM (in week-3) with a large-sized effect (d=1.26) found between pre-intervention (week-1) and self-reported ER difficulties prior to the third session (week-3). Such findings support those of Erisman & Roemer (2010) who found that self-reported ER difficulties were unaffected by only one session. This study extends such findings, demonstrating that ER difficulties are susceptible to change after two 45-minute sessions. However, the mean baseline DERS-S scores of the meditation sample in the previous study, whilst selected as high-scoring, were lower (M=50.93*, SD*=8.10) than those of the current sample (M=73.60, SD=13.37) thereby allowing a greater possibility of a reduction in scores. This may also be indicative of the current high levels of ER difficulties in students and therefore limits the generalisability of this study to other populations. Future research may benefit from assessing whether MM individually delivered MM audio-recordings can reduce ER difficulties in students with lower baseline ER difficulties and in other relevant populations.

Hypothesis 3: Positive affect

In line with H3, the present study found that 3 MM sessions significantly increased self-reported PA for meditators but not controls from pre- to post-intervention. Furthermore, self-reported PA began to significantly increase as early as one week after the first session (week-2) with a large-sized effect (d=1.14) and continued to significantly increase in comparison to pre-intervention scores on a weekly basis - except for the post-intervention PAS scores which were not significantly different from the final-session scores. This replicates previous findings of increased PA after brief MM sessions (Erisman & Roemer, 2010) and interventions (Jain *et al.*, 2007; Orzech *et al.*, 2009) and provides support for theoretical speculations that MM may

initially exert its beneficial effects by increasing positive emotions (Garland *et al.*, 2010). However, there are still contradictions as to the relationship between MM and PA. For example, Brown & Cordon (2009) argue that MM should initially promote balanced affective states rather than increases in PA or decreases in NA - supported by findings of decreased PA after MM sessions (Thompson & Waltz, 2007). Alternatively, Garland *et al.* (2010) argue that MM should initially increase PA by cultivating a greater awareness of pre-existing PA which would only lead to balanced affect in the long-term. The present study supports Garland *et al.*'s (2010) argument - based on the 'broaden and build theory' (Fredrickson, 1998), as it was found that the meditation group reported significant increases in PA after only one session and this continued to significantly increase throughout the intervention. Thus the non-significant finding between the final session and post-intervention may support the argument that affect eventually becomes more balanced. Alternatively, such findings could indicate waning participant expectation (Erisman & Roemer, 2010). This potentially constitutes a limitation of the present research as participants may have had positive expectations as to the beneficial effects of meditation due to, for example, increased media coverage. Future research could address such confounding variables by masking the focus of MM studies (Sin & Lyubomirsky, 2009).

Hypothesis 4: Negative affect

Finally, the present study found that 3 MM sessions did not significantly reduce self-reported NA from pre- to post-intervention in either participant group. Conversely, the means show a trend of increased NAS scores for meditators, albeit non-significant. This is in contradiction to Goldin & Gross's (2010) findings that an MBSR program reduced self-reported NA – a finding replicated in other shorter MM interventions (Shapiro *et al.*, 1998). An obvious explanation for such results may be the short duration of MM training. However, Jain *et al.* (2007) used a four-week MM intervention in students and found reductions in NA. Theoretically, these findings appear to contradict Garland *et al.*'s (2010) theory: that initially, increased PA in MM interventions accompanies decreased NA. However, such results may reflect the less rigorous nature of the present intervention - the use of audio-recordings as opposed to a MM tutor and the lack of explicitly structured homework. Future research may benefit from continuing to contrast different durations of MM interventions to establish the minimal time for such changes in negative affect to occur (Zeidan *et al.*, 2010) and furthermore, assessing the differences between session delivery and format. Alternatively, as Chambers *et al.* (2009) argue, mindful ER may not lead to reduced NA because MM does not directly alter affective states but instead encourages awareness and acceptance of such states which may initially result in a greater awareness of NA and thus an increase in self-reported NA (Thompson & Waltz, 2007).

Broader implications

Due to increasing reports of student mental health problems (Bewick *et al.*, 2010) it is imperative for accessible MM interventions for students to be explored as a possible adjunct to university counselling services (Shaprio *et al.*, 2008). Few studies have specifically explored applying meditation practices within higher education therefore the present findings are promising in terms of the contribution of brief MM

interventions on the emotional well-being of students. In particular, in a review of research, Shapiro *et al.* (2008) argue firstly that increased everyday mindfulness can lead to improved attention and concentration that can facilitate learning, secondly, that reduced ER difficulties can promote adaptive coping mechanisms, and thirdly, that increased PA enhances cognitive processes relevant to study. The present findings therefore suggest that such outcomes are partially amenable to being enhanced through a brief MM intervention. Furthermore, there are theoretical implications as the present findings support the argument that MM initially exerts its effects on emotional processes, though the role of MM on affect needs further delineation.

Limitations and future research

In addition to the specific limitations and recommendations already mentioned, there are general limitations to address within the present study and within broader MER research.

Firstly, although extending previous research by using an active control condition (Davidson, 2010), the control session content may have been emotionally evocative to some third-year students. Whilst careers guidance audio-recordings were chosen to engage students, it may have caused tension in students worried about career options upon graduation. Future research may benefit from utilising less provocative content or using a comparison condition matched more closely to the MM sessions format (Williams, 2010).

Secondly, for the meditation condition, it is not possible to discern the effects of the specific guided meditations used. For example, the confidence of the meditation tutor has been shown to influence participants (Davidson, 2010) and subsequently, using the same audio-recordings throughout may have biased results and limited generalisability. This may be overcome by using comparison conditions utilising different guided MMs, therefore teasing apart the effects and also balancing the positive expectations between groups (Williams, 2010). Furthermore, the partial success of these individually delivered sessions should not prevent further rigorous analysis of the differences between individual and group MM interventions specifically for student populations (Shapiro *et al.*, 2007).

A third limitation of the present study is the exclusive use of self-report measures (Baer *et al.*, 2006). Whilst the majority of MM research utilises either self-report or neuro-imaging methodologies, it is important for MM research to explore other measurement techniques such as behavioural, physiological or experience-sampling methods as retrospective reports are known to be biased by memory distortion (Brown & Ryan, 2003). Furthermore, a thorough examination of the different sub-scales of the measures used would be an advantageous exploration for future research as different facets of mindfulness or ER may be affected differently in brief MM interventions in comparison to lengthier ones (Brown and Ryan, 2003).

The final limitation concerns the constructs of MM and ER. As both MM and ER are new research areas there is still dispute as to their conceptual and definitional status (Bloch, 2010; Williams, 2010). For example, Chambers *et al.* (2009) argue that MM and ER are perhaps best not viewed as discrete constructs but as orthogonal

constructs. This could have influenced the present results and thus necessitates studies that explore the way in which these facets overlap. For example, to clarify the effect of MM on PA and NA and illuminate current theoretical and research contradictions, future research might benefit from using the PANAS sub-scales as an overall measure to serve as an indicator of overall reported emotional reactivity (Arch & Craske, 2006), thus moving beyond the positive and negative demarcation which may not be a useful conceptualisation of MMs effects (Brown & Cordon, 2009).

Conclusion

The present study has demonstrated that 3 weekly MM sessions can have a beneficial impact upon the emotional well-being of students aged 18-24. In particular - increases in self-reported everyday mindfulness and PA and reductions in self-reported ER difficulties; changes which have been consistently associated with psychological well-being (Chambers *et al.*, 2009) and are integral to recent positive psychology interventions in vulnerable populations (Shapiro *et al.*, 2002). The non-significant finding of the present MM sessions on NA may correspond to the less-intensive nature of the intervention, indicating that future research should consider variations in the delivery of MM interventions and continue to distinguish the short-term processes underlying findings of long-term salutary effects.

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