



The influence of an application-based mindfulness intervention on self-reported rumination, stress, emotional intelligence and life satisfaction in undergraduate students

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### ABSTRACT

Mindful practice is suggested to improve emotional intelligence (EI), life satisfaction (LS), trait mindfulness (TM) and alleviate both stress and rumination. These notions are postulated to benefit undergraduates' scholastic experience. Subsequently, short-term digital mobile mindfulness applications have evolved, including Headspace®. However, insufficient research has explored the effectiveness of Headspace®.

Using a mixed field design, this study investigated the effectiveness of Headspace® on undergraduates' self-reported rumination, stress, TM, LS and EI, in comparison to an active control condition. Participants listened to either ten minutes of guided meditation using Headspace® ( $n = 23$ ), or an informative recording ( $n = 21$ ), each day for ten days. A 2 X 2 mixed factorial ANOVA revealed Headspace® significantly improved LS and EI, but did not significantly improve TM nor reduce stress and rumination pre-post intervention. A mediation analysis revealed that rumination mediates the relationship between mindfulness and stress regardless of Headspace®.

The findings indicate Headspace® is effective in improving EI and LS within undergraduates and that one mechanism by which mindfulness alleviates stress is via rumination. The applications, limitations and further research directions are discussed.

|            |                   |        |            |                   |                        |
|------------|-------------------|--------|------------|-------------------|------------------------|
| KEY WORDS: | TRAIT MINDFULNESS | STRESS | RUMINATION | LIFE SATISFACTION | EMOTIONAL INTELLIGENCE |
|------------|-------------------|--------|------------|-------------------|------------------------|

## Introduction

Mindfulness descended from Buddhist practice 2,500 years ago (Van Gordon et al., 2015) and is widely used to alleviate psychological problems and promote wellbeing (Cullen, 2011). A common definition is an awareness that transpires from paying attention in a non-judgemental way and incorporating the present moment (Kabat-Zinn, 1994). There are two notions of mindfulness; state mindfulness which refers to mindfulness during meditation (Lau et al., 2006) and trait mindfulness, which is conceptualised as a stable predisposition to be mindful in everyday life (Kiken et al., 2015; Brown and Ryan, 2003). It is postulated that a linear relationship between those who are more momentarily mindful and those who also portray a more mindful trait disposition exists (Brown and Ryan, 2003), contrary to Thompson and Waltz (2007) who state a linear relationship is non-existent.

The most prevalent mindfulness intervention is Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982); an eight-week group intervention incorporating mindfulness and yoga (Carmody et al., 2009; Josefsson et al., 2012). It has, however, been suggested that meditation alone has greater effects upon mindfulness than MBSR (Eberth and Sedlmeier, 2012). Research also suggests that the effects of MBSR may be exaggerated as those who embark on an MBSR course seek to lessen their stress not to improve their mindfulness, unlike those who attend a mindfulness course (Eberth and Sedlmeier, 2012). The cost and duration of MBSR means that it is not an accessible intervention for everyone and there should, therefore, be an alternative available (Dobkin et al., 2013). This may be achieved through the use of modern technology.

The exponential development of technology is the paradigm shift towards mobile health interventions which, whilst in their infancy (Free et al., 2013), young adults have demonstrated a positive affinity and responsive attitude towards these digital-based interventions (Malboeuf-Hurtubise et al., 2015). Research has expanded this notion by reporting the effectiveness of Internet-based mindfulness programs on reducing stress, anxiety and depression (Boettcher et al., 2014; Myint et al., 2011). Lauricella (2014) further compared digital recording mindfulness to face-to-face mindfulness and found that although only a quarter of undergraduates preferred the digital method it provided key benefits in that it gave participants greater privacy and repeatability options. This premise may increase with the evolving developments of digital mindfulness applications.

Howells et al. (2014) reported improvements in wellbeing having used short-term digital mindfulness, although the findings of this study are questionable as participants were aware of what was being measured, potentially generating a biased outcome. Josefsson et al. (2012) also found that a four-week mindful program did not significantly increase mindfulness more than a relaxation group, so proposed the program was too short to distinctly develop mindfulness sufficiently. Although, mindful practice should be cautioned as it ought not to take the one size fits all approach, as mindfulness is not suitable for everyone (Teasdale et al., 2003; Shigaki et al., 2006).

There remains insufficient evidence of the efficacy of digital mindfulness applications (Mohr et al., 2013). It would, therefore, be valuable to attain a greater

understanding of how effective short-term mobile mindfulness applications are upon psychological wellbeing.

Research commonly measures the effectiveness of mindfulness with regards to psychological wellbeing: an umbrella term referring to our thoughts and feelings (Diener et al., 1999). Exploring the notions within this and their relationships with mindfulness is pivotal for further interventions.

Lazarus and Folkman (1984) proposed stress is a two-part process; involving environmental demands and individuals' own coping resources, an imbalance between these produces stress, termed the Transactional theory. Students' stress levels at university are increasing and have been found to impede academic performance (Schmidt et al., 2015). Studies reveal undergraduates have experienced deficits in attention, concentration, learning and productivity due to stress (Gallego et al., 2014; Austin et al., 2010). The Transactional theory suggests undergraduates have inadequate coping resources to balance these environmental stressors. Mindfulness is postulated to improve these coping mechanisms, through increasing the left-sided anterior activation which reduces negative affect (Davidson et al., 2003). In support of this, undergraduates who undertook mindfulness practice experienced reduced stress as well as improved coping resources and work engagement (Gallego et al., 2014; Weinstein et al., 2009; Leroy et al., 2013). However, mindful practice was not successful with undergraduates who were experiencing exam-pressure (Myint et al., 2011).

Rumination, emotional intelligence and life satisfaction are constructs placed within 'psychological wellbeing', that are influenced by mindfulness. The Whole Life Satisfaction Theory of Happiness, suggests life satisfaction is the foundation to happiness (Feldman, 2008), as it's a subjective interpretation of the myriad of variables within our lives whilst excluding an emotional or affective component (Antaramian et al., 2008). Research suggests that greater mindfulness is significantly associated with increased life satisfaction, (Schutte and Malouff, 2011; Prempas, 2014; Bajaj and Pande, 2016) as mindfulness develops emotional regulation and emotional competencies (Wang and Kong, 2013). Undergraduates may benefit from greater life satisfaction as it's associated with greater resilience and reduced vulnerability when confronted with academic challenges, subsequently improving their academic performance (Rode et al., 2005).

Emotional intelligence refers to the ability to monitor and distinguish between one's own and others' emotions, thereby guiding our own actions (Salovey and Mayer, 1990). Previous literature established that mindfulness improves and facilitates the development of emotional intelligence (Brown and Ryan, 2003; Snowden et al., 2015; Baer et al., 2004; Wright and Schutte, 2013; Wang and Kong, 2013). It is thought that undergraduates can benefit from increased emotional intelligence as it's suggested to improve their interpersonal relationships and reduces stress (Brackett et al., 2011; Siu, 2009). Although, it's unknown whether short-term digital mindfulness applications can deliver such results.

In addition, mindfulness claims to reduce rumination. More mindful individuals have reduced activity in their default mode network, which is our 'inattentive' state responsible for rumination (Doll et al., 2015). The most abundant theory of

rumination is the Response Styles Theory (Nolen-Hoeksema, 1991), where rumination consists of fixation and repetitive thinking about causes, consequences and symptoms of negative affect (Keng et al., 2016; Nolen-Hoeksema et al., 2008). Mindfulness is thought to prevent the fixation on negative thoughts and instead desensitizes them (Hawley et al., 2014; Keng et al., 2011), consequently alleviating rumination (Kearns et al., 2016; Coffey and Hartman, 2008).

Research indicates these notions coincide, for example it is thought rumination predicts and moderates stress (Stroud et al., 2015; Mezo and Baker., 2012). Research also suggests rumination is a response to stress (Skitch and Abela, 2008) which follows the Stress-Reactive model of rumination whereby rumination occurs after experiencing a stressful event (Alloy et al., 2000). Subsequently those who practice mindfulness are reported to have reduced stress (Neale-Lorello and Haaga, 2015; Harnett et al., 2010).

Mindfulness is also thought to mediate rumination (Raes and Williams, 2010), as mindful practice is suggested to reduce rumination by developing attentional control and teaching oneself how to disengage and prevent rumination (Segal et al., 2002; Nolen-Hoeksema et al., 2008). This inverse relationship between mindfulness and rumination has been recognised in recent literature (Petrocchi and Ottaviani, 2016; Selby et al., 2015; Keune et al., 2011). However, several of these studies do not include a comparison group, such as Harnett et al. (2010). Therefore, the findings cannot always be attributed to the mindfulness practice per se as there may have been extraneous variables influencing the outcome (Davidson, 2010). An active control group is therefore essential to make such comparisons. From the abundance of literature that highlights the dynamic relationship between mindfulness, stress and rumination, it remains uncertain if rumination mediates mindfulness and stress. This may provide a clearer insight upon the mechanisms to how mindfulness effectively reduces stress.

The preliminary research suggests mindfulness appears beneficial within the notions mentioned, although it remains unknown whether these benefits are universal to short-term digital mindfulness applications, as research has yet to outline their effectiveness. Therefore, this study will take a novel approach by aiming to investigate the efficacy of a short-term, mobile, mindfulness application, Headspace®, upon undergraduates who would benefit from an accessible, short-term, mindful intervention to maximise their scholastic experience and help cope with university stress. A mixed field design was implemented with undergraduates randomly allocated to a mindfulness condition or an active control condition. Each condition consisted of ten minute recordings for ten days in which self-reported measures of emotional intelligence (EI), life satisfaction (LS), trait mindfulness (TM), stress and rumination were employed to compare from pre-intervention to post-intervention. This will facilitate our understanding of how to achieve greater mindfulness that coincides with the technological advances of today. The secondary aim of the study was to establish if rumination mediates the relationship between mindfulness and stress regardless of a mindful intervention.

It was hypothesised that participants in the mindfulness condition would experience an increase in emotional intelligence (hypothesis one), life satisfaction (hypothesis two) and trait mindfulness (hypothesis three), as well as reduced

rumination (hypothesis four) and stress (hypothesis five) in comparison to an active control condition from pre-questionnaire to post-questionnaire. Coinciding with the secondary aim the sixth hypothesis was that rumination would mediate the relationship between mindfulness and stress regardless of the intervention.

## **Methodology**

### **Design**

The study followed a 2 X 2 mixed field design. The between-subjects' independent variable was the two conditions (mindfulness vs. control). The within-subjects' independent variable was assessment time (pre-questionnaire and post-questionnaire). The scores from the self-reported questionnaires measuring, rumination, stress, TM, EI and LS, were the dependent variables.

### **Participants**

Undergraduates were recruited by opportunistic sampling through advertisements placed upon the Research Participation Pool: software available to Manchester Metropolitan University psychology students, which exchanged participation for 180 points, enabling participants to use the software in future. Advertisements were additionally published on social media (Appendix 1). The eligibility criteria required that participants were over 18 years old, a current undergraduate, and meditation-naïve.

A power analysis using G\*Power 3.1.9.2 (Faul et al., 2009) with a medium effect size (Cohen's  $d = .25$ ), a power of .95 and a Cronbach's alpha value of  $\alpha = .05$ , determined that a minimum of 36 participants were needed (Appendix 2). Initially, 70 participants began the study, 26 were later excluded due to incompleteness. The response rate was 62.86%, as 44 eligible participants completed the study, including the mindfulness condition ( $n = 23$ ) and control condition ( $n = 21$ ). This was as predicted by other repeated-measure mindfulness studies (Chittaro and Vianello, 2016; Malboeuf-Hurtubise et al., 2015).

Online survey software; Qualtrics, was programmed to randomly allocate participants into equal gender groups using quotas. However, difficulties in recruitment and a high drop-out rate meant the quotas were later removed. Thus, 66% females ( $n = 29$ ) and 34% males ( $n = 15$ ) participated. This female dominance is similar to Schutte and Malouff's (2011) study.

### **Materials**

Five established questionnaires were employed to ensure the reliability and validity of each measure. Responses were collected using Likert scales (Likert, 1932).

### **Assessing Emotions Scale**

The Assessing Emotions Scale (AES; Schutte et al., 2009; Appendix 3.1) was adopted to measure Emotional Intelligence (EI), as it measures EI as a singular global factor (Kun et al., 2010). The AES shows a high internal consistency ( $\alpha = .90$ ) and good re-test reliability (.78) (Schutte et al., 2009). The AES is a 33-item questionnaire, containing statements such as “*I have control over my emotions.*” Responses were measured using a 7-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The final score can range from 33 to a maximum of 165, with items 5, 28 and 33 reversed scored as per the authors’ instructions, the higher the score, the higher the EI (Schutte et al., 2009).

### **Depression Anxiety Stress Scale**

The Depression Anxiety Stress Scale (DASS; Lovibond and Lovibond, 1995; Appendix 3.2) is a 42-item scale measuring three negative emotional states: depression, anxiety and stress. This research only used the stress subscale which was approved in the authors’ instructions (Lovibond and Lovibond, 1995). The stress subscale was appropriate for this study as it detects non-specific arousal (Warnecke et al., 2011) thus focuses on everyday stress (Parkitny and McAuley, 2010). DASS Stress comprises 14 items, such as “*I found that I was very irritable*”. Participants responded using a 4-point Likert scale, from 0 (*did not apply to at all*) to 3 (*applied to me very much or most of the time*). The highest obtainable score within the subscale is 42 suggesting highly stressed, and 0 being the least stressed (Lovibond and Lovibond, 1995). The stress subscale is a reliable and valid scale with a reported Cronbach’s alpha of  $\alpha = .90$  with subscales of anxiety and depression reporting .84 and .91 (Crawford and Henry, 2003; Lovibond and Lovibond, 1995).

### **Ruminative Thoughts Scale**

The Ruminative Thoughts Scale (RTS; Brinker and Dozois, 2009; Appendix 3.3) was employed to measure rumination. The RTS was used as it refers to a general thinking style and does not predict being in a sad mood (Voon et al., 2013). RTS consists of 20 statements, such as “*I can’t stop thinking about some things*”. Participant responded to how well it describes them using a 7-point Likert scale ranging from 1 (*Not at all*) to 7 (*Very well*). The lowest score is 20 and the highest score is 140, which signifies a high ruminative thinking style (Brinker and Dozois, 2009). The scale possesses high internal consistency ( $\alpha = .95$ ) and obtains good test-retest reliability (Brinker and Dozois, 2009).

### **Mindfulness Attention Awareness Scale**

The Mindful Attention Awareness Scale (MAAS; Brown and Ryan, 2003; Appendix 3.4) was employed to measure trait mindfulness (TM), as it obtains a historical and modern Buddhist scholarship standpoint (Brown et al., 2011). Thus, it may be more appropriate for measuring TM from a digital intervention. Participants rated 15 statements, for example “*I find myself preoccupied with the future or the past*” using a 6-point Likert scale that corresponds best with how often they experience each statement from 1 (*Almost always*) to 6 (*Almost never*). The

maximum score is 90 demonstrating high mindfulness and the lowest score being 15 (Brown and Ryan, 2003). MAAS obtains a high internal consistency with reporting Cronbach's  $\alpha = .80$  to  $.90$  (Brown and Ryan, 2003).

### **Satisfaction with Life Scale**

The Satisfaction with Life Scale (SWLS; Diener et al., 1985; Appendix 3.5) was employed to measure Life Satisfaction (LS) as it measures LS overall rather than a specific area (Diener et al., 1985). It consists of five statements for example: "*If I could live my life over, I would change almost nothing*". The participants respond using a 7-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*). The highest scoring band is between 31-35 which defines the participant as '*extremely satisfied*' to between 5-9 defined as '*Extremely dissatisfied*'. Its reported internal consistency is  $\alpha = .87$  (Diener et al., 1985).

Permission for each questionnaire was not necessary as all questionnaires are in the public domain and have permission to use within research.

### **Technology Entertainment and Design Talks©**

Technology Entertainment and Design Talks (TED Talks©), were employed for the active control condition as they mimic the structure of the mindfulness condition. Each TED Talk© was ten minutes with varying content classified as 'informative' to be neither provocative nor invasive (Appendix 4). Participants were emailed daily hyperlinks directing them to Qualtrics which contained recordings for each corresponding day (Appendix 5). To monitor participants progress and to ensure participants listened to the full recording, a timer was embedded into Qualtrics. Permission was not required for the use of TED Talks©.

### **Headspace®**

Headspace® was employed for the mindfulness condition. It is a free mobile application that delivers ten minutes of guided meditation for ten days. On the onset of accessing Headspace®, each participant paired their device with the researcher using the 'buddy' system, this enabled the researcher to monitor their progress. Headspace® was employed as it's the most downloaded mindfulness application (Laurie and Blandford, 2016) and thought to be the best (Mani et al., 2015). Permission was sought and granted (Appendix 6).

### **Procedure**

Once participants had accepted the invitation to the study via the Research Participation Pool (Appendix 7), they were directed to Qualtrics, which facilitated data collection by exporting the raw data into analytic software; SPSS (Wright, 2005). An information sheet was presented; detailing the study further with regards to process, eligibility and time commitment (Appendix 8), followed by an informed consent form (Appendix 9) and an anonymity form (Appendix 10).



Participants were randomly allocated into two groups, the control condition and mindfulness condition. This was achieved by programming Qualtrics to allocate either a one (for Headspace®) or two (for TED Talks©) onto participants' anonymous codes. All participants completed an initial series of established questionnaires electronically (Appendix 3). On completion, participants emailed the researcher using their numerical student email address containing the first number of their anonymous code. This allowed for group specific instructions to be sent (Appendix 11 and 12).

Both interventions were designed to be structurally similar, so any changes could be attributed to the mindfulness intervention. Therefore, all participants listened to ten minute recordings of either guided meditation using Headspace® or informative talks via TED Talks©, for ten consecutive days via a mobile device. Participants were requested to conduct the tasks in quiet environments, to help eliminate distracting thoughts and to facilitate the effectiveness of the Headspace® (Cooper, 2012; Feldman et al., 2007; Puddicombe, 2016).

Daily manipulation checks occurred for both conditions. Participants' daily progress was monitored on Headspace® using the buddy system to ensure they engaged in the application. Similarly, TED Talk© recordings were monitored using the embedded timer in Qualtrics, to make sure each participant logged in and listened for the whole duration.

Daily reminder emails were sent to encourage participation (Appendix 13). On completion of the ten days, participants completed the series of questionnaires again and were provided a group specific debrief (Appendix 14 and 15).

## **Ethics**

The study adhered to Manchester Metropolitan University's ethical guidelines and the British Psychological Society guidelines. Ethical considerations were reported in the approved Application for Ethical Approval Form (Appendix 16). It can be deemed unethical to have employed an active control group that were abstained from accessing the hypothesised benefits of Headspace® in order to create comparisons. To overcome this, the control condition were provided a group specific debrief containing guidance on how to access Headspace®. Additionally, informing participants of each variable being measured may have resulted in participants demonstrating demand characteristics, thereby jeopardising the integrity of the research similar to Howells et al. (2014). Thus, the umbrella term "psychological wellbeing" was adopted in the initial correspondence, each measure was later disclosed within the debriefs.

## Results

### Preparation of Data

All raw data from both mindfulness ( $n = 23$ ) and control ( $n = 21$ ) condition was exported into IBM SPSS Statistics 22.0 in preparation for analysis. All data outputs can be located in Appendix 17. Three questions on the AES scale were reverse scored as per the authors' instructions, the totals of each measure pre-questionnaire and post-questionnaire were then calculated. In order to check the internal consistency reliability Cronbach's alpha ( $\alpha$ ) coefficients were generated for all measures pre-questionnaire and post-questionnaire, which all obtained an  $\alpha$  of above 0.7, which is an established satisfactory reliability (Nunnally, 1978), see table 1.

Normality of data was checked for all measures pre-questionnaire and post-questionnaire, by obtaining skewness statistic and running histograms (Appendix 18). Normality and skewness was accepted, as fell within normal distribution bands (Tabachnick and Fidell, 2005). Post AES mindfulness did not, though it was retained as it was considered to be a true score and not a product of measurement error (Tabachnick and Fidell, 2005), in addition Analysis of Variance (ANOVA) procedures are still robust, with moderate deviations from normality (Lunney, 1970).

Table 1

*Internal Consistency (Reliability) and Confidence Intervals for All Measures Pre-Questionnaire and Post-Questionnaire*

| Measure <sup>1</sup> | Number of items in measure | Reliability | 95% confidence interval |             |
|----------------------|----------------------------|-------------|-------------------------|-------------|
|                      |                            | $\alpha$    | Lower bound             | Upper bound |
| Pre DASS Stress      | 14                         | .93*        | .90                     | .96         |
| Pre AES              | 33                         | .90*        | .85                     | .94         |
| Pre RTS              | 20                         | .96*        | .94                     | .98         |
| Pre MAAS             | 15                         | .90*        | .86                     | .94         |
| Pre SWLS             | 5                          | .88*        | .81                     | .93         |
| Post DASS Stress     | 14                         | .94*        | .91                     | .96         |
| Post AES             | 33                         | .95*        | .93                     | .97         |
| Post RTS             | 20                         | .97*        | .95                     | .98         |
| Post MAAS            | 15                         | .92*        | .88                     | .95         |
| Post SWLS            | 5                          | .91*        | .85                     | .94         |

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

<sup>1</sup> DASS stress= Stress subscale of Depression, Anxiety and Stress Scale, AES= Assessing Emotions Scale, RTS= Ruminative Thoughts Scale, MAAS= Mindfulness Attention Awareness Scale, SWLS= Satisfaction With Life Scale

### Hypothesis One – Emotional Intelligence (EI)

To determine whether EI significantly increased from pre-questionnaire to post-questionnaire. AES scores were measured for both conditions pre-questionnaire and post-questionnaire. Table 2, contains means and standard deviations for both conditions, pre-questionnaire and post-questionnaire.

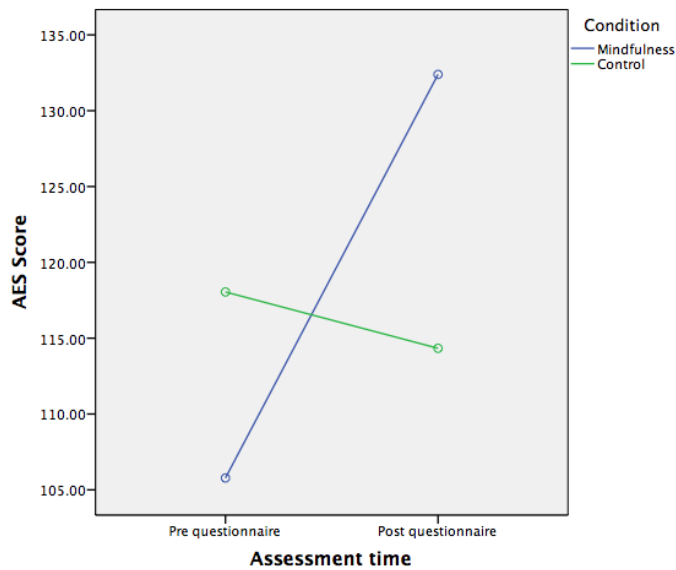
Table 2

*Mean Values and Standard Deviations for AES Scores Pre-Questionnaire and Post-Questionnaire for Mindfulness Condition, Control Condition and Total Sample*

| Assessment time | Participant group               |           |                             |           |                                  |           |
|-----------------|---------------------------------|-----------|-----------------------------|-----------|----------------------------------|-----------|
|                 | Mindfulness<br>( <i>n</i> = 23) |           | Control<br>( <i>n</i> = 21) |           | Total Sample<br>( <i>N</i> = 44) |           |
|                 | <i>M</i>                        | <i>SD</i> | <i>M</i>                    | <i>SD</i> | <i>M</i>                         | <i>SD</i> |
| Pre AES         | 105.78                          | 18.47     | 118.05                      | 11.74     | 111.64                           | 16.64     |
| Post AES        | 132.39                          | 21.43     | 114.33                      | 17.75     | 123.77                           | 21.56     |
| Overall         | 119.09                          | --        | 116.19                      | --        | --                               | --        |

To investigate whether there are significant differences between AES scores, a 2 X 2 mixed factorial ANOVA was performed. The within-subjects independent variable was assessment time (pre-questionnaire and post-questionnaire), and the between-subjects independent variable was the condition (mindfulness or control) with the dependent variable being the AES score<sup>2</sup>. A significant main effect for assessment time was found,  $F(1, 42) = 8.35$ ,  $p = .006$ ,  $\eta_p^2 = .166$ , but not for the condition,  $F(1, 42) = 0.64$ ,  $p = .430$ ,  $\eta_p^2 = .015$ . A significant interaction effect was observed,  $F(1, 42) = 14.64$ ,  $p < .001$ ,  $\eta_p^2 = .258$ . Figure 1, displays this interaction. Post-hoc tests were required to further interpret the interaction.

<sup>2</sup> For all ANOVAs Mauchly's test was not significant, therefore sphericity is assumed. All reported significance values are two-tailed with an alpha level of .05 unless stated.



*Figure 1.* A means plot demonstrating the significant interaction between assessment time (pre-questionnaire and post-questionnaire) and condition (mindfulness or control) for the AES.

### Post-hoc tests

To explore the significant interaction found within the ANOVA, paired-sample t-tests were conducted for each condition (mindfulness and control). The independent variable was assessment time (pre-questionnaire and post-questionnaire) and the dependent variable was the AES score.<sup>3</sup> A significant increase was found for the mindfulness condition from pre-questionnaire ( $M = 105.78$ ,  $SD = 18.47$ ) to post-questionnaire ( $M = 132.39$ ,  $SD = 21.43$ ), with a large effect size<sup>4</sup>,  $t(22) = 3.81$ ,  $p = .001$ ,  $d = 0.80$  but not for the control group pre-questionnaire ( $M = 118.05$ ,  $SD = 11.74$ ) to post-questionnaire ( $M = 114.33$ ,  $SD = 17.75$ ),  $t(20) = 1.17$ ,  $p = .257$ . Therefore, only the mindfulness condition experienced a significant increase in EI from pre-questionnaire to post-questionnaire.

### Hypothesis Two – Life Satisfaction (LS)

To establish whether LS significantly increased from pre-questionnaire to post-questionnaire, SWLS scores were taken for both conditions pre-questionnaire and post-questionnaire. The corresponding means and standard deviations can be located in Table 3.

<sup>3</sup> For all post-hoc tests, the Bonferoni correction was applied to control for pairwise comparisons ( $.05/2 = .025$ )

<sup>4</sup> All effect sizes were calculated using an online effect size calculator for paired t-tests (Wiseheart, 2013; Appendix 19). A small effect size is .20, a medium is .50, and a large is .80 according to guidelines by Cohen (1988).

Table 3

Mean Values and Standard Deviations for SWLS Scores Pre-Questionnaire and Post-Questionnaire for Mindfulness Condition, Control Condition and Total Sample

| Assessment time | Participant group               |           |                             |           |                                  |           |
|-----------------|---------------------------------|-----------|-----------------------------|-----------|----------------------------------|-----------|
|                 | Mindfulness<br>( <i>n</i> = 23) |           | Control<br>( <i>n</i> = 21) |           | Total Sample<br>( <i>N</i> = 44) |           |
|                 | <i>M</i>                        | <i>SD</i> | <i>M</i>                    | <i>SD</i> | <i>M</i>                         | <i>SD</i> |
| Pre SWLS        | 19.17                           | 6.58      | 24.14                       | 6.63      | 21.55                            | 6.99      |
| Post SWLS       | 26.70                           | 8.20      | 23.10                       | 6.43      | 24.98                            | 7.54      |
| Overall         | 22.94                           | --        | 23.62                       | --        | --                               | --        |

To investigate whether there were significant differences between SWLS scores, a 2 X 2 mixed factorial ANOVA was performed. The within-subjects independent variable was assessment time (pre-questionnaire and post-questionnaire), the between-subjects independent variable was condition (mindfulness or control) and the dependent variable was the SWLS score. A significant main effect for assessment time was found,  $F(1, 42) = 6.13, p = .017, \eta_p^2 = .127$  but not for the condition,  $F(1, 42) = 0.17, p = .683, \eta_p^2 = .004$ . A significant interaction effect was found,  $F(1, 42) = 10.74, p = .002, \eta_p^2 = .204$  (see figure 2). To interpret the interaction further, post-hoc tests are required.

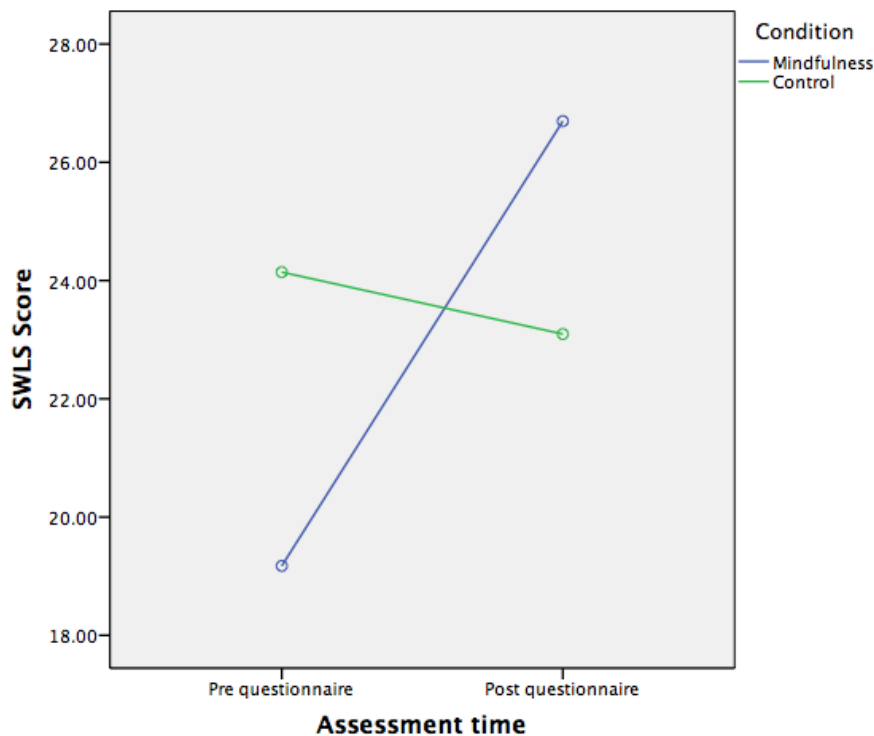


Figure 2. A means plot demonstrating the significant interaction between assessment time (pre-questionnaire and post-questionnaire) and condition (mindfulness or control) for the SWLS.

## Post-hoc tests

To determine the source of significance within the ANOVA, paired-sample t-tests were carried out for both the mindfulness and control condition. The independent variable was assessment time (pre-questionnaire and post-questionnaire) and the dependent variable was SWLS score. A significant increase was found for the mindfulness condition from pre-questionnaire ( $M = 19.17$ ,  $SD = 6.58$ ) to post-questionnaire ( $M = 26.70$ ,  $SD = 8.20$ ) with a medium effect size,  $t(22) = -3.26$ ,  $p = .004$ ,  $d = -0.68$ . Whereas, a non-significant increase was found for the control condition from pre-questionnaire ( $M = 24.14$ ,  $SD = 6.63$ ) to post-questionnaire ( $M = 23.10$ ,  $SD = 6.43$ ),  $t(20) = 1.00$ ,  $p = .329$ . This suggests only the mindfulness condition experienced significant increases in LS from pre-questionnaire to post-questionnaire.

## Hypothesis Three – Trait Mindfulness (TM)

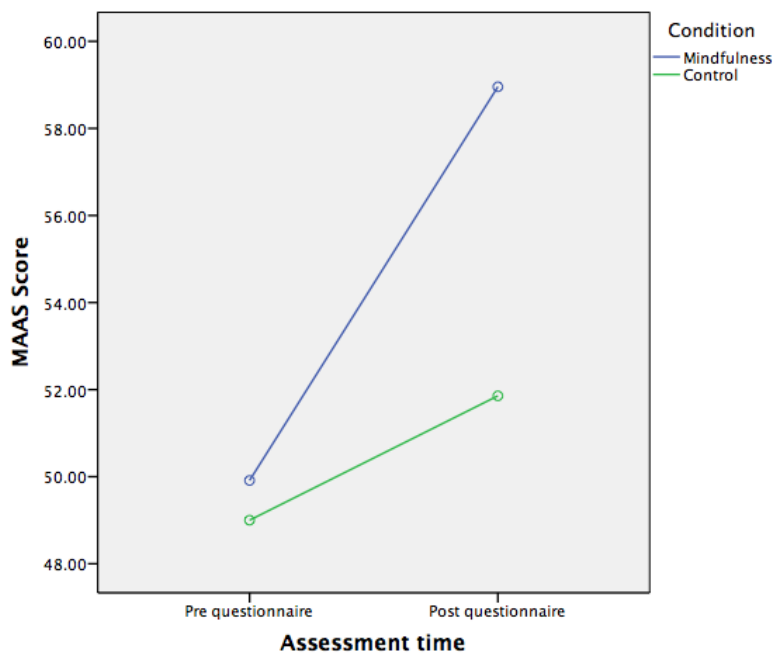
To investigate whether TM significantly increased from pre-questionnaire to post-questionnaire, MAAS scores were taken for both conditions pre-questionnaire and post-questionnaire. The means and standard deviations for both conditions pre-questionnaire and post-questionnaire can be located in table 4.

Table 4

*Mean Values and Standard Deviations for MAAS Scores Pre and Post Questionnaire for Mindfulness Condition, Control Condition and Total Sample*

| Assessment time | Participant group           |           |                         |           |                              |           |
|-----------------|-----------------------------|-----------|-------------------------|-----------|------------------------------|-----------|
|                 | Mindfulness<br>( $n = 23$ ) |           | Control<br>( $n = 21$ ) |           | Total Sample<br>( $N = 44$ ) |           |
|                 | <i>M</i>                    | <i>SD</i> | <i>M</i>                | <i>SD</i> | <i>M</i>                     | <i>SD</i> |
| Pre MAAS        | 49.91                       | 13.90     | 49.00                   | 12.78     | 49.48                        | 13.23     |
| Post MAAS       | 58.96                       | 16.48     | 51.86                   | 11.64     | 55.57                        | 14.66     |
| Overall         | 54.44                       | --        | 50.43                   | --        | --                           | --        |

A 2 X 2 mixed factorial ANOVA was conducted, the within-subjects independent variable was assessment time (pre-questionnaire and post-questionnaire) and the between-subjects independent variable was condition (mindfulness or control) with the dependent variable being the MAAS score. A significant main effect for assessment time was observed,  $F(1, 42) = 4.00$ ,  $p = .052$ ,  $\eta_p^2 = .087$  but not for the condition  $F(1, 42) = 1.84$ ,  $p = .182$ ,  $\eta_p^2 = .042$  nor for the interaction  $F(1, 42) = 1.08$ ,  $p = .304$ ,  $\eta_p^2 = .025$ . Figure 3 demonstrates this non-significant interaction. Therefore, participants did not experience a significant increase in mindfulness from pre-questionnaire to post-questionnaire.



*Figure 3.* A means plot demonstrating the non-significant interaction between assessment time (pre-questionnaire and post-questionnaire) and condition (mindfulness or control) for the MAAS.

#### Hypothesis Four – Rumination

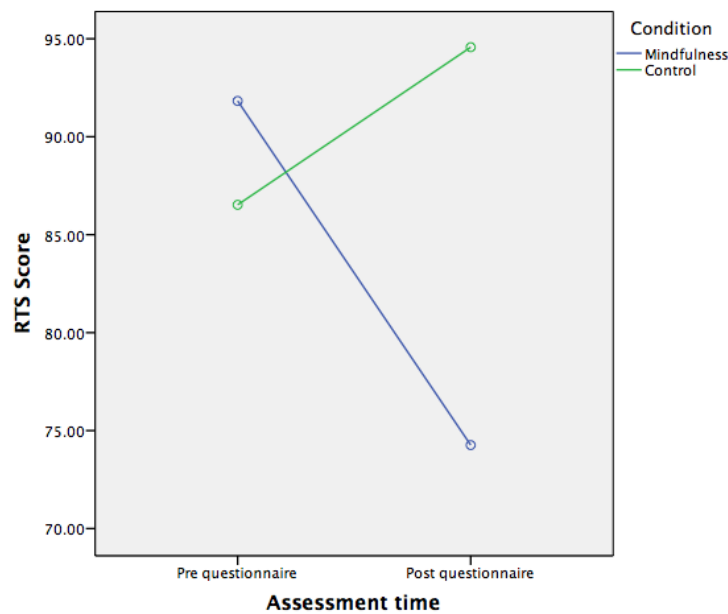
To establish whether rumination significantly decreased from pre-questionnaire to post-questionnaire, RTS scores were taken pre-questionnaire and post-questionnaire for both conditions. Table 5 contains the means and standard deviations for both conditions, pre-questionnaire and post-questionnaire.

Table 5

*Mean Values and Standard Deviations for RTS Scores Pre-Questionnaire and Post-Questionnaire for Mindfulness Condition, Control Condition and Total Sample*

| Assessment time | Participant group       |       |                     |       |                          |       |
|-----------------|-------------------------|-------|---------------------|-------|--------------------------|-------|
|                 | Mindfulness<br>(n = 23) |       | Control<br>(n = 21) |       | Total Sample<br>(N = 44) |       |
|                 | M                       | SD    | M                   | SD    | M                        | SD    |
| Pre RTS         | 91.83                   | 25.72 | 86.52               | 30.37 | 89.30                    | 27.84 |
| Post RTS        | 74.26                   | 29.90 | 94.57               | 22.96 | 83.95                    | 28.43 |
| Overall         | 83.05                   | --    | 90.55               | --    | --                       | --    |

To investigate whether there are significant differences between RTS pre-questionnaire and post-questionnaire, a 2 X 2 mixed factorial ANOVA was conducted. The within-subjects independent variable was assessment time (pre-questionnaire and post-questionnaire), the between-subjects independent variable was condition (mindfulness or control) and the dependent variable was the RTS score. A non-significant main effect for assessment time was observed,  $F(1, 42) = 0.85$ ,  $p = .361$ ,  $\eta_p^2 = .020$  as well as for the condition,  $F(1, 42) = 1.34$ ,  $p = .254$ ,  $\eta_p^2 = .031$ . However, a significant interaction was found,  $F(1, 42) = 6.18$ ,  $p = .017$ ,  $\eta_p^2 = .128$ , displayed in figure 4. To interpret this interaction further, post-hoc tests are required.



*Figure 4.* A means plot representing the significant interaction between assessment time (pre-questionnaire and post-questionnaire) and condition (mindfulness or control) for the RTS.

### Post-hoc tests

To determine the source of significance within the ANOVA, paired-sample t-tests were conducted for both conditions (mindfulness and control). The independent variable was the assessment time (pre-questionnaire and post-questionnaire) and the dependent variable was the RTS score. A non-significant decrease was found for the mindfulness condition from pre-questionnaire ( $M = 91.83$ ,  $SD = 25.72$ ) to post-questionnaire ( $M = 74.26$ ,  $SD = 29.90$ ) with a small effect size,  $t(22) = 2.11$ ,  $p = .046$ ,  $d = 0.44$ . A non-significant decrease was also found for the control pre-questionnaire ( $M = 86.52$ ,  $SD = 30.37$ ) to post-questionnaire ( $M = 94.57$ ,  $SD = 22.96$ ),  $t(20) = -1.40$ ,  $p = .177$ . Thus, neither conditions experienced a significant decrease in rumination.



## Hypothesis Five – Stress

To establish whether stress significantly decreased from pre-questionnaire to post-questionnaire, DASS stress scores were measured pre-questionnaire to post-questionnaire for both conditions. The means and standard deviations for both conditions pre-questionnaire and post-questionnaire can be found in table 6.

Table 6

*Mean Values and Standard Deviations for DASS Stress Scores Pre-Questionnaire and Post-Questionnaire for Mindfulness Condition, Control Condition and Total Sample*

| Assessment time  | Participant group               |           |                             |           |                                  |           |
|------------------|---------------------------------|-----------|-----------------------------|-----------|----------------------------------|-----------|
|                  | Mindfulness<br>( <i>n</i> = 23) |           | Control<br>( <i>n</i> = 21) |           | Total Sample<br>( <i>N</i> = 44) |           |
|                  | <i>M</i>                        | <i>SD</i> | <i>M</i>                    | <i>SD</i> | <i>M</i>                         | <i>SD</i> |
| Pre DASS Stress  | 33.56                           | 10.34     | 28.43                       | 8.60      | 31.11                            | 9.79      |
| Post DASS Stress | 25.43                           | 8.73      | 27.33                       | 10.25     | 26.34                            | 9.42      |
| Overall          | 29.5                            | --        | 27.88                       | --        | --                               | --        |

To investigate whether there are significant differences between stress pre-questionnaire to post-questionnaire for both conditions. A 2 X 2 mixed factorial ANOVA was conducted. The within-subjects independent variable was assessment time (pre-questionnaire and post-questionnaire), and the between-subjects independent variable was the condition (mindfulness or control) with the dependent variable being the DASS stress score. A significant main effect for assessment time was observed,  $F(1, 42) = 5.50, p = .024, \eta_p^2 = .116$ , but non-significant effect for the condition,  $F(1, 42) = 0.60, p = .444, \eta_p^2 = .014$  and interaction,  $F(1, 42) = 3.20, p = .081, \eta_p^2 = .071$ , illustrated in figure 5. Therefore, stress did not significantly reduce from pre-questionnaire to post-questionnaire in the mindfulness condition.

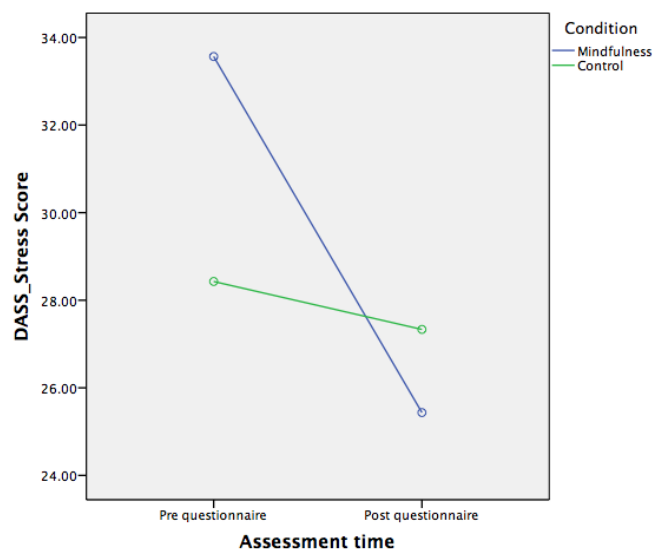


Figure 5. A means plot representing the interaction between assessment time (pre-questionnaire and post-questionnaire) and condition (mindfulness or control) for the DASS Stress.

### Hypothesis Six – Mediation

To examine whether rumination mediates the relationship between mindfulness and stress, regression analyses were conducted with post-questionnaire scores for the sample overall in order to satisfy the four stages of mediation established by Baron and Kenny (1986). The predictor variable was post-questionnaire MAAS scores. The mediator variable was post-questionnaire RTS scores and the criterion variable was post-questionnaire DASS stress score. Following Baron and Kenny (1986) guidelines, there was no need for hierarchical, stepwise regression or any additional computations and each individual coefficient for each equation was estimated. Table 7, displays a Pearson correlation matrix which establishes there are significant linear relationships between the criterion, mediator and predictor variables (Field, 2013), thus suitable for regression analysis.

Table 7

*Pearson Correlation Matrix Between RTS, MAAS and DASS Stress Scores Post-Questionnaire (N =44)*

|             | RTS | MAAS    | DASS Stress |
|-------------|-----|---------|-------------|
| RTS         | --  | -.580** | .589**      |
| MAAS        | --  | --      | -.433*      |
| DASS Stress | --  | --      | --          |

\*\* $p < .001$ , \* $p < .01$ , two-tailed.

Multicollinearity was checked in accordance to O’Brein (2007) who denotes a common rule of thumb that if the Variance Inflation Factor (VIF) is over 10, and the tolerance level is less than .20 (Menard,1995) this signifies a cause for concern. There was no cause for concern in this study as the tolerance was .66 and the VIF was 1.51 for the correlation between MAAS and RTS. Baron and Kenny (1986) established the following steps for mediation:

*Step one:* The initial predictor variable (MAAS score) needs to impact the criterion variable (DASS score). A standard regression analysis was conducted, see table 8, which concluded that MAAS scores significantly predicted DASS scores,  $t(42) = 3.11$ ,  $p = .003$ . This regression analysis explains 19%<sup>5</sup> of variance in stress can be predicted by mindfulness, which is statistically significant,  $F(1, 42) = 9.67$ ,  $p = .003$ . Thus, meeting step one of the four criteria.

<sup>5</sup> Note: Adjusted  $R^2$  values are included in the parentheses

Table 8

*Summary of Regression Analysis for Predicting Post-Questionnaire DASS Stress Scores from Post-Questionnaire MAAS Scores (N = 44)*

| <b>Variable</b>      | <b>B</b> | <b><math>\beta</math> (beta score)</b> | <b>t</b> | <b>Sig.(p)</b> |
|----------------------|----------|--|----------|----------------|
| Constant (intercept) | 41.80    | --                                     | --       | --             |
| MAAS                 | -.278    | -.433                                  | -3.11    | .003           |

*Note:  $R^2 = .187$  (.168)*

*Step two:* The mediator (RTS score) needs to be seen to be affected by the predictor variable (MAAS score) in a second regression analysis conducted, see table 9. This criteria has been met, as MAAS scores are a significant predictor of RTS scores,  $t(42) = -4.62$ ,  $p < .001$ . The regression analysis explains 34% of variance in rumination can be predicted by mindfulness, which is significant,  $F(1, 42) = 21.31$ ,  $p < .001$ . Therefore, as mindfulness increases, rumination decreases.

Table 9

*Summary of Regression Analysis for Predicting Post-Questionnaire RTS Scores from Post-Questionnaire MAAS scores (N = 44)*

| <b>Variable</b>      | <b>B</b> | <b><math>\beta</math> (beta score)</b> | <b>t</b> | <b>Sig.(p)</b> |
|----------------------|----------|--|----------|----------------|
| Constant (intercept) | 146.47   | --                                     | --       | --             |
| MAAS                 | -1.13    | -.580                                  | -4.62    | .000           |

*Note:  $R^2 = .337$  (.321)*

*Step three:* A regression analysis including the mediator (RTS score) and predictor (MAAS score), the mediator variable must be seen to affect the criterion variable (DASS score), see table 10. Step three was also met, as the RTS score was a significant predictor of DASS scores,  $t(41) = 3.33$ ,  $p = .002$ , so as rumination decreases, stress also decreases accordingly. The regression analysis explains 36% of variance in stress is foreseeable from rumination and mindfulness, which is significant,  $F(2, 41) = 11.52$ ,  $p < .001$ .

Table 10

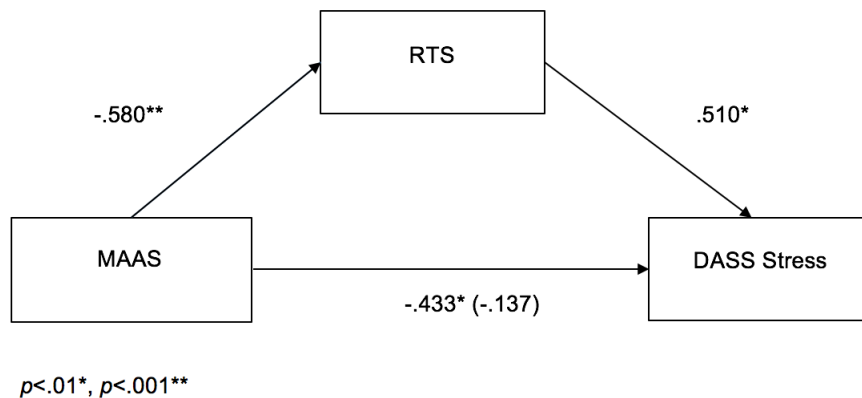
*Summary of Regression Analysis for Predicting Post-Questionnaire DASS Stress Scores from Post-Questionnaire MAAS Scores and Post-Questionnaire RTS scores (N = 44)*

| <b>Variable</b>      | <b>B</b> | <b><math>\beta</math> (beta score)</b> | <b>t</b> | <b>Sig.(p)</b> |
|----------------------|----------|--|----------|----------------|
| Constant (intercept) | 17.03    | --                                     | --       | --             |
| MAAS                 | -.088    | -.137                                  | -.891    | .378           |
| RTS                  | .169     | .510                                   | 3.33     | .002           |

*Note:  $R^2 = .360$  (.329)*

*Step four:* In the same regression analysis, the influence of the predictor variable (MAAS score) upon the criterion variable (DASS score) must be lower than in step one. For a perfect mediation this value should become non-significant when

controlling for the mediator variable (RTS score) which occurred, see table 10. This analysis found MAAS was not a significant predictor of DASS,  $t(41) = -.891, p = .378$ , so when addressing rumination an increase in mindfulness will not result in a decrease in stress. All four stages for mediation outlined by Baron and Kenny (1986) have been met. A Sobel test was conducted to investigate the size or significance of this mediation (Preacher and Hayes, 2004; Hayes, 2009). The Sobel test confirmed this indirect effect was significant ( $z = -2.31, p = .020$ )<sup>6</sup>, this mediation is demonstrated in figure 6. Therefore, rumination does significantly mediate the relationship between mindfulness and stress.



*Figure 6.* Standardised regression coefficients for RTS mediating the relationship between the relationship of MAAS and DASS, where the standardised regression coefficient between MAAS and DASS when controlling for RTS is included within the parentheses.

## Discussion

### Hypothesis One – Emotional Intelligence (EI)

EI measured using the AES significantly increased from pre-questionnaire to post-questionnaire for the mindfulness condition in comparison to the control condition, as hypothesised. These findings suggest Headspace® improves EI, supporting the preliminary literature that mindfulness practice increases EI (Snowden et al., 2015; Wang and Kong, 2013; Wright and Schutte, 2013). It is interesting to note the findings are consistent with previous research that used different EI measures, for example Wang and Kong (2013) utilised Wong Law Emotional Intelligence Scale (Wong and Law, 2002). Headspace® therefore may benefit undergraduates indirectly as increased EI is associated with improved interpersonal relationships, reduced stress (Brackett et al., 2011; Siu, 2009) and reduced narcotic consumption (Brackett et al., 2004). It would be interesting for future research to explore how long these effects last.

<sup>6</sup> An online Sobel test calculator was used for the Sobel Test (Soper, 2006: Appendix-20)

## **Hypothesis Two – Life Satisfaction (LS)**

As hypothesised the mindfulness condition experienced a significant increase in LS from pre-questionnaire to post-questionnaire in comparison to the control condition. These findings coincide with a plethora of research that also employed SWLS to measure LS, who similarly concluded that practicing mindfulness increases LS (Bajaj and Pande, 2016; Schutte and Malouff, 2011; Harnett et al., 2010). This is justified by Wang and Kong's (2013) theoretical explanation, that mindfulness practice develops effective emotion regulation which develops emotional competencies, subsequently improving one's LS. This highlights the potential benefits of undergraduates using Headspace®, as according to Whole Life Satisfaction Theory of Happiness (Feldman, 2008), LS is the fountain to happiness. It is suggested that happiness and LS improve academic performance (Gilman and Huebner, 2006; Rode et al., 2005).

## **Hypothesis Three – Trait Mindfulness (TM)**

Unexpectedly, both conditions reported a slight increase in TM as measured by MAAS, but this increase was not significant for the mindfulness condition from pre-questionnaire to post-questionnaire as hypothesised. This contrasts previous research that found a digital mindfulness method effective in significantly increasing TM, although this was not using Headspace® (Lauricella, 2014). There are several potential reasons why. Firstly, although participants were advised on the meditative environment, there was no control over this, which can curtail Headspace®'s effectiveness through impeding focus, alertness and relaxation within the mind (Puddicombe, 2016). Secondly, although an active control group was employed to permit a comparison, it's possible that the TED Talks© were influential. Participants were undergraduates most likely to be under academic pressures at the time. Thus, taking a break to listen to TED Talks© may have been relaxing and they could have experienced a mindful pause, which increases one's mindfulness by breaking from daily life's atomicity (Alidina, 2015). Additionally, Josefsson et al. (2012) found no difference in levels of mindfulness between a short-term (four-week) mindfulness intervention and relaxation. This provides some rationale as to why both groups increased in TM but neither significantly.

To the researchers' knowledge no literature has yet reported the effectiveness of Headspace® delivering TM. It is plausible that Headspace®'s duration is too short for mindfulness to be significantly established and manifested as Josefsson et al. (2012) concluded a four-week mindful intervention was too short for mindfulness to distinctly develop further than what relaxation would produce. By comparison, MBSR recommends 45 minutes daily in order to obtain psychological benefits (Segal et al., 2002). Prospective research may advantage from employing participants who are not under academic pressure to minimise this influence and extending the duration of Headspace®.

## **Hypothesis Four – Rumination**

Rumination, measured using the RTS did not significantly decrease from pre-questionnaire to post-questionnaire in the mindfulness condition as hypothesised,

contradicting previous findings that conclude mindfulness practice reduces rumination (Deyo et al., 2009; Coffey and Hartman, 2008; Kearns et al., 2016). The Response Styles Theory (Nolen-Hoeksema, 1991) suggests rumination is the fixation and repetitive thinking about distress, it is possible that as participants' mindfulness had not significantly improved they were unable to attend mindfully towards these negative emotions, so failed to desensitize and reduce the repetitiveness of the rumination (Keng et al., 2011). Rumination did, however, decrease slightly in the mindfulness condition, suggesting that Headspace® was again too short to induce such significant effects. Further, embedded within MBSR courses is yoga which Carmody et al. (2009) found more significant to reduce negative affect than other techniques in the program. Future research could combine yoga with Headspace® to explore if this may enhance mindfulness in order to reduce rumination.

### **Hypothesis Five – Stress**

Stress, measured using the stress subscale of DASS did not significantly decrease from pre-questionnaire to post-questionnaire in the mindfulness condition as hypothesised. Unexpectedly, as Gallego et al. (2014) found mindfulness practice reduced stress, although no measurements for participants' mindfulness were taken. Thus, it's unknown whether participants experienced reduced stress due to increased mindfulness or an extraneous factor. Mindfulness is suggested to develop coping resources (Davidson et al., 2003; Weinstein et al., 2009), although as mindfulness did not significantly improve, it can be postulated that these coping resources were insufficiently developed, thus stress will remain a product of environmental demands and inadequate coping resources, as the Transactional Theory (Lazarus and Folkman, 1984) indicates.

In addition, many participants were undergoing multiple-choice exams at the time which Myint et al. (2011) found mindfulness was ineffective upon undergraduates with exam-pressure, this is pertinent for future research, as the study would benefit from avoiding participants under exam-pressure.

### **Hypothesis Six – Mediation**

As hypothesised, rumination significantly mediated the relationship between mindfulness and stress regardless of the intervention. The preliminary stages for mediation corresponded with previous research, such as mindfulness significantly predicted stress (Neale-Lorello and Haaga., 2015), and mindfulness significantly predicted reduced rumination (Keune et al., 2011). Additionally, as rumination reduced so too did stress, similar to findings from Stroud et al. (2015). This offers insight into the mechanisms of mindfulness and how it's able to reduce stress via manipulating rumination. Future research can subsequently be more direct and effective when exploring the relationship between mindfulness and stress.

### **Strengths and Limitations**

A field design was employed so attained high ecological validity thus more generalisable to the student population. As by nature of a field design the lack of

control can be problematic, although an attempt to mitigate this was made by integrating manipulation checks.

In addition to the limitations already noted within the hypotheses, there were several overarching limitations to the study. Firstly, self-reporting scales were adopted for their high reliability and validity. Nevertheless, they are subject to bias and social desirability (Bajaj and Pande, 2016), besides it being difficult to assess their accuracy (Brown and Ryan, 2003). Future research could lessen this by additionally collecting physiological information to support participants' responses and provide a deeper understanding of mindfulness. Furthermore, there are several different mindfulness scales that were developed independently. These scales symbolise different theoretical perspectives of mindfulness, therefore individually they fail to acquire the whole complexity of mindfulness (Kadziolka et al., 2015). Future research could moderate this by utilising multiple mindfulness scales in a bid to capture the complexity of mindfulness.

## **Implications**

This original study provides valuable insight into the effectiveness of Headspace®. The study demonstrated Headspace® is successful in improving LS and EI, which as mentioned offers several benefits for undergraduates. Headspace® was not found effective in increasing TM or in reducing stress and rumination. It may be suggested that Headspace®'s ten minutes a day for ten days is too brief to develop mindfulness skills as alluded previously, though all factors did increase marginally signifying Headspace® was having a slight effect. Further research addressing the limitations mentioned is advised before any inferences are made. The study also offers insight into the pathway of how mindfulness reduces stress through manipulating rumination.

## **Conclusion**

The current study demonstrated Headspace® improves LS and EI and that rumination mediates the relationship between mindfulness and stress regardless of the intervention. Conversely, Headspace® did not significantly improve undergraduates' TM or reduce their rumination or stress. Previous research has only examined Headspace® on its accessibility and aesthetics (Mohr et al., 2013; Laurie and Blandford, 2016) and so to the researchers' knowledge the effectiveness of Headspace® delivering mindfulness in comparison to an active control group has not been conducted before. Therefore, whilst this research unexpectedly found Headspace® not to improve mindfulness the findings are valuable, indicating that ten minutes a day for ten days is too brief. The mediation also infers that mindfulness reduces stress via manipulating rumination, this may have valuable applications for universities that are currently aiming to reduce student stress via mindfulness courses (Swain, 2016).

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