

A comparison of varied and generalised mindfulness interventions on cold-induced pain in  
healthy adults

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A comparison of varied and generalised mindfulness interventions on cold-induced pain in healthy adults

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# Declaration

This work is original and has not been submitted in relation to any other degree or qualification.

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

**With sincere thanks to my supervisor, Nick Hulbert-Williams, for his continued support and guidance with this piece of research.**

## Supervision Log

<u>Date</u>	<u>Topics Discussed/To Do</u>
27/01/2017 Nick	Introduction - Initial meeting about project with general discussion/queries. To do - Begin researching Mindfulness in preparation for ethics application/background into study.
28/02/2017 Evelyn, Lee, Sam, & Nick	Project meeting – General discussion introducing project To do - Sam to send out draft umbrella ethics application. Work on ethics application/lit review in meantime.
24/03/2017 (Rescheduled 31/03/2017)	Amendments to draft Ethics application (Lit review; adding Evelyn's information; adjustments to advertisements and background research). To do - Suzanne to complete ethics application. Email Nick draft to review.
26/04/2017 Evelyn, Sam	Lab training - Cold Pressor procedure To do - Meet with Nick to address issues that arose (e.g. need to get colouring books/recordings).
05/05/2017 Sam, Evelyn & Nick	Trial run of experiment with Sam as participant (Suzanne from 1-2; Evelyn from 2-3) To do - Make participant packs and email to Nick to review upon completion.
18/05/2017 Evelyn	Made participant packs and emailed to Nick to review.
26/05/2017 Nick	Supervision - Participant packs reviewed and shown how to create data record in SPSS. To do – Make a list of things still needed for experiment (e.g. recordings and colouring books). Nick and Lee to make recordings; Same to make amendment to ethics' application to include age/gender; Evelyn and Suzanne to meet to work on SPSS data collection sheet.
29/05/2017 Evelyn	Created SPSS data collection sheet and emailed to Nick to review.
09/06/2017 Nick, Evelyn & Sam	Project meeting – Reviewed SPSS data collection sheet as there were queries regarding scales. Organised a time for a second run through and agreed lab times for study. To do – Remove extra labels from SPSS; print off participant packs ready for experiments; post study on RPS.
09/06/2017 Evelyn	Removed extra labels from SPSS; changed demographic questions. To do – Monitor RPS and message Evelyn if any timeslots are booked.
14/06/2017 Evelyn	Practise run of study and confirmed all lab times/schedule. To do – Agreed to message each other as participants are booked.

<u>Date</u>	<u>Topics Discussed/To Do</u>
16/06/2017 Nick and Evelyn	Group supervision – Discussed study and issues that arose so far (i.e. participants wearing jewellery or using wrong stimuli). To do – Continue with data collection.
30/06/2017 Nick & Evelyn	Group supervision - Checked in, discussed study and issues. To do – Continue with data collection.
13/07/2017 Evelyn	Made amendments to SPSS spreadsheet. To do – Email final copies to Nick and Evelyn
14/07/2017 Nick & Evelyn	Group supervision - Discussed study, reviewed SPSS spreadsheet and made additional amendments. Scheduled project meeting. To do - Reformat time (change to scale; record time in seconds and enter date as yyyy/mm/dd); change participant numbers (both packets and in SPSS). Begin to enter data. Email changes/SPSS spreadsheet to Evelyn
26/07/2017 Evelyn, Nick, Lee, Sam	Project meeting - Discussed how experiment went/procedures and any issue that arose during data collection (such as adherence measure being left out and ceiling used as 10m as opposed to 5m). To do – Finish data entry (use 999 for missing values, change time to scales, etc., see notes)
28/07/2017 Nick	Supervision – Covered SPSS issues such as imputing contingency data (MEM – how long have you done...); ethnicity query; adherence measure; Cronbach's alpha (discussed scoring subscales and reverse-keyed questions). Resolved issues regarding calculating totals. To do – Read chapters 4-5 of Discovering Stats book; run normality checks; calculate Cronbach's alpha and sum totals for measures.
04/08/2017 Nick	Supervision - Went over Q-plots, histograms and normality checks; Discussed how to explore gender differences. To do – Correlation matrix for age/t-test for gender; continue to work on discussion section.
09/08/2017 Nick	Supervision - Reviewed Cronbach's alphas as some were low as well as went over normality checks/correlation output (should have been t-test for gender). Discussed difficulties writing hypotheses. To do – Run ANOVA for time and condition; research multiple exemplar training; rewrite hypotheses; run gender t-test, not correlation
25/08/2017 Nick and Kevin	Supervision - Went over ANOVA results. Discussed what to do with self-reported data and possibilities for analysing it. To do – Run additional ANOVAs and ANCOVAs (control for believability and experience). Draft for 01/09.
30/08/2017 Claudine	Stats surgery to review ANOVAs and ANCOVA results
13/09/2017 Nick	Supervision – Draft feedback. To do – Continue to work on dissertation and email with any queries as last supervision. Participant packets with all data to be given to Nick upon completion of project.

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## **Abstract**

Mindfulness is becoming increasingly popular, not only in mainstream culture, but in a therapeutic context as well. Current research has shown that mindfulness-based interventions (MBIs) can be used to manage pain as well as psychological distress. This raises fundamental questions about how interventions should be standardised and delivered. The aim of this study was to trial two MBIs, a 'varied' approach against a 'generalised' approach, and compare their efficacy. Twenty-two participants completed a battery of self-report questionnaires to establish baseline levels of mindfulness before completing a cold-pressor task designed to measure their pain tolerance. After completing either of the 15 minute mindfulness training, participants' mindfulness levels and pain tolerances were reassessed. It was thought that after receiving one of these mindfulness-based interventions, participants would experience an increase in pain tolerance, as measured by a cold-pressor. It was also theorised that mindfulness training would have a positive effect on participants' self-reported mindfulness. Contrary to expectations, the results did not reveal any significant interaction between either mindfulness interventions on pain tolerance nor self-reported mindfulness. Although the hypotheses were not supported, existing research recognises the complexities in defining and generalising mindfulness. Further work is needed to explore the underlying mechanisms of mindfulness and to establish the viability of providing therapist-free mindfulness training as method of pain-reduction.

## Introduction

### What is mindfulness?

Originating from Buddhist philosophy, mindfulness can be seen as a combination of mental processes in which the practitioner focuses attention and gains insight of their personal self (Carmody, Baer, Lykins & Olendzki, 2009). Others, such as Brown and Ryan (2003) described mindfulness as a conscious attention to present-moment experience. Shapiro, Carlson, Astin and Freedman (2006) noted that whilst it is often equated with meditation, it encompasses much more and described it as state of consciousness.

As demonstrated, the term mindfulness embodies a multitude of concepts, each of which are open to interpretation (Brown & Ryan, 2004; Chiesa, Anselmi & Serretti, 2014). Reaching a consensus on how best to accurately transfer the original Buddhist traditions into a modern Western psychological paradigm has proved problematic at best (Chiesa, 2013). Some view it as a state of consciousness or a series of mental processes, whilst others a type of meditation (Vago & Silbersweig, 2012). Despite difficulties in defining mindfulness, there are key characteristics which have remain fairly universal. Therefore, the aim of this literature review is to establish the main constructs of mindfulness and its underlying mechanisms, before exploring recent research on the therapeutic applications of mindfulness.

Firstly, mindfulness features an attention and awareness to present moment experiences (Chambers, Lo, Allen, 2007; Creswell, 2017). Sometimes referred to as focused attention meditation (FAM), the practitioner is taught to isolate their attention, usually on breathing or on a singular object (Tops et al., 2014; Lippelt et al., 2014). If attention fades, the practitioner is taught first to acknowledge and then disengage with the distraction, before returning to the focus of their meditation (Zeidan & Vago, 2016). The focus should remain on present-moment experiences therefore, disturbances which continue to interrupt and break concentration (e.g. an alarm going off in the distance) then that distraction could become the object of mindfulness (Thera, 1962). This serves to quiet the mind, but also cultivate self-regulation (Thera, 1962).

Although FA often incorporates breathing exercises or becoming attuned to bodily sensations (Zeidan & Vago, 2016), it is important to note that the objectives of mindfulness extend beyond relaxation (Dimidjian & Linehan, 2003) or stress relief (Lippelt, Hommel, & Colzato, 2014). According to Thera (1962), the purpose of focusing on the breath rests solely in noticing and sustaining focus; that is, it is not to establish a set rhythm, which beginners often try to do. In Buddhist traditions, breath was chosen as a focus as it lies on the cusp of voluntary and involuntary functions and contributed to enhance understanding of the body as a life force (Thera, 1962).

It is also important to distinguish between attention and awareness. Brown and Ryan (2004) explained attention as the capacity to maintain concentration and focus. Awareness, in contrast, is achieved by bringing insight – that is, monitor senses, thoughts and feelings – to that focus (Bishop et al., 2004; Brown & Ryan, 2004). Many view the skills of focused attention as a prerequisite for other forms of meditation and once they have sufficiently developed this skill and can sustain attention, they advance to more complex meditative techniques (Lippelt et al., 2014).

A second characteristic of mindfulness is that, mindful observations should be met without interpretation or judgement (Chambers, Lo, Allen, 2007). Being able to monitor receptions in this way is often seen as the segue from FA into open monitoring, or OM (Lutz, Slagter, Dunne & Davidson, 2008). Sometimes this is called *Bare Attention*, as perceptions are stripped bare of any labels or subjective judgements and met with an openness (Thera, 1962). OM also a key component in the construct of vipassana (Zeidan & Vago, 2016), as it is thoughts have undergone an ‘incorruptible analysis’ and are therefore free from falsifications (Thera, 1962).

A third, ubiquitous facet of mindfulness is acceptance, which according to Bishop et al. (2004), is a process of ‘allowing’ thoughts in, even if those thoughts and feelings are unpleasant, and remaining open and curious about them. Also referred to as receptiveness, acceptance specifically addresses a conscious willingness to meet and experience stimuli as opposed to avoiding it (Brown, Ryan & Creswell, 2007). Avoiding it, explained Brown & Ryan

(2004), could be considered actively becoming unaware and therefore, *mindless*. Bishop et al. (2004) further assert that it would be impossible to truly give something full attention whilst simultaneously resisting it (Bishop et al., 2004).

Lastly, there is *dukkha*, which can be seen as the crux of Buddhist doctrine (Thera, 1962). Crudely translated to 'suffering', Vago and Silbersweig cited *dukkha* as the link between traditional and modern models of mindfulness. This translation is insufficient however, as *dukkha* is not just enduring unpleasant feelings or painful experiences – they are not the cause of suffering (Teasdale & Chaskalson, 2011). Instead, the root of suffering is how we relate and respond to them, often by deeming them unsatisfactory or unwanted (Teasdale & Chaskalson, 2011). In the Buddhist text of Satipatthāna Sutta, mindfulness is described as a route towards the 'cessation of suffering' as it is thought that when one can overcome biased representations of self and world, they will be free from suffering (Analayo, 2003).

### **Clinical applications of mindfulness**

If one of the main objectives of mindfulness meditation is to be liberated from suffering and psychological distress (Bishop et al., 2004; Thera, 1962), then it is no surprise that mindfulness approaches have been integrated into modern medicine in effort to treat both mental and physical health (Analayo, 2003; Chiesa & Malinowski, 2011). In 1979, Kabat-Zinn (Chiesa & Malinowski, 2011) was one of the first to define mindfulness secularly, and for clinical applications. Using concepts derived from Theravada Buddhism as a base for his model, he described mindfulness as, 'paying attention in a particular way, on purpose, in the present moment, and nonjudgmentally' (Kabat-Zinn, 1994, 4) and developed an 8-week intervention programme, mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1994). In addition to yoga and gentle stretching, MBSR comprised of mindful yoga, gentle stretching and a meditative technique called body scanning, which is systematically moving attention to all the regions throughout the body (Chiesa & Malinowski, 2011). MBSR was the first of such programmes to provide empirical evidence supporting the effectiveness of mindfulness on

chronic pain and it paved the way for numerous other mindfulness-based interventions (MBIs) (Creswell, 2017).

Two decades later, Hayes, Strosahl & Wilson (1999) integrated mindfulness skills into their behavioural therapy model, acceptance and commitment therapy (ACT). According to Hayes (2004), ACT is built upon Relational Frame Theory (RFT), a theory in which language and cognition are purely contextual (Hayes, 2004). In ACT, clients are taught to reconceptualise these linguistic contexts as being referential; that is, language only has meaning because it is linked to a context (Hayes, 2004). Another method ACT utilises is looking at thoughts and feelings from a distance, as an observing self (Chiesa & Malinowski, 2011). This distanced or 'decentred' approach helps facilitate emotional flexibility and reduce emotional reactivity, both of which are key constructs in mindfulness (Hayes and Feldman, 2004). The discouragement of experiential avoidance and acceptance of unwanted thoughts and feelings in a non-judgmental way is yet another core concept of both ACT and mindfulness (Hayes and Feldman, 2004). Despite using many strategies attributed to mindfulness, it is one of the few MBIs not explicitly linked with a specific influence (Chiesa & Malinowski, 2011).

A third approach, dialectical behaviour therapy (DBT) was developed to help reduce suicidal behaviour in patients with borderline personality disorder (Linehan, Armstrong, Saurez, Allmon & Heard, 1991). This framework has also been adapted for the treatment of binge eating disorders (Bishop et al., 2004) and addiction (Breslin, Zack & McMMain, 2002). In a study conducted by Telch, Agras and Linehan (2001), significant improvements with 89% of the participants abstaining from binge eating by the end of the DBT.

One of the main benefits associated with mindfulness and with MBIs, is that has been shown to reduce rumination and habitual reactivity (Shapiro et al., 2006; Wilson & Sandoz, 2008). In their meta-analysis on the effectiveness of MBIs on varying psychiatric and medical disorders, Hofmann, Sawyer, Witt and Oh (2010) reported mindfulness to improve anxiety and mood symptoms. However, in reference to psychiatric applications of mindfulness, Lindsay and Creswell (2017) cautioned that in the early stages of learning to meditate, practitioners may experience emotional agitation and a heightened awareness of intrusive thoughts, until

their acceptance skills are developed. Hayes and Feldman (2004) theorised that this is linked to experiential avoidance and an over engagement with thoughts due to a lack of emotional regulation. Perhaps this could explain evidence from Wells (1990) and later, Wells and Cartwright-Hatton (2004), who found that mindfulness exacerbated some psychological dysfunctions for those suffering from anxiety, psychosis and post-traumatic stress. Their findings raised important implications for the treatment of those with mental health difficulties and subsequently led to a new model of MBI which utilised external stimuli as the foci for FA (Shapiro et al., 2006; Wells & Cartwright-Hatton, 2004).

In addition to alleviating psychological distress, a wealth of empirical evidence has shown mindfulness strategies to be effective at managing pain (Chiesa & Serretti, 2011; McCracken & Vowles, 2014; Reiner, Tibi, Lipsitz, 2012). More recently, Burnett, Phillips and Tashani (2017) found evidence which demonstrated the analgesic effect mindfulness had on experimentally induced pain. Zeidan and colleagues (2016) conducted an experiment in which participants were randomly assigned to either a mindfulness condition, a sham mindfulness condition, placebo or control groups and found that mindfulness reduced pain intensity. What made this study particularly interesting was that it also used functional neuroimaging; evidence was found that those in the mindfulness condition showed greater activation in regions connected with modulation of pain (Zeidan et al., 2016) whilst other groups neural activity was non-significantly correlated. Not only did this imply that mindfulness can produce analgesic effects, it also suggested that mindfulness is mechanistically unique on a biological level (Zeidan et al., 2016).

Despite these promising results, MBIs are not without criticism. Some, especially those with solid understanding of Buddhist teaching, have raised concerns that contemporary constructs of mindfulness clash with classical theories (Rapgay & Bystrisky, 2009; Carmody, et al., 2009). Crane et al. (2013) attributed this 'dilution in integrity' to the rapid expansion and increased popularity of mindfulness. Others have questioned whether or not mindfulness can be measured empirically at all given it is prescientific, abstract and philosophical in nature (Rapgay & Bystrisky, 2009).

## **Mechanisms of mindfulness**

Based on the aforementioned empirical evidence, mindfulness appears to have a positive impact on pain reduction and general psychological wellbeing. However, a widely cited criticism of these interventions is that there is very little understanding of how mindfulness works and what processes occur that make it effective (Carmody et al., 2009; Rappay & Bystrisky; Chiesa & Malinowski, 2011). Hanley et al. (2016) noted that research into the effects of mindfulness often fail to clarify what type of mindfulness techniques were used, which adds to the confusion.

In an attempt to rectify this issue and operationalise mindfulness, Bishop et al. (2004) redefined mindfulness as consisting of two components: (1) a self-regulating focus towards present-moment experiences, and (2) an attitude of curiosity, openness and acceptance (Chiesa & Malinowski, 2011). Hayes and Shenk (2004) were critical of this interpretation as they felt it relied too heavily on a cognitive perspective, as opposed to a behavioural one. In addition, Bishop et al. (2004)'s explanation of fundamental mindfulness processes relied heavily on meditation, whereas Hayes and Shenk (2004) argued that there are numerous other ways to focus attention on present-moment experiences.

Other writers have attempted to operationalise mindfulness as a collection of behaviours (Baer et al., 2006; Hanley et al., 2016). This type of model is somewhat advantageous as it breaks down elements of consciousness which are difficult to quantify (Hanley et al., 2016). For example, Shapiro et al. (2006) developed a mindfulness model which attempted to classify three internal behaviours, or *axioms*: intention, attention and attitude (IAA). This was further classified into four subcomponents central to mindfulness, 'self-regulation; values clarification; cognitive, emotional, and behavioural flexibility; and exposure' (Shapiro et al., 2006, 377). Much like other conceptualisations, attention refers to focusing on present-moment whilst attitude is concerned with attending to thoughts with compassion and patience (Carmody et al., 2009) Intention initially requires the practitioner to reflect on their motivations and requires a degree of self-regulation (Harrison et al., 2017). What most would use as rough definition for mindfulness (that is, the ability to disidentify from one's thoughts



and experience the present moment with objectivity), Shapiro and colleagues referred to as '*reperceiving*' (Shapiro et al., 2006, 377). This described the cognitive shift in thinking and, eventually this may shift to an outwards and be manifested as a compassion for others (Shapiro et al., 2006). Whilst the IAA model presented by Shapiro and colleagues can be successfully applied to managing feelings, critics argue that it does little to explain how to utilise mindfulness, nor is it more precise than any other, already existing, construct of mindfulness (Harrison et al., 2017). It also fails to relate to a theoretical framework and does not apply to modifications in behaviour (McCracken, & Vowles, 2014).

### **Rationale for current study**

The majority of the literature outlined above supports the efficacy of mindfulness training on pain management. However, there are few studies which compare techniques of how mindfulness is taught. In their 2013 study aimed at assessing the integrity of MBIs, Crane et al. (2013), recognised the lack of empirical evidence to support that one teaching method was preferential to another.

Therefore, the primary aims of this study are to investigate the analgesic effects of mindfulness on cold-induced pain tolerance; as well as directly compare two specific mindfulness training interventions. It is thought that if mindfulness can be operationalised, this would lead to improved treatment programmes and subsequently, better patient outcomes.

Whilst the two interventions developed for this study featured constructs central to mindfulness, such as decentering and openness, they varied in how these techniques were taught. The first intervention, a 'varied' approach, was based on multiple exemplar training and therefore consisted of an assortment of different exercises (mindful eating and focusing attention on sounds of nature). The second intervention, a 'generalised' approach, consisted of variations of the same exercise, a body scan.

In sum, this study aimed to investigate the impact mindfulness training would have on participants' pain tolerances and overall mindfulness. Firstly, it was thought that participants' pain tolerance scores would improve after receiving mindfulness training ( $H_1$ ). It was also

theorised that there would be a difference in participants' scores, based on which training intervention they received (H<sub>2</sub>). Lastly, it was thought that participants' self-reported mindfulness scores would increase following mindfulness training (H<sub>3</sub>).

## **Methodology**

### **Design of Study**

A lab-based study was chosen as allowed researchers to standardise and objectively compare pain tolerances, which were measured using a cold-pressor. This would help establish if pain tolerance could be influenced by type of mindfulness training, either varied or generalised, and allow for the control of any extraneous variables. All participants were initially assessed to establish baseline pain tolerance and mindfulness scores before completing one of the assigned mindfulness training conditions. Then the pain tolerance test was repeated, as were mindfulness measures. The design itself was interactional, and looked at within-subjects' differences in pain tolerance and mindfulness, as well as between-subject differences in training conditions. Due to the intrinsic nature of mindfulness, it is not something which can be assessed through observation (Baer, 2011); therefore, this study relied on several self-report questionnaires to measure participants' mindfulness before and after training.

To test whether or not mindfulness training would have a positive effect on pain tolerance (H<sub>1</sub>), a 2x2 mixed-method ANOVA was used. The independent variable is the type of mindfulness intervention the participants received, and the dependent variables are pain tolerance, as measure by the seconds participants were able to immerse their hand in the cold-pressor. This was also used to test H<sub>2</sub>, by analysing whether or not one mindfulness training condition (varied or generalised) could improve participants' pain tolerance more than the other. Additional mixed-design ANOVAs were conducted to investigate H<sub>3</sub>, and explore any changes in mindfulness experiences based on training conditions.

This study, including recruitment, all experimental procedures, and data collection, took place in accordance with the British Psychological Society's (BPS) ethical code and

received ethical approval from the University of Chester's Ethics' Committee. Likewise, all data was anonymised and stored in compliance with the Data Protection Act.

### **Experimental Conditions**

Two types of mindfulness interventions were developed, a 'varied' approach and a 'generalised' approach. The varied approach was based on multiple exemplar training and therefore consisted of a variety of 3 different exercises (mindful eating of a raisin and observing sounds of nature). The second intervention, the generalised approach, consisted of variations of the same theme, body scans. Both interventions featured constructs central to mindfulness, such as decentring and openness.

Both interventions consisted of three separate audio tasks, which lasted approximately 20 minutes in total, and were listened to via headphones. The first recording consisted of a basic introduction to mindfulness and was listened to by both groups. Those in the 'varied training' condition had two additional audio tasks which included the mindful eating of a raisin and listening to sounds of nature. The second and third audio tasks for the generalised condition consisted of variations of body scans.

The scripts for each intervention were also based on work carried out by Lucaille et al. (2014). In their study evaluating the effectiveness of mindfulness on reducing food cravings, Lucaille and colleagues (2014) directly compared 3 specific mindfulness skills (awareness, acceptance, and disidentification) taught in various combinations. They found that disidentification, or separating oneself from their unpleasant craving, to be the most effective skill. The scripts produced for the current study included this strategy in hopes that participants would be able to learn to accept their cold-pressor induced discomfort and distance themselves from the pain they were experiencing. For example, cues such as, 'when dealing with difficult situations, it can be helpful to take a step back from your thoughts', were aimed at teaching participants to see themselves as observers. Full transcripts of each of the training packages can be found in Appendix A.

## Participants

A convenience sample of 22 individuals were recruited via social media and word of mouth. Those whom were psychology students at the university were given 4 SONAS credits as compensation for taking part in the study. Due to health and safety concerns, participants with a history of heart conditions, fainting, seizures, frostbite; those with open sores or cuts on the hand to be immersed; those with Raynaud's phenomenon or severe anxiety were excluded from the study.

Of the participants, 15 were female ( $M = 29.13$  years,  $SD = 9.58$ ), 4 were male ( $M = 28.25$  years,  $SD = 9.74$ ) and 3 chose not to disclose their gender ( $M = 34.33$  years,  $SD = 4.51$ ). A further three students had been excluded early in the recruitment process (prior to being invited to the lab) after they declared medical conditions that prohibited them from taking part in the study. The first individual had a history of epilepsy, the second had a heart murmur and the third had had several major heart operations. As they did not meet the inclusion criteria, no data was collected. Participants were allocated a training condition on an alternating basis none of the participants were aware that there was more than one mindfulness training.

## Materials and Measures

All of the following questionnaires were generically labelled to reduce any potential biases their titles may have produced, before they were compiled into participant packs. The questionnaire packets also included two demographic questions to ascertain participants' age and gender.

**MEM** Prior experiences and knowledge of both mindfulness and other forms meditation was assessed using a 9-item *Mindfulness Experience Measure* (MEM) questionnaire, which was developed specifically for this study. It consisted of dichotomous questions such as, 'Do you ever mediate?' (yes/no) and contingency questions such as, 'Have you ever meditated? If so, how often?' The full form can be found in Appendix B.

**Toronto Mindfulness Scale** The Toronto Mindfulness Scale (TMS; Lau et al., 2006) is comprised of 13 statements, designed to assess two factors, 'decentring' and 'curiosity'.

Respondents are instructed to reflect on their recent experience (in this study's case, using the cold-pressor) and rate the extent to which they relate to each statement using a 5-point, Likert-type scale (0 = not at all, 4 = very much). Items loaded on the curiosity subscale are concerned with remaining open and curious to present-moment experiences (Lau et al., 2006, 1452). Decentring items such as, 'I was more concerned with being open to my experiences than controlling or changing them' (Lau et al., 2006) reflect an open attitude and objectivity towards personal experiences, without interference or control (Lau et al., 2006, 1452). The TMS has been seen by some as advantageous as it is the only scale to measure state mindfulness (Bergomi, Tschacher, & Kupper, 2012) and to focus on specifically measuring the decentred stance (Teasdale et al., 2002).

Scores for each subscale are summed and higher composite scores indicate higher levels of mindfulness. An internal reliability analysis was conducted for each subscale of the TMS. For the pre-intervention, decentring subscale, Cronbach's alpha = .87 and post-intervention, Cronbach's alpha = .75. For the curiosity subscale, Cronbach's alpha ranged from .087 to .90. For a full version of the TMS, see Appendix C.

**Acceptance & Action Questionnaire-II** The Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011). A 7-point Likert-like scale (1= never true, 7 = always true) is used to rate 7 statements which measure psychological flexibility and acceptance (Hayes et al., 2006). For example, statements such as 'worries get in the way of my success' assess whether or not the respondent is able to objectively connect with present moment experiences, and if they persevere through or avoid any unwanted experiences (Bond et al., 2011). The pre-intervention AAQ-II was found to have good reliability ( $\alpha = .81$ ) with post-intervention alphas were also found to be acceptable ( $\alpha = .73$ ). The full version of Bond et al.'s (2011) AAQ-II can be found in Appendix D.

**Mindful Attention Awareness Scale** The Mindful Attention and Awareness Scale (MAAS; Brown & Ryan, 2003) is a 15-item, self-report inventory aimed at measuring receptiveness and openness to what is occurring in the present moment. It consists of statements such as, 'I get so focused on the goal I want to achieve that I lose touch with what

I am doing right now to get there' which are ranked on a 6-point Likert-like scale (1 = almost always, 6 almost never) (Brown & Ryan, 2003). The MAAS demonstrated a high internal consistency, with alphas ranging from .86 (pre-intervention) to .92 (post-intervention). See Appendix E for full version of MAAS.

**Believability and Experience Measures** Participants were also asked how much they believed that they had engaged in a real psychological technique and how much prior experience they had with the experimental techniques that were used (e.g. using headphones for training purposes). Participants rated each question: 1 = not at all/no experience and 10 = completely/extensive experience.

**Cold-pressor apparatus** The cold-pressor is comprised of a basin filled with cold water which is circulated continually to ensure a constant temperature of 3°C and to prevent any localised warming of the water around the hand. The temperature display was masked so participants would not know temperature of the water.

Pain tolerance was measured as the length of time, in seconds, the participant was able to keep their hand in the water. A ceiling time of 10 minutes was set, although participants were only informed of if they reached this time. If a participant achieved this time, they would be asked to remove their hand immediately. They would still be invited to complete mindfulness training; however, they would not be able to complete any further cold-pressor tasks.

## **Procedure**

### **Initial screening, Questionnaires and Instructions**

The study took place in a quiet lab based at the University of Chester. All participants were required to read an information sheet which explained the procedure and inclusion criteria (See Appendix F for full information sheet). As an added safety measure, all participants were asked to verbally confirm that they did not suffer from any of the medical conditions that would prohibit them from taking part in the study. They were made aware that they had the right to withdraw from the study at any point. Participants were then given the opportunity to ask any questions and written consent was obtained (See Appendix G for

consent form). Once informed consent was given, participants were asked to ensure mobile phones were turned off or put on silent. Sitting at a desk, participants completed a brief demographic questionnaire which asked for their age and gender, followed by the MEM, the AAQ – II (Bond et al., 2011) and the MAAS (Brown & Ryan, 2003). During this time, the researcher remained in the room; however, they sat behind a privacy screen in effort to minimise distractions.

### **Cold-pressor tasks and Mindfulness Training**

Participants were then told that they would be completing a pain tolerance task that would involve immersing their non-dominant hand in cold water for as long as they could tolerate. In preparation, participants were given safety instructions (e.g., skin should not come in contact with the bottom or sides of tank), removed any jewellery and cleaned hands with an alcohol-based sanitizing gel. A pen mark was then drawn 3cm beyond the crease of their wrist to indicate where the water level should remain throughout the task. Participants were reminded that the object was to keep their hand immersed in the water for as long as possible and that if the pain became too much, they were to remove their hand from the water. Initially, both the participant and the experimenter were sat either side of the cold pressor; however, as the first two participants attempted to engage in conversation during the task, the experimenter stood behind the participant in subsequent trials.

When participants removed their hand from the water, the time was recorded by the experimenter using the stopwatch function of a mobile phone. Participants were not informed of their times until after the study was concluded. They then returned to the desk to complete the TMS and begin the mindfulness training. Training conditions were alternated between participants and none of the participants were aware that there was more than one mindfulness training. The cold-pressor task was then repeated, following the same procedure as in the first trial. The believability and experience scales were filled out.

Upon completion of the final questionnaire, participants' packets were then sealed in an envelope along with their timings for the cold-pressor tasks. At this point, any lingering questions (such as what their times were for the cold-pressor task or the temperature of the

water) were answered; however, participants were asked not to share this information with any future or potential participants as this might influence their subsequent behaviour or performance. Lastly, all participants were thanked for their time and provided with the debrief sheet (See Appendix H). This included information about the study, as well as the contact information of staff and relevant guidance the participant could follow if the experiment had caused them any distress. Those of whom were psychology students were awarded 4 SONAS credits.

### **Statistical Analysis**

Prior to analysis, all data was entered into Statistical Package for the Social Sciences (SPSS, Version 23-24 for IBM) data editor and scores from questionnaires were calculated. The level of significance for all statistical tests was set at  $p \leq .005$ . Given the smaller sample size ( $N = 21-23$ ), Shapiro-Wilks tests were used to determine that the data was statistically normal.

After normality assumptions were met, it was realised that participants' gender and age might be factor. To control for confounding variables such as these, an independent t-test (gender/baseline pain tolerance) was conducted and Pearson's correlation coefficient was calculated to determine if there was a significant relationship between participants' age, mindfulness or pain tolerances. Additionally, a one-way ANCOVA was conducted to determine if there was a significant difference between mindfulness training on time, whilst controlling for participants' prior experience with experimental procedures. This test was then repeated in a second ANCOVA in order to control for how much participants believed that what they were experiencing was a valid scientific construct.

## **Results**

### **Descriptive statistics**

The means and SD for pre- and post- training self-reported mindfulness, pain tolerances and all other measures can be found in Table 1 below. On average, participants



reported higher levels of mindfulness on their post-training AAQ-II, MAAS, and the curiosity subscale of the TMS. All but two participants performed better during their second cold-pressor trial. One participant reached the ceiling time of 10 minutes and was asked to stop. As this occurred during their second trial and they had completed all other aspects of the study, their data was included in all analyses.

**Table 1.** Descriptive Statistics for Experimental Measures

Measure	Pre-Training			Post-Training		
	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>
1. AAQ-II	17.77	6.34	22	18.10	5.36	21
3. MAAS	3.49	.81	22	3.49	1.01	22
5. TMS (Curiosity subscale)	12.81	6.69	22	17.86	5.26	21
7. TMS (Decentring subscale)	12.95	7.31	22	11.68	3.66	22
9. Believability	**	**	**	8.90	1.22	21
10. Experimental Experience	**	**	**	4.05	2.80	22
11. Time pre-training**	49.73	65.95	22	49.73	65.95	22
12. Time post-training**	80.33	123.91	22	80.33	123.91	22

Note: Means (*M*), Standard deviations (*SD*), Number of Participants (*N*)

\*Not applicable as only measured post-training

\*\*Time measured in seconds

An independent samples t-test was used to explore gender differences in baseline pain tolerances. On average, men scored higher ( $M = 114.45$ ,  $SD = 145.27$ ) than women ( $M = 34.03$ ,  $SD = 22.65$ ); however, these differences were not found to be significant,  $t(3.04) = 2.22$ ,  $p = .349$ . Levene's test indicated unequal variances ( $F = 22.66$ ,  $p < .001$ ), so degrees of freedom were adjusted from 17 to 3.04.

Next, Pearson's correlation analysis was used to explore the relationship between participants' age and their pain tolerance scores or any outcome measures of mindfulness. See Table 2 below for correlations of age, pain intensity and mindfulness measures. As indicated by the results below, age was not found to be a confounding variable.

**Table 2.** Correlation Matrix for Age, Mindfulness Measures and Time

Variables		Age	AAQ-II Pre	AAQ-II Post	MAAS Pre	MAAS Post	TMS (C) Pre	TMS (C) Post	TMS (D) Pre	TMS (D) Post	Believability	Experience	Time Pre	Time Post
Age	<i>R</i>	1	-.099	-.268	-.046	.035	-.245	-.029	-.082	.178	.251	.420	-.274	-.269
	<i>P</i>		.660	.240	.838	.877	.273	.899	.718	.427	.273	.052	.217	.225
	<i>N</i>	22	22	21	22	22	22	21	22	22	21	22	22	22
AAQ-II pre	<i>R</i>	-.009	1	.778	-.287	-.135	-.065	.139	-.206	-.182	-.457	-.171	-.003	-.040
	<i>P</i>	.660		.000	.196	.550	.774	.547	.358	.418	.037	.447	.990	.861
	<i>N</i>	22	22	21	22	22	22	21	22	22	21	22	22	22
AAQ-II post	<i>R</i>	-.268	.778**	1	-.402	-.384	-.163	.252	-.267	.080	-.427	-.358	.204	.175
	<i>p</i>	.240	.000		.071	.086	.479	.283	.243	.730	.060	.111	.374	.447
	<i>N</i>	21	21	21	21	21	21	20	21	21	20	21	21	21
MAAS pre	<i>R</i>	-.046	-.287	-.402	1	.938	.537	.150	.576	.127	.163	.434	-.131	-.178
	<i>P</i>	.838	.196	.071		.000	.010	.517	.005	.573	.480	.043	.562	.427
	<i>N</i>	22	22	21	22	22	22	21	22	22	21	22	22	22
MAAS post	<i>R</i>	.035	-.135	-.384	.938	1	.519	.098	.595	.119	.169	.550	-.171	-.231
	<i>P</i>	.877	.550	.086	.000		.013	.672	.003	.597	.464	.008	.447	.302
	<i>N</i>	22	22	21	22	22	22	21	22	22	21	22	22	22
TMS (C) pre	<i>R</i>	-.245	-.065	-.163	.537	.519	1	.652	.696	.124	.177	-.086	-.065	-.094
	<i>p</i>	.273	.774	.479	.010	.013		.001	.000	.583	.443	.704	.775	.677
	<i>N</i>	22	22	21	22	22	22	21	22	22	21	22	22	22
TMS (C) post	<i>R</i>	-.029	.139	.252	.150	.098	.652	1	.481	.280	.169	-.240	.024	-.020
	<i>P</i>	.899	.547	.283	.517	.672	.001		.027	.219	.463	.294	.918	.930
	<i>N</i>	21	21	20	21	21	21	21	21	21	21	21	21	21
TMS (D) pre	<i>R</i>	.082	-.206	-.267	.576	.595	.696	.481	1	.302	.346	.121	-.152	-.257
	<i>P</i>	.718	.358	.243	.005	.003	.000	.027		.171	.125	.592	.499	.248
	<i>N</i>	22	22	21	22	22	22	21	22	22	21	22	22	22
TMS (D) post	<i>R</i>	.178	-.182	.080	.127	.119	.124	.280	.302	1	.332	.039	.145	.079
	<i>P</i>	.427	.418	.730	.573	.597	.583	.219	.171		.142	.864	.521	.728
	<i>N</i>	22	22	21	22	22	22	21	22	22	21	22	22	22
Believability	<i>R</i>	.251	-.457*	-.427	.163	.169	.177		.346	.332	1	.491*	-.001	.000
	<i>P</i>	.273	.037	.060	.480	.464	.443		.125	.142		.024	.997	.999
	<i>N</i>	21	21	20	21	21	21	21	21	21	21	21	21	21

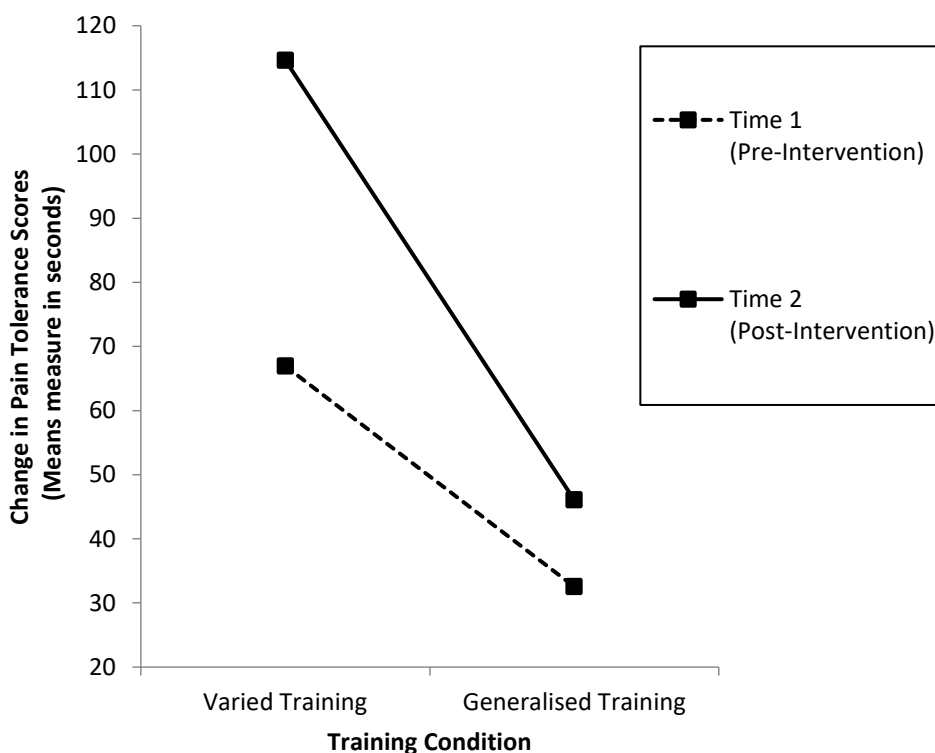
**Table 2.** Correlation Matrix for Age, Mindfulness Measures and Time

Variables		Age	AAQ-II Pre	AAQ-II Post	MAAS Pre	MAAS Post	TMS (C) Pre	TMS (C) Post	TMS (D) Pre	TMS (D) Post	Believability	Experience	Time Pre	Time Post
Experience	<i>R</i>	.420	-.171	-.358	.434	.550	-.086	-.240	.121	.039	.491	1	-.147	-.182
	<i>P</i>	.052	.447	.111	.043	.008	.704	.294	.592	.864	.024		.513	.417
	<i>N</i>	22	22	21	22	22	22	21	22	22	21	22	22	22
Time pre	<i>R</i>	-.274	-.003	.204	-.131	-.171	-.065	.024	-.152	.145	-.001	-.147	1	.963
	<i>P</i>	.217	.990	.374	.562	.447	.775	.918	.499	.521	.997	.513		.000
	<i>N</i>	22	22	21	22	22	22	21	22	22	21	22	22	22
Time post	<i>R</i>	-.269	-.040	.175	-.178	-.231	-.094	-.020	-.257	.079	.000	-.182	.963	1
	<i>P</i>	.225	.861	.447	.427	.302	.677	.930	.248	.728	.999	.417	.000	
	<i>N</i>	22	22	21	22	22	22	21	22	22	21	22	22	22

Note: \* $p < 0.05$  level, 2-tailed. \*\* $p < 0.01$ , 2-tailed.

## Interaction between pain tolerance, experimental conditions and mindfulness measures

Data was analysed by using a mixed-design ANOVA with a within-subjects factor of pain tolerance and a between-subjects factor of mindfulness conditions (varied and generalised) in order to test  $H_1$  and  $H_2$ . Figure 1 shows the mean change in pain tolerance rating (as measured by time, in seconds) for varied and generalised training groups across pre- and post-training cold-pressor trials.

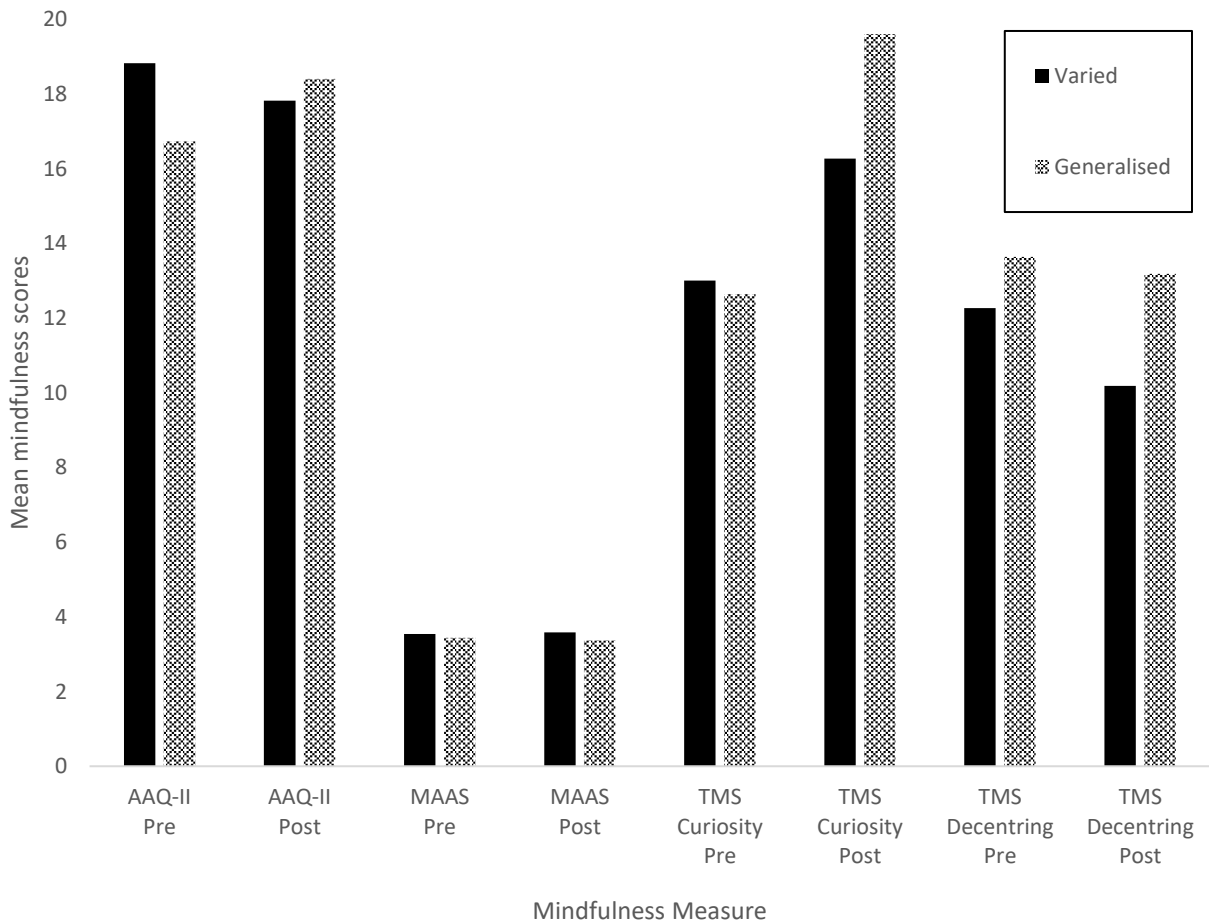


**Figure 1.** Interaction between training conditions and pre-/post-intervention pain tolerance scores.

Results showed that there was a significant main effect for time,  $F(1, 20) = 5.35$ ,  $p = .031$ ,  $\eta_p^2 = .21$ , with participants improving performance during the second cold-pressor trial. In contrast, there was not a significant effect for mindfulness training condition  $F(1, 20) = 1.70$ ,  $p = .207$ ,  $\eta_p^2 = .078$ , which indicated that participants in both conditions achieved similar times. There were also no significant interaction for time dependent on either mindfulness condition,

$F(1,20) = 1.67, p = .211 \eta_p^2 = .077$ . Therefore, although pain tolerance times increased during the second trial, the results indicated that this difference was not attributed to the mindfulness intervention. As there was not a significant interaction, no additional post hoc tests were performed.

Next, a series of 2 (before and after scores) x 2 (condition), mixed-design ANOVAs were conducted to investigate the interaction between the two mindfulness training conditions and mindfulness experienced, as measured by changes in scores on the TMS, MAAS and AAQ-II questionnaires. Figure 2 below represents the ANOVAs comparing the mean values of mindfulness scores for each measure, from baseline to post-intervention between the two conditions.



**Figure 2.** Mean pre-/post-intervention mindfulness scores across conditions.

The main effect of self-reported mindfulness on the MAAS was not significant,  $F(1, 20) = .02, p = .882, \eta_p^2 \geq .001$  which suggested that participants' mindfulness did not increase. Similarly, the main effect on the mindfulness condition was found to be not significant,  $F(1,20), .16, p = .691, \eta_p^2 = .008$  which indicated similar scores for each condition. Despite differences in MAAS scores, no interaction was found with either condition,  $F(1, 20) = .57, p = .461, \eta_p^2 = .027$ . Overall, these results suggest that the any differences in MAAS scores could not be attributed to the mindfulness condition.

Similarly, pre- and post-training scores for the curiosity subscale of the TMS also yielded significant differences in mindfulness,  $F(1, 19) = 21.87, p > .001, \eta_p^2 = .54$ . However, there was no main effect on condition,  $F(1,19), = .357, p =.557, \eta_p^2 = .89$ , and no significant interaction between TMS curiosity scores and condition,  $F(1, 19) = 2.88, p = .106, \eta_p^2 = .13$ . This suggested that the changes in TMS curiosity scores were not significantly related to the training conditions.

In contrast, a comparison of TMS decentring scores did not show a significant main effect of mindfulness,  $F(1, 20) = .68, p = .419, \eta_p^2 = .03$ . This indicated that participants' mindfulness scores before and after training were similar. There was also no significant main effect for mindfulness condition,  $F(1, 20), = 1.28, p = .271, \eta_p^2 = .06$ . Likewise, there was no significant interaction between TMS decentring scores and either mindfulness condition,  $F(1, 20) = .281, p =.602, \eta_p^2 = .01$ . There was also no significant main effect of AAQ-II mindfulness scores,  $F(1, 19) = .03, p = .864, \eta_p^2 = .002$ , nor mindfulness condition,  $F(1, 19) = .05, p = .821, \eta_p^2 = .003$ . Lastly, there was no significant interaction between either condition on AAQ-II scores,  $F(1,19) = 1.77, p = .200, \eta_p^2 = .085$ . Taken together, these results did not support  $H_3$  as there was no interaction between either mindfulness condition or any self-reported mindfulness outcome measures.

### **Covariates of believability and experience**

Results from an ANCOVA indicated there was no significant effect of mindfulness condition on time after controlling for participants' believability,  $F(1, 18) = 1.45, p =.244$ .

Furthermore, a second ANCOVA revealed no significant differences in time  $F(1, 19) = .1.71$ ,  $p = .207$ , between the two mindfulness conditions whilst adjusting for experiences. This would suggest that any differences in time could not be attributed to how much the participant believed it was a valid scientific study nor due to their experience with such experimental procedures.

## **Discussion**

The purpose of this study was to examine the effects of two types of mindfulness training on both pain tolerance and participants' mindfulness. Specifically, it was theorised that: mindfulness training would have a positive, analgesic effect which would be demonstrated by higher pain tolerance scores post-training ( $H_1$ ); there would be a difference between pain tolerance by those who received varied training or generalised mindfulness training ( $H_2$ ); and self-reported mindfulness scores would increase following mindfulness training ( $H_3$ ).

### **Brevity of training/lack of practise**

Results from the first ANOVA revealed that although participants improved pain tolerance during their second cold-pressor trial, this could not be attributed to the acquisition of mindfulness strategies. Contrary to the expectations of  $H_1$  and  $H_2$ , neither a generalised, nor a varied approach had a significant impact on participants' ability to increase their pain threshold. It remains unclear as to whether or not the main effect of pain tolerance could have been a result of practise effects or if the mindfulness training could have primed participants and altered their reaction to pain.

The first hypothesis was theorised based on the success of previous studies which demonstrated that brief mindfulness training had positive effects on tolerance to cold-induced (Burnett et al., 2017; Liu et al., 2013) and electrically-stimulated (Zeidan et al., 2010) pain. Results however, were consistent with work conducted by Kingston, Chadwick, Meron and Skinner (2007). In their 2007 study which sought to investigate the effect of mindfulness on pain tolerance and psychological well-being, they too documented increases in cold-induced

pain tolerances but could not attribute changes to mindfulness training (Kingston et al., 2007). Length of training was cited as a possible limitation (Kingston et al., 2007) and it is thought that the present study may have also been subject to these limitations.

In Zeidan et al. (2010)'s study, which found that brief mindfulness interventions were successful in increasing pain tolerance, training lasted an hour, spread across 3 days. Liu et al. (2013), whose study did employ a much briefer intervention and demonstrated successful results, included 10m of practise time following their 15m mindfulness training. Similarly, Burnett, Phillips and Tashani (2017) allowed for quiet reflection time for participants to practise their newly acquired skills.

The present study's total mindfulness training was under 20 minutes and, although the intervention included practise exercises such as holding a raisin in their mouth or breathing deeply, it did lack additional time for participants to hone their newly learnt skills. In their comparison of mindfulness and relaxation, Lancaster, Klein and Knightly (2016), reported mixed results on the efficacy of brief mindfulness training and argued that the training may have been too brief for participants to properly engage with the training which may have made it difficult to register effect. It is possible, therefore, that the present study was limited by brevity of training and lack of practise time, both of which would appear to be potentially contributing factors to the learning and application of mindfulness techniques.

Despite this study's null findings, it does highlight the importance of considering length and methodology of training, particularly if mindfulness is to be taught outside of an experimental setting. Perhaps a further study could explore what the minimum dosage requirements of mindfulness training might be. Similarly, another study could investigate the importance of rehearsal in mindfulness training. Additionally, if evidence that the mindfulness intervention elicited a greater pain threshold was found, it would be interesting to evaluate how long those effects lasted in a longitudinal study.



## Development of training

This research was also designed to evaluate and compare two very specific training approaches, in hopes of operationalising mindfulness (H<sub>2</sub>). Results from the second ANOVA found no significant interaction between the type of mindfulness intervention and participants' pain threshold and therefore, did not support claims that either a varied or generalised mindfulness training would be more effective than another. Although these results are disappointing, part of the process in determining what is effective is identifying what is not effective. Therefore, it is important to note that these null findings do not mean that mindfulness training interventions should be rejected; if anything, they highlight the need continually adjust and improve delivery techniques.

There still exists a wide body of evidence to support the efficacy of mindfulness interventions; however, so does the gap in our understanding of how mindfulness actually works (Carmody et al., 2009; Lindsay & Creswell, 2017; Shapiro et al., 2006). If modern medicine wishes to continue to employ mindfulness in a therapeutic context, then research needs to put a stronger focus on identifying the subcomponents that underpin its efficacy (Shapiro et al., 2006). This view is supported by Burns (2016) and Chiesa, Anselmi & Serretti (2014) who note that if these underlying mechanisms were better understood, interventions could be catered to better attend to patients' specific needs. Studies such as these clearly indicate that there is a need for robust assessment of specific variables of mindfulness, such as openness, attention and self-regulation in order to determine which elements are most beneficial (Burns, 2016; Carmody et al., 2009).

However, one major drawback to this approach is that there is a risk of reducing mindfulness to the acquisition of a set of theoretical skills, which some argue undermines the very paradigm of mindfulness (Crane, 2012; Dreyfus, 2011; Teasdale & Chaskalson-Kulananda, 2011; Thera, 1962). Kabat-Zinn and Santorelli (2011), even explicitly stated in their *Standards of Practice* for trainee teachers, 'mindfulness is never a matter of teaching or operationalizing techniques'. According to Teasdale & Chaskalson-Kulananda (2011), when

skills are developed superficially, learners lack the understanding of the true nature of suffering and therefore will struggle to face and overcome it. This is, in essence, what separates mindfulness from being a relaxation technique from being a framework for greater understanding (Teasdale & Chaskalson-Kulananda, 2011). Teasdale & Chaskalson-Kulananda theorise that a solid framework of the understanding of suffering is key to unlocking the full beneficial impacts of mindfulness.

In effort to preserve the integrity of mindfulness, work has been done to assess the training of mindfulness teachers and their methods (Crane et al., 2010; Crane et al., 2013). One consensus which emerged was that in order for instructors to fully exemplify the essence of mindfulness, they need to have a deep, personal understanding and experience in meditative practise themselves (Crane et al., 2013; Evans et al., 2015; Grossman, 2011; Kabat-Zinn & Santorelli, 2011). So, although it is logical to want to isolate the mechanisms critical to the efficacy of mindfulness, there may be limits as to how far this can inform the teaching and learning of mindfulness; it seems a deeply personal, first-hand understanding from the teacher is also a potential contributing factor (Dreyfus, 2011; Grossman, 2011; Kabat-Zinn, 2011). This raises an important issue for 'self-help' or therapist-free MBIs as this could impact their efficacy or banalize the meaning of mindfulness.

### **Measuring mindfulness**

It was also theorised that participants' mindfulness scores would be positively impacted by the training which they received ( $H_3$ ). Whilst it was thought that mindfulness training led to an increase in mindfulness, this was not evidenced in the current study. Possible explanations for these results is the training was ineffective and participants did not acquire any new mindfulness skills; that participants may have learned the skills but did not employed them; or lastly, that the measures used to detect any changes in mindfulness were insufficient. Each of these potential explanations will be explored below.

During the current study, a number of participants openly discussed the experiment and cited distraction as a strategy. For example, participant number 6 described how, during her first trial, she had vividly imagined a scene from the film Titanic in which the character has

their hand immersed in the icy water. She also expressed her enjoyment in learning mindfulness techniques and that had attempted to use the strategies to improve her time. As the participant also acknowledged using mindfulness strategies, this would suggest that the training was ineffective. However, in this particular case, perhaps the lack of observed increase could be attributed to an inflated baseline score. In studies conducted by Nouwen et al. (2006, in Zeidan et al., 2010) and Weiss, Dahlquist and Wohlheiter (2014), distraction was found to be an effective approach for reducing cold-induced pain. Similarly, Zeidan et al. (2010) found that whilst meditation also produced effective pain reduction, distraction techniques were found to have a palliative effect on high-intensity pain, though not on low pain. Although this is a single case, and therefore cannot be extrapolated to all participants, it does raise a potential concern regarding scores' precision but also how any changes in mindfulness scores may be interpreted.

That said, Zeidan et al. (2010) went on to highlight the overall difficulty in assessing whether or not participants employ 'true' mindfulness during experimental studies. This is further supported by Lacaille et al (2014)'s previously mentioned study on mindfulness and cravings, which reported that roughly one-quarter of their participants admitted to not utilising the skills they had been taught. This has important implications for the feasibility and accessibility of developing mindfulness interventions as, if participants struggled to engage with the training, it could inhibit any beneficial effects.

An adherence measure, designed to assess how much participants utilised their mindfulness training in the second cold-pressor task, had been developed for this study but regrettably, was left out of participants' packets by accident. This would have been useful as it would have potentially provided insight as to whether or not improved scores could be attributed towards the intervention or were the result of practise effects or other coping mechanisms. In future investigations, a qualitative approach that incorporates a discussion or written feedback into what participants were thinking or feeling during each cold-pressor trial might help develop a more complete picture of how participants manage pain. Using qualitative methods to assess mindfulness was advocated by Bergomi et al. (2012) in their

review of mindfulness assessments, as they felt such evaluations could address issues in assessing participants whom lacked experience or understanding of mindfulness.

### **Self-report questionnaires**

Establishing valid assessment criteria is vital for demonstrating empirical evidence, and this is especially pertinent if mindfulness is to continue to be incorporated into the field of medicine (Bergomi et al., 2012). One of the issues which repeatedly emerged during research is the lack of coherence in what might be subsumed under the term mindfulness, as well as what its assessment criteria should be comprised of (Chiesa et al., 2014; Crane et al., 2013). In their recent review of MBIs, Harrison et al. (2017) stated that the lack of consensus of what mindfulness entails, along with constant expansion of alleged mechanisms, hinders progress. Consequently, attempts to accurately evaluate what cannot be defined in a scientifically coherent manner, are questionable (Harrison et al., 2017).

For example, the MAAS (Brown & Ryan, 2003), has received criticism for being negatively worded, leading opponents to question whether measuring how unaware individuals are is the same as measuring mindfulness (Hanley et al., 2016). Hanley and colleagues (2016) further explained this point by adding, measuring one's sadness should not be used to inform their level of happiness as opposites do not necessarily equate. Mindfulness has also proved to be challenging to measure as it is inherently within-self (Crane et al., 2013) and Grossman (2011) theorised that a minimum amount of mindfulness may be needed, before participants can accurately identify and reflect on their mindfulness.

Despite these difficulties, Baer (2006) assessed numerous self-report mindfulness measures and found them to not only have high internal consistencies, but also that they were strongly correlated with each other and to participants' experiences of mindfulness. In a similar, more recent analysis of self-report mindfulness measures, Bergomi et al. (2013) found some measures to be moderately correlated, although some lacked any correlation at all. As such, some researchers remain sceptical of the reliability of self-report mindfulness scales. For example, Chiesa (2013) challenged studies in which the MAAS was deemed reliable as they suffered from a lack of control. He contends that without controls, changes in mindfulness

cannot conclusively linked to mindfulness practise as they could be related to extraneous variables such as the participant's expectations (Chiesa, 2013). Similarly, subjects may also perceive themselves to be more mindful following training, irrespective of any effects (Chiesa, et al., 2014).

The above highlights potential limitations to the current investigation as the study lacked a control group and may have placed an over-reliance on self-report measures. In order for a more accurate comparison between groups, a placebo condition of similar duration could be used in future research. Lastly, Crane et al. (2013) suggested that as mindfulness is not manifested externally, in an easily observable way, assessments can be made of the teaching process. Therefore, in addition to the elucidation of how mindfulness works, it would be advisable that methodological approaches, such as how it is taught, continue to be studied. Factors such as duration (length of session as well as frequency/quantity of sessions); mode of delivery (e.g. by a therapist or via recordings) and setting (via online, with a therapist or at a retreat) could be considered. This was perhaps one of the main strengths of this piece of research as previously there had been a paucity of comparisons of teaching methods.

### **Further limitations**

There is one last caveat to consider when interpreting the results. The sample was relatively small and homogeneous, as it consisted almost entirely of female psychology students. Therefore, findings may not generalise as this may have introduced a selection bias produced by an overrepresentation of specific groups. It is also possible that the lack of interaction between baseline pain tolerance and post-training tolerance could be a result of a lack of power and any effects were too small to detect. Further studies should address these issues by recruiting a larger and more gender-balanced sample.

## **Conclusion**

This study set out to investigate the effectiveness of two variations in mindfulness training in improving pain tolerance. It was an important study as a great deal of research has shown mindfulness to be beneficial to pain reduction, however little had been done to operationalise it for clinical use. Additionally, previous studies used much longer mindfulness interventions and none directly compared varied and generalised training approaches.

The present research was unable to find evidence to support the rationale that brief, therapist-free, mindfulness training is effective in improving pain tolerance, nor did it demonstrate that one method of training was preferential to another. It is thought that these findings may have been limited by too brief of an intervention or possibly on the training methods and delivery themselves. The training methods used need to undergo adjustments and further work is needed to identify the underlying mechanisms of mindfulness before being implemented in a therapeutic environment. Although the results are somewhat disappointing, they still contributed to the growing body of mindfulness literature and hope to stimulate dialogues on ways to improve the provision of therapist-free mindfulness training.

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## Appendix A – Scripts for Mindfulness Training Conditions

### **Recording 1 – Used as first recording for both varied and generalised (8:50)**

In this recording, I'm going to try to change the way you deal with experiences and sensations. This should help you get better at the cold-pressor task you just did. Please follow along and try to do each step as I suggest it. Close your eyes and take a nice, slow, relaxing breath. Now just let your breathing continue as normal. Notice how you're feeling right now. Try to be open and curious to whatever you're feeling. Notice whether there's any part of your body where there is any tension. You don't need to do anything about it, just notice it. Now pay attention to your breath again for a moment. Just notice the feeling as the breath comes in and out. You don't need to change anything, just notice. You might notice how your chest moves. You might notice the feeling of your breath in your nose or on your upper lip. Whatever you notice, just pay attention to it. Be curious about what it feels like and don't try to change it. When you're ready, I'd like you to move your attention to your hands. Because they're so important for getting things done, our brains tend to notice any feelings or sensations in our hands more than in most parts of our body. I want you to try and be curious as to how your hands feel. Be really curious. Are there any sensations you notice, no matter how small or subtle? Can you notice anything else? Don't worry about whether the feel is nice or not, just notice how it feels. Nothing is right or wrong here, just be open and curious about how your hands feel. Notice any thoughts you might have about this task. For example, you might think it's silly or strange. You might be hoping that the next instruction is about finishing the task. I'd like you to carry on a little longer if you can. If any thoughts come up, try your best to let these thoughts just be there. Try not to judge them as good or bad. Do you find your mind wandering to other things? That's okay. None of us is completely in control of our thoughts. Gently return your attention to your own hands. Learning to focus your attention this way can help you stay in control when doing difficult things. In order to feel in control of your actions, even when unhelpful thoughts come up. It can be helpful to take a step back from your thoughts and sensations. Whilst you sit here noticing

your hands, if you have a thought like, 'This is weird,' try telling yourself that you are having the thought that it is weird. If you start thinking, 'I'm bored' notice what happens when you say to yourself instead, 'I'm having the thought that I'm bored.'

It can be helpful to distance yourself from your thoughts to get a different perspective. For a moment, imagine some friends of yours are arguing fiercely. You're right in the middle of it. Now imagine you step away from the argument for a breath of fresh air. Perhaps you go outside. Looking back in through the window, you can see your friends arguing still. They're still right there in front of you but you've got a bit of distance on it. And you can see the argument from a distance. Try to see the sensations in your mind and body like that, from a distance. Notice them like a curious observer outside the window, looking in. Often when trying to focus on one thing for a long time, people feel the urge for distraction. Their minds just start to think about other things. Whilst we've been doing this exercise, have you noticed this in yourself? Have you noticed at all that your mind has started to settle down and can now pay attention to your hands? Getting some perspectives on your thoughts or on sensations like cold, hot or pain can encourage this process to happen even faster. It's a bit like bobbing on the surface of the ocean on a surfboard. As each wave comes, it pushes you around but if you're skilful, you can ride the wave without being swamped by it. Even though the wave is big and powerful, you stay in control and soon the wave is passing and things become still again. When we have a strong feeling or urge, they're usually like waves. We can ride them skilfully. The way to do this is to get some distance and remind ourselves that we're having the feeling the way I showed you earlier. Okay, we're done with this exercise. Once you're ready, remove the headphones and let the experimenter know the recording has finished.

### **Recording 2 for varied mindfulness training (7:42)**

In this next recording, I'm going to build on what we did before to try to change the way your experience sensations. I'm still trying to help you get better at the cold-pressor test you just did. Please follow along and try to do each step as I suggest it. Closing your eyes, take a slow and relaxing breath. Now, just let your breathing continue as normal. Just let it go on the way it has done all day long,

without you needing to interfere. Just pay attention to your breath for a moment. Hopefully, you're sitting comfortably but if you aren't, feel free to change your posture so that you're sitting in a comfortable but upright position. Notice how it feels to be sitting in this chair. You don't need to change anything, just notice it. Where does your body make contact with the chair? With the floor? Be curious about what it feels like and don't try to change it.

When you're ready, open your eyes and pick up the raisin in front of you. Again, this exercise is all about being really curious towards something that we normally take for granted. I want you to see if you can be curious about this every day object. Be really curious. First look at it. What does it look like? How does it feel? Roll it around in your fingers if you like. Does its texture change? If your mind starts to judge, to tell you that this is silly for instance, that's okay. Just thank your mind for that thought and turn your attention to the raisin. Try not to get wrapped up in whether it's pleasant or unpleasant, just be open and curious about how it feels. When you're ready, put the raisin in your mouth. Do your best not to chew it. And try your best not to swallow. Notice how your mind reacts.

Try your best to let any thoughts just be there. You are not in control of every thought but you can be in control of your actions. Do you have any urge to chew or swallow? What does the urge feel like? Where is the urge in your body? Perhaps it's in your mouth or maybe in your throat or chest? Bite into the raisin twice, no more. Do you still have the urge to swallow? Remember that as strange as it seems, when you get an urge, it can be useful to bring extra attention, to be really curious as to how it feels because it can help you stay in control when you're doing difficult things.

Keep observing for a few seconds if you can. And resist the temptation to swallow as you slowly start to chew the raisin. Do it as slowly as you can. In order to feel in control of your actions when dealing with difficult situations, it can be helpful to take a step back from your thoughts. As you're chewing the raisin, or even if you've given in and already swallowed, see whether your mind comes up with any thoughts. As before, if your mind says something like, 'This is weird', and on to the front of it, think instead, 'I'm having the thought that this is weird'. Notice who is having that thought.

Take a moment to catch yourself having another thought and see if you can notice that you are not a thought. This is the same as getting perspective on our thought, just as we did before.

Okay, so you've been sitting here awhile, eating a raisin very, very slowly. Has your desire to swallow change over time. Did the urge come, go, come, and go? Or perhaps it just became weaker and stronger over time. It can be really helpful to notice that some things we think of as stable and constant, like the feeling of cold, might actually ebb and flow over time. This is part of learning to surf urges, learning to stay in control, even when urges and desires threaten to overtake you. You've learned two things to help you to surf urges as we call it. First, notice that you are having a feeling or thought but that thought or feeling isn't you. Second, notice that urges and feelings usually get stronger and weaker over time. Together these techniques will help you stay in control. Okay, we're done with this exercise. Once you're ready, remove the headphones and let the experimenter know that the recording has finished.

### **Recording 2 for varied training (5:10)**

In this recording, we'll continue to build the same skills but since you've done this thing twice now, I'm going to say less. We're still trying to help you get better at the cold pressor task you just did. Please, still follow along and try to do each step as I suggest it. Take a moment to make yourself comfortable. Take a centring breath and then continue breathing as normal. Notice how your body feels. You might choose to pay attention to your breath or to how you feel in the chair or to something else. Don't judge how it feels, just take a moment to check in and be curious as to what it feels like. We take these things for granted in our busy lives so it's odd but nice to have a moment just to be curious about what it feels like to sit here in this chair.

In a moment, I'm going to add some sounds to this recording. I want you, if you can, to be curious about the sounds. Just listen to them like music. I will speak over the top of the sounds from time to time. Just try to listen to the sounds. If your mind wanders, that's okay, just bring it gently back to the sounds. Try not to get wrapped up in whether the sounds are pleasant or unpleasant. Just be open and curious about how they sound. Notice how your mind reacts. Try your best to let your

thoughts just be there. You are not in control of every thought but you can be in control of your actions. If you have an urge not to listen to some of the louder noises, see whether you're able to just be curious about that urge. What does it feel like? Doing this can help you feel in control when you're doing difficult things.

Keep observing for a few seconds if you can. If your mind gives you unhelpful thoughts, remember to add on, 'I'm having the thought that...' and remember who is having that thought. Notice to any desire to listen to the sounds or avoid the sounds changes over time as this can help you stay in control even when urges and desires threaten to overtake you. Okay, we're done with this exercise. Once you're ready, remove the headphones and let the experimenter know the recording has finished.

### **Recording 2 for generalised training (7 minutes, 40 seconds)**

In this next recording, I'm going to build on what we did before to try to change the way you experience bodily sensations so they have less power over you. We're still trying to help you get better at the cold-pressor task you just did. Please follow along and try to do each step as I suggest it. Closing your eyes, take a slow and relaxing breath. Now just let your breathing continue as normal. Just let it go on the way it has done all day without you needing to interfere. Just pay attention to your breath for a moment. Hopefully you're sitting comfortably, but if not, feel free to change your posture so you're sitting in a comfortable but upright position. Notice how it feels to be sitting in this chair. You don't need to change anything, just notice. Where does your body make contact with the chair, with the floor? Be curious about what it feels like and don't try to change it.

When you're ready, I'd like you to bring your attention to your shoulders. I want to see if you to be curious about how they feel right now without you changing anything. Be really curious. Are there any points of tension? Does anything feel warm or cold? Are there any sharp or dull feelings? Can you feel the air or your clothes against your shoulders? Are you aware of any sensations at all in your shoulders?



If your mind starts to judge, to tell you it's not nice for instance, that's okay. Just thank your mind for that thought and return your attention to your shoulders. Try not to get wrapped up in whether it's pleasant or unpleasant, just be open and curious about how it feels. Is your mind giving you any thoughts about this task? Your mind might start looking towards the future, wondering how long I'm going to ask you to do this odd exercise for. Just return to the present moment. I'd like you to go on a little longer if you can. Just bring your attention back to your shoulders. Notice how your mind reacts. Try your best to let your thoughts just be there. You're not in control of every thought but you can be in control your actions. Just noticing your shoulders.

Do you have any urge to think about something else? What does the urge feel like? Where is the urge in your body? Remember that as strange as it seems, when you get an urge, it can be useful to bring extra attention to be really curious about how it feels. It can help you stay in control when you're doing difficult things. Keep observing for a few seconds if you can. Keep paying attention to your shoulders a little longer if you're willing. In order to feel in control of your actions, when dealing with difficult situations, it can be helpful to take a step back from your thoughts.

Spend a moment trying to let your mind go quiet. As you direct your attention to the feelings in your shoulders, see if your mind comes up with any thoughts. As before, if your mind says something like, 'this is weird', you can add something on the front of it and think instead, 'I'm having the thought that this is weird'. Notice who is having that thought. Take a moment to catch yourself having another thought and see if you can notice that you are not that thought. This is the same as getting perspective on a thought as we did before.

Okay, so you've been sitting here awhile doing this exercise. Have you noticed a desire to stop this task? Did the urge come and go, come and go? It can be really helpful to notice that some things we think of stable and constant really ebb and flow over time. This is part of learning to surf urges, learning to stay in control even when urges and desires threaten to overtake you. You've learned two things that will help you to surf urges as we call it. First, notice that you are having the feeling or thought. That that thought or feeling isn't you. Secondly, notice that urges and feelings usually get

stronger and weaker over time. Together, these techniques can help you stay in control. Okay, we're done with this exercise. Once you're ready, remove the headphones and let the experimenter know the recording has finished.

### **Recording 3 for generalised training (4:20)**

In this recording, we'll continue to build the same skills but since you've done this sort of thing twice now, I'm going to say less. We're still trying to help you get better at the cold-pressor task you just did. Please still follow along and try to do each step as I suggest it. Take a moment to make yourself comfortable. Take a centring breath and then continue to breathe as normal. Notice how your body feels. You might choose to pay attention to your breath, or to how you feel in the chair, or something else. Don't judge how it feels, just take a moment to check in and be curious as to what it feels like. We take these things for granted in our busy lives so it's odd but nice to have a moment to be just curious about what it feels like to just sit here in a chair.

When you're ready, this time, I want you to direct your attention to your feet. It may be odd but it's no different to what you've done before. As with your hands and with your shoulders, I want you to be curious as to how your feet feel. If your mind wanders, it's okay, just bring it back gently to your feet. Try not to get wrapped up in whether the feelings are pleasant or unpleasant. Just be open and curious about how your feet feel right now. Notice how your mind reacts.

You are not in control of every thought but you can be in control of your actions. If you have any urge to think of anything else, see if you're able to be curious about that urge. What does it feel like? Doing this can help you stay in control when you're doing difficult things. Keep observing for a few seconds if you can. If your mind gives you unhelpful thoughts, remember to add on, 'I'm having the thought that...' and remember who is having that thought. Notice whether how you feel about this exercise changes over time. If it does feel silly and you'd like to stop doing it, notice whether that has changed. Has it come and gone? Noticing these kinds of things can help you to stay in control even when urges and desires threaten to overtake you. Okay, we're done with this exercise.

Once you're ready, remove the headphones and let the experimenter know that the recording has finished.

Appendix B - Mindfulness Experience Measure

How much do you know about mindfulness? 0-100 \_\_\_\_\_

How much experience do you have with mindfulness? 0-100 \_\_\_\_\_

Do you currently meditate? Y/N \_\_\_\_\_

If so, how often? Please circle: daily/weekly/monthly/less than monthly

Have you ever practiced meditation? Y/N \_\_\_\_\_

Do you currently practice yoga, tai chi, or a similar discipline with a focus on controlled bodily movements? Y/N \_\_\_\_\_

If so, how often do you practice? Please circle: daily/weekly/monthly/less than monthly

How many months/years have you done this activity? \_\_\_\_\_

Have you ever been on a meditation/mindfulness/yoga retreat, or something very similar?  
Y/N \_\_\_\_\_

Appendix C – Toronto Mindfulness Scale (TMS; Lau et al., 2006)

Instructions: We are interested in what you just experienced. Below is a list of things that people sometimes experience. Please read each statement. Next to each statement are five choices: “not at all,” “a little,” “moderately,” “quite a bit,” and “very much.” Please indicate the extent to which you agree with each statement. In other words, how well does the statement describe what you just experienced, just now?

	<b>Not at all</b>	<b>A little</b>	<b>Moderately</b>	<b>Quite a bit</b>	<b>Very much</b>
1. I experienced myself as separate from my changing thoughts and feelings.	0	1	2	3	4
2. I was more concerned with being open to my experiences than controlling or changing them.	0	1	2	3	4
3. I was curious about what I might learn about myself by taking notice of how I react to certain thoughts, feelings or sensations.	0	1	2	3	4
4. I experienced my thoughts more as events in my mind than as a necessarily accurate reflection of the way things ‘really’ are.	0	1	2	3	4
5. I was curious to see what my mind was up to from moment to moment.	0	1	2	3	4
6. I was curious about each of the thoughts and feelings I was having.	0	1	2	3	4
7. I was receptive to observing unpleasant thoughts and feelings without interfering with them.	0	1	2	3	4
8. I was more invested in just watching my experiences as they arose, than in figuring out what they could mean.	0	1	2	3	4
	0	1	2	3	4

9. I approached each experience by trying to accept it, no matter whether it was pleasant or unpleasant.					
10. I remained curious about the nature of each experience as it arose.	0	1	2	3	4
11. I was aware of my thoughts and feelings without overidentifying with them.	0	1	2	3	4
12. I was curious about my reactions to things.	0	1	2	3	4
13. I was curious about what I might learn about myself by just taking notice of what my attention gets drawn to.	0	1	2	3	4

Appendix D – Acceptance and Action Questionnaire – II (AAQ-II; Bond et al., 2011)

Below you will find a list of sentences. Please rate how true each statement is for you by circling a number next to it. Use the scale below to make your choice.

The rating scale is as follows:

- 1 = Never true
- 2 = Very seldom true
- 3 = Seldom true
- 4 = Sometimes true
- 5 = Frequently true
- 6 = Almost always true
- 7 = Always true

1	My painful experiences and memories make it difficult for me to live a life that I would value.	1 7	2	3	4	5	6
2	I'm afraid of my feelings.	1 7	2	3	4	5	6
3	I worry about not being able to control my worries and feelings.	1 7	2	3	4	5	6
4	My painful memories prevent me from having a fulfilling life.	1 7	2	3	4	5	6
5	Emotions cause problems in my life.	1 7	2	3	4	5	6
6	It seems like most people are handling their lives better than I am.	1 7	2	3	4	5	6
7	Worries get in the way of my success.	1 7	2	3	4	5	6

Appendix E – Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003)

Below is a collection of statements about your everyday experience. Using the 1–6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be.

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

1. \_\_\_\_ I could be experiencing some emotion and not be conscious of it until sometime later.
2. \_\_\_\_ I break or spill things because of carelessness, not paying attention, or thinking of something else.
3. \_\_\_\_ I find it difficult to stay focused on what's happening in the present.
4. \_\_\_\_ I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.
5. \_\_\_\_ I tend not to notice feelings of physical tension or discomfort until they really grab my attention.
6. \_\_\_\_ I forget a person's name almost as soon as I've been told it for the first time.
7. \_\_\_\_ It seems I am "running on automatic" without much awareness of what I'm doing.
8. \_\_\_\_ I rush through activities without being really attentive to them.
9. \_\_\_\_ I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there.
10. \_\_\_\_ I do jobs or tasks automatically, without being aware of what I'm doing.
11. \_\_\_\_ I find myself listening to someone with one ear, doing something else at the same time.
12. \_\_\_\_ I drive places on "automatic pilot" and then wonder why I went there.
13. \_\_\_\_ I find myself preoccupied with the future or the past.
14. \_\_\_\_ I find myself doing things without paying attention.
14. \_\_\_\_ I snack without being aware that I'm eating.



## Appendix F – Information Sheet

You are invited to take part in a research study exploring how individuals learn mindfulness skills. This is run by the Chester Research Unit for the Psychology of Health. You have been chosen because you have self-selected for the experiment and you fit the criteria. **Just to remind you, there are some exclusion criteria (listed below\*) Please inform the researcher if you do not fit the criteria as this might impact on your ability to safely take part in this study.** Please take time to read the following information carefully and decide whether you would like to participate. This experiment should take one hour.

**\*Exclusion Criteria:** history of cardiovascular disorder; history of fainting or seizures; history of frostbite; open cut or sore on hand to be immersed; fracture of limb to be immersed; history of Reynaud's phenomenon (hands turn white or blue, on exposure to cold, then red on warming), or severe anxiety.

### **Who is undertaking this research study?**

This study is being led by a team composed of Dr Lee Hulbert-Williams, Nick Hulbert-Williams, Sam Ashcroft, Kevin Hochard, Suzanne Fleming and Evelyn Acheampong at the University of Chester.

### **What do I have to do/ what will happen?**

You will complete a quick questionnaire at the start of the experiment. You will then complete a pain tolerance task in which you must hold your hand in cold water for as long as possible. After that you will receive an introduction to mindfulness. You will have your pain tolerance measured again using the cold water task. Finally, you will fill in another questionnaire. The experiment is not diagnostic or used for development purposes. You will get further instructions when you begin the task.

### **Do I have to take part?**

You do not have to take part and you need not give a reason for this decision. Participation is entirely voluntary. Consent will be taken using the consent form that you receive before the experiment. You will need to provide written consent once you have finished reading this information if you wish to participate by signing the consent form provided.

Should you wish to withdraw from the research before you have completed the experiment, you can withdraw by informing the experimenter. Please note that your responses will be saved and may be used in the final analysis, but these results are completely anonymous. Should you wish for your partially collected results to not be used, please let the experimenter know your wishes on withdrawal from the study.

Please also be aware that once you have completed the experiment, it will not be possible to withdraw your responses as they will be made completely anonymous and no identifiable information will be connected with the results.

### **Is there any potential harm from taking part in the study?**

There are no anticipated directly harmful effects from taking part. If you feel that you are performing poorly on the task and really wanted to do well, you may feel slightly frustrated. If you become distressed during the experiment you are free to withdraw from the study at any time. If you need information, support and guidance about stress or mental health, you could look at the following sources:

Mind Info Line: information on all aspects of mental distress.

0845 766 0163 - 9am to 5pm, Monday to Friday.  
www.mind.org.uk

Student Support and Guidance (SSG) – University of Chester (UoC students and staff only).  
01244 511 548  
student.welfare@chester.ac.uk

### **How will I benefit from the study?**

You will be taught a cutting-edge modern therapy technique that has been linked to increased well-being. You will be able to use this technique in any setting to potentially relieve stress. If you are a psychology student, you will also receive 4 RPS credits for participating.

### **Confidentiality**

All information to be used in this study is strictly confidential and will only be used for the purposes of this research and subsequent publication. Your responses will be anonymised, pooled with the other responses, and all data will be securely stored to ensure confidentiality. Your name or any traceable identifier will not appear in the data files. As your responses will be unidentifiable it will not be possible to remove your data once you have completed the experiment.

Data will be stored in accordance with the Data Protection Act and University Research Policies. Once analysis is complete, data will be kept on password protected computers, and will be confidentially destroyed approximately five years after study completion.

### **What will happen to the results of the study?**

The results will be analysed based on your performance on the task. The findings will be written up as a series of research papers which will be submitted to relevant journals. Results may also be presented at scientific meetings and conferences. In all results, all participants will remain anonymous. If you would like a summary of the results, please contact Sam Ashcroft (see below); please note that individual feedback cannot be shared as all data is anonymous.

### **Complaints procedure**

If you wish to make a complaint about any aspect of this research, or how you have been treated as a participant, please address it to:

***Professor R. Bramwell, Head of Department, Department of Psychology, University of Chester, Parkgate Road, Chester, CH1 4BJ.***

### **Where can I get further information?**

Feel free to ask any questions now. If you require further information, please contact: Suzanne Fleming, [1619860@chester.ac.uk](mailto:1619860@chester.ac.uk) and Evelyn Acheampong [1620544@chester.ac.uk](mailto:1620544@chester.ac.uk)

## Appendix G – Consent Form

Please read the following statements and sign at the bottom of the page if you agree to take part in the research. If you have any concerns about doing so, please let the researcher know, or contact a member of the research team:

**Researcher:**

Suzanne Fleming

Email: [1619860@chester.ac.uk](mailto:1619860@chester.ac.uk)

Evelyn Acheampong

Email: [1620544@chester.ac.uk](mailto:1620544@chester.ac.uk)

**Supervisor:**

Nick Hulbert-Williams

Email: [n.hulbertwilliams@chester.ac.uk](mailto:n.hulbertwilliams@chester.ac.uk)

- 1) I confirm that I have read and understood the information sheet for the above study.
- 2) I understand that my participation is voluntary.
- 3) I understand that if I decide that I no longer wish to take part I can withdraw before completion of the study, without giving any reason. I also understand that if I withdraw part of the way through the study, the incomplete results may still be used in the final analysis unless I ask the experimenter to do remove my results. I understand that my results cannot be removed after my data is collected.
- 4) I understand that I will undertake a pain tolerance cold pressor task with mindfulness training. I understand that nothing in this experiment is diagnostic.
- 5) I understand that I will be taught some techniques that may help me to improve my therapeutic skills and that I will be asked to practice these during the study.
- 6) I understand that in participating in this study my responses will be dealt with in a secure, anonymous and confidential manner. I agree that data collected during this study may be published in academic journals or at conferences, and understand that I will not be identifiable from the final data.
- 7) I confirm that I have read the exclusion criteria on the information sheet. I confirm that none of the exclusion criteria prevent me from undertaking this study.
- 8) I agree to take part in the above study.

Please sign to indicate your agreement to the statements above, and your consent to take part in this research.

Date \_\_\_\_\_

Signature \_\_\_\_\_

## Appendix H – Debrief Sheet

We would like to thank you for taking the time to participate in this study.

The aim of this research is to investigate how people use mindfulness when experiencing pain. We are comparing training packages to discover which kind of training is most useful. In particular, we are investigating how people perform on a cold pressor task when they are trained on mindfulness with tasks that are similar or not to the cold pressor task. It is expected that participants will perform better on the cold pressor task if they are trained on things similar to the cold pressor task. This may have implications for how we teach mindfulness. Feel free to ask the experimenter any quick questions now. For more information, see the paper by Hayes (1999) which we can email to you if you like.

We would like to take this opportunity to remind you once again that everything within the study will be treated as confidential. We are therefore unable to provide individual feedback.

Please feel free to contact us if you have any further questions about this study. Our contact details are provided at the bottom of this page. If you have any concerns about your mental well-being, please seek advice from your GP. You may also find the following sources of information helpful:

Mind Info Line: information on all aspects of mental distress.  
0845 766 0163 - 9am to 5pm, Monday to Friday.  
[www.mind.org.uk](http://www.mind.org.uk)

Student Support and Guidance (SSG) – University of Chester (UoC students and staff only).  
01244 511548  
[student.welfare@chester.ac.uk](mailto:student.welfare@chester.ac.uk)

If you would like to learn more about mindfulness, please visit this website:  
<http://www.oxfordmindfulness.org/learn/resources/>

Once again, many thanks for participating in this research. We hope you enjoyed participating and have learnt something about mindfulness.

If you would like any further information about this research, please contact a member of the research team:

Suzanne Fleming [1619860@chester.ac.uk](mailto:1619860@chester.ac.uk)

Evelyn Acheampong [1620544@chester.ac.uk](mailto:1620544@chester.ac.uk)

Nick Hulbert-Williams (Supervisor) [n.hulbertwilliams@chester.ac.uk](mailto:n.hulbertwilliams@chester.ac.uk)

Lee Hulbert-Williams (Supervisor) [l.hulbertwilliams@chester.ac.uk](mailto:l.hulbertwilliams@chester.ac.uk)