

This is a preprint of an article submitted for consideration in the Journal of Positive Psychology [copyright Taylor & Francis]. The Journal of Positive Psychology is available online. The article was published in July 2010, Vol 5, Issue 4, 264-274.

## **A controlled trial of mindfulness training in schools; the importance of practice for an impact on well-being.**

Felicia A Huppert<sup>a\*</sup> and Daniel M Johnson<sup>b</sup>

<sup>a</sup>Department of Psychiatry and Well-being Institute, University of Cambridge, UK  
Tel: +44 1223 336970 Fax: +44 1223 336968 Email: [fah2@cam.ac.uk](mailto:fah2@cam.ac.uk)

<sup>b</sup>Faculty of Science and Technology, Queensland University of Technology, Queensland, Australia  
Email: [dmj1977@gmail.com](mailto:dmj1977@gmail.com)

\*Corresponding author: Email: [fah2@cam.ac.uk](mailto:fah2@cam.ac.uk)

## **Abstract**

We report the results of a short programme of mindfulness training administered to adolescent boys in a classroom setting. Intervention and control groups (N=155) were compared on measures of mindfulness, resilience and psychological well-being. Although the overall differences between the two groups failed to reach significance, we found that within the mindfulness group, there was a significant positive association between the amount of individual practice outside the classroom and improvement in psychological well-being and mindfulness. We also found that improvement in well-being was related to personality variables (agreeableness and emotional stability). Most students reported enjoying and benefiting from the mindfulness training, and 74% said they would like to continue with it in the future. The results of this preliminary study are encouraging. Further work is needed to refine the training programme and undertake a definitive randomised controlled trial, using both subjective and objective outcome measures, with long term follow-up.

**Keywords:** well-being; education, mindfulness; adolescents; intervention

## Introduction

In recent years there has been a growing acceptance that schools should not only provide children with a formal education but should also consider the well-being of the child as a whole. For the most part, this new approach has focused on identifying and managing mental health problems, bullying, and antisocial behaviour within the school context, and there have been many encouraging findings (e.g. Weissberg & Kumpfer, 2003; Vreeman & Carroll, 2007). However, if our interest is in the well-being of all children, we need to go beyond the alleviation of symptoms or problem behaviours, and consider approaches which can benefit all children. The alarmingly low rates of well-being, both objective (eg health, educational attainment) and subjective (eg life satisfaction) among children in economically advantaged centres such as the UK and the US (UNICEF, 2007) makes this issue not only timely, but urgent.

In this paper we focus on subjective aspects of well-being. We define well-being as the combination of feeling good and functioning well (Huppert, 2009; Keyes, 2002). Feeling good includes positive emotions such as happiness, contentment, interest and affection. Functioning well includes a sense of autonomy or self-determination (i.e. the ability to make choices), competence and self-efficacy (i.e. capability in undertaking daily activities), resilience in the face of challenge or adversity which involves the awareness and management of thoughts and feelings, and positive relationships, which encompasses empathy and kindness (eg Ryan and Deci, 2001; Ryff and Singer, 1998).

So how can we increase the well-being of children in the school context? There are many possible approaches, some focussing on increasing confidence and self-esteem, some on increasing resilience, and others on improving social and emotional skills. For example, programmes on social and emotional learning have become widespread throughout North America and are mandatory in state schools in the UK and Australia. Most approaches, such as all those based on cognitive behaviour therapy (CBT), were originally developed for the treatment or prevention of disorder, but can be applied as a universal intervention to enhance the well-being of all children, rather than being targeted at problem groups. Nevertheless, where the effectiveness of such interventions has been evaluated, the outcome measures are usually negative (e.g. the reduction of depressive symptoms or bullying) rather than positive (the enhancement of positive feelings and positive functioning). A case in point is the highly regarded, well evaluated Penn Resiliency Program (Gillham et al., 2007). The 12-lesson programme has been found to substantially reduce the incidence of depression and problem behaviours among adolescents, but to date, effects on the enhancement of well-being have not been published.

A promising approach to enhancing the well-being of children in school, which may have benefits for many aspects of well-being, is to provide training in mindfulness. As described in the Mental Health Foundation Report 2010: "Mindfulness is a way of paying attention. It means consciously bringing awareness to our experience, in the present moment, without making judgements about it." Usually we pay little attention to our experience; rather we are swept away by thoughts and feelings, external events, interactions with others, or memories about the past and hopes and fears about the future. Most of the time we are on automatic pilot, caught up in our experience and reacting automatically, especially when we are under pressure. In contrast, staying consciously aware of what is happening allows us to see and experience things 'as they really are' and have choice over how we respond. With mindfulness, we deliberately observe and accept what is happening right now, in our bodies, minds, and the world around us, with an attitude of gentle curiosity.

In experiential terms, mindfulness has a calming and centring effect. By focussing on an object such as the breath, the busy, buzzing, sometimes scattered mind, becomes clearer. In this state, sensations, thoughts and feelings enter consciousness awareness but their obsessive

or “hooked” quality is reduced when they are observed with interest and curiosity, and then let go. Reduced anxiety and a sense of calm arise from not judging what goes on in the mind or in the external world, but simply accepting the experience as it is.

In light of our understanding of the principles and experience of mindfulness practice, we can hypothesise that mindfulness training has the potential to enhance well being in a number of ways. With respect to positive feelings, the central practice of being in the present provides an opportunity to increase such feelings through savouring on-going experiences. The practices of calming the mind and observing experiences with curiosity may be directly linked to feelings of contentment and interest.

With respect to positive functioning the mindfulness practice of learning to respond rather than to react could enhance the sense of autonomy or self-determination, through the increased ability to make choices. Increased choice can lead to a greater sense of self-efficacy, while competence could be increased through the training of attention regulation. Training in the conscious control of attentional resources (maintaining, selecting, shifting) is likely to have beneficial effects on learning, problem-solving, decision making and other cognitive processes. The awareness and acceptance of our thoughts and feelings including painful ones may have direct benefits for emotion regulation, which is a key part of resilience.

Benefits of mindfulness for interpersonal relationships may derive from several aspects of the practice. Responding rather than reacting may reduce negative interpersonal behaviours such as anger or aggression. Increased awareness of the behaviour and feelings of others may lead to greater appreciation of positive behaviours such as affection, generosity, or humour, and an increased understanding of the other’s difficulties, such as sadness, anger or confusion. Further, it is often said that being kinder and more accepting of oneself leads to great kindness, acceptance and empathy towards others. (Eg Baer, 2003; Mental Health Foundation, 2010)

Mindfulness practices are congruent with much of the theory and practice in positive psychology. Positive psychology is a broad umbrella which is fundamentally concerned with the scientific understanding and promotion of what makes life go well (Seligman, 2002). A large body of research within positive psychology has focussed on evidence for the benefits of positive emotions and how to increase them (Fredrickson 2001, Lyubomirsky et al 2005). Another strand of research and practice within positive psychology concerns resilience, and encompasses the widely used Penn Resiliency Program (Gillham et al, 2007; Reivich, 2003). Positive psychology is also concerned with interpersonal aspects of well-being and interventions have been developed which promote kindness, gratitude and forgiveness (eg Emmons and McCullough, 2002; McCullough and vanOyen Witvliet, 2005). While interventions in positive psychology are often quite focussed on a particular outcome, a mindfulness approach can influence a range of these outcomes. In a recent review of positive psychology interventions, Sin and Lyubomirsky (2009) included a large number of studies which used mindfulness training.

Studies of mindfulness-based interventions in adults, including a number of good quality randomised controlled trials, confirm the benefits of such training across a wide range of outcomes. Evidence for the benefits of mindfulness training in adults has been summarised in several major reviews and meta-analyses (Baer, 2003; Grossman, Niemann, Schmidt, & Walach, 2004; Irving, Dobkin, & Park, 2009; Mental Health Foundation, 2010; Salmon et al., 2004). Mindfulness interventions are usually administered to adults in the form of Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, Lipworth, & Burney, 1985) or Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams, & Teasdale, 2002) both of which typically involve an 8-week programme with group sessions of around 2 hours per week and individual daily home practice of around 40 minutes per day, usually guided by listening to a CD.

The specific benefits of mindfulness for cognitive function include improvements in focused and selected attention (e.g. Jha, Krompinger, & Baime, 2007; Tang et al., 2007). Benefits for mental health including the reduction of symptoms of distress have been demonstrated in both clinical and non-clinical populations (e.g. Jha et al., 2007; Ma & Teasdale, 2004; Speca, Carlson, Goodey & Angen, 2000; Williams, Kolar, Reger, & Pearson, 2001). There is also evidence of the enhancement of well-being including positive mood (Nyklíček & Kuijpers, 2008; Shapiro, Oman & Thoresen, 2008), self-esteem and optimism (Bowen et al., 2006) and self-compassion and empathy (Shapiro, Schwartz, & Bonner, 1998; Shapiro, Astin, Bishop & Cordova, 2005; Shapiro, Brown, & Biegel, 2007). Mindfulness-based interventions have also shown substantial benefits for physical health, including the management of chronic pain (e.g. Grossman, Tiefenthaler-Gilmer, Raysz, & Kesper, 2007; Morone, Greco, & Weiner, 2008), improved neuroendocrine and immune functioning (Davidson et al., 2003; Tang et al., 2007) and improvements in health-related behaviours such as reductions in binge eating (Kristeller & Hallett, 1999) and substance misuse (Bowen et al., 2006).

Far less research has been undertaken with children or adolescents, but in light of the cognitive, emotional and social benefits of mindfulness meditation in adults, its application within the school context is becoming more widespread (see for example the report by the Garrison Institute, 2005). However in the published literature to date there has been little systematic evaluation of the effects of mindfulness training in children. A recent review by Burke (2009) summarises the limited evidence published to date regarding children and adolescents. We focus here on the latter group, in whom mood is known to be volatile, and where there is evidence of low levels of satisfaction with school compared to younger children (nef, 2004).

Almost all the published research with adolescents has targeted those with problems, including learning difficulties (Beauchemin, Hutchins & Patterson, 2008), conduct disorder (Singh et al., 2007) and externalising disorders such as attention deficit and autistic spectrum disorders (Bogels, Hoogstad, van Dun, De Shutter & Restifo, 2008; Zylowska et al., 2007). These studies report a range of benefits in attention and emotion regulation and improvement in social skills, but the samples are very small (ranging from 3 to 34), there are no control groups and the results are mostly non-quantitative. One study which provided mindfulness training to children without specific problems involved a 5-week modified MBSR intervention with children aged 11 to 13 (Wall, 2005). Participants reported feeling calmer after the sessions, but the evidence was anecdotal and the mindfulness training was combined with Tai Chi, so it is not possible to know to what extent the improvement was the result of the mindfulness training. While anecdotal or qualitative information is a valuable starting point, a convincing demonstration of the benefits of such training require (a) that the group which practised mindfulness shows greater benefits than a comparison group which did not undertake the mindfulness training, and (b) that the effects of the training be measured in a quantifiable manner.

The present study aimed to advance our understanding of the effects of mindfulness training in adolescents by administering a modified MBSR course in a school context, measuring relevant variables pre- and post-intervention, and comparing changes on these variables in classes which had received the mindfulness training with classes which had not. Sample size was relatively large (total recruited n=173) and both qualitative and quantitative measures were used. The outcome measures we chose to examine were mindfulness, resilience and psychological well-being. These were measured using standard scales developed for adults, since we could find no appropriately validated measures for adolescents. Additional outcome measures included the extent of individual practice outside of lesson time and the pupils' evaluations of the training programme and its effects on them.

It is widely acknowledged that for any intervention we should not assume that "one size fits all". We were therefore interested to know whether characteristics of individual students might

be related to the effectiveness of mindfulness training. Because well-being is one of our principal outcome measures, and there is known to be a strong association between well-being and personality (De Neve & Cooper, 1998; Diener & Lucas, 1999; Steel et al, 2008) we decided to include a baseline measure of personality using the Five-factor model (McCrae & Costa, 1987). The question we addressed was whether type of personality influenced an adolescent's receptiveness to, or the effects of, mindfulness training.

## **Methods**

### *Participants and study design*

Fourteen- and fifteen-year-old students from two independent (fee-paying) boys' schools participated in this study. These two schools were selected because religious education teachers in each school, who were longstanding mindfulness practitioners, were keen to train pupils in this practice and participate in a research study. A total of 173 students were recruited from eleven religious education classes. The preponderance of the sample were white British, with ethnic minorities accounting for about 5% of the sample (mainly ethnic Chinese from Hong Kong). Six of the classes were normally taught by one of the above teachers and were allocated to the mindfulness intervention. Five classes, which were normally taught by other teachers, acted as controls. The parents of students in both the mindfulness and control groups were informed about the study. The parents of one student refused consent, and a parent of another student expressed some reservations, so these two pupils were not included in the study.

The mindfulness training was based on the program developed by Kabat-Zinn and colleagues at the University of Massachusetts Medical School (Kabat-Zinn, 2003). It comprised four 40 minute classes, one per week, which presented the principles and practice of mindfulness meditation. The mindfulness classes covered the concepts of awareness and acceptance, and the mindfulness practices included bodily awareness of contact points, mindfulness of breathing and finding an anchor point, awareness of sounds, understanding the transient nature of thoughts, and walking meditation. The mindfulness practices were built up progressively, with a new element being introduced each week. In some classes, a video clip was shown to highlight the practical value of mindful awareness (e.g. "The Last Samurai", "Losing It"). Students in the mindfulness condition were also provided with a specially designed CD, containing three 8-minute audio files of mindfulness exercises to be used outside the classroom. These audio files reflected the progressive aspects of training which the students were receiving in class. Students were encouraged to undertake daily practice by listening to the appropriate audio files. During the 4-week training period, students in the control classes attended their normal religious studies lessons.

All participants completed a short series of online questionnaires before and after the 4-week intervention period. This took place in a computer room either one week before the first training sessions or at the start of the first session (baseline), and one week after the conclusion of the sessions (follow-up), and took around 15 minutes.

### *Measures*

The questionnaires were selected in order to measure the effect of mindfulness training on changes in mindful awareness, resilience, and well-being. Short questionnaires were chosen to maximise the likelihood of completion.

To measure mindfulness, the Cognitive and Affective Mindfulness Scale - Revised (CAMS-R; Feldman, Hayes, Kumar, Greeson & Laurenceau, 2006) was used. This scale was chosen as it is designed to cover the four domains commonly identified as being key to mindfulness: the ability to regulate attention; an orientation to the present or immediate experience, awareness of experience, and an attitude of acceptance towards experience. The scale consists of 12 items answered on a 4-point Likert scale ranging from 1 (rarely / not at all) to 4 (almost always). Sample items include "I am easily distracted" and "I am able to focus on

the present moment". The scale was found to be reliable in the current study (Cronbach's alpha at time 1 = 0.612 and at time 2 = 0.646), and has been shown to have good reliability and validity with a large (N=548) student sample (Feldman et al., 2006).

To measure resilience, the Ego-Resiliency Scale (ERS; Block & Kremen, 1996) was used. The scale is commonly employed as a measure of psychological resilience, defined as the capacity to modify responses to changing situational demands, especially frustrating or stressful encounters (Tugade & Fredrickson, 2004). The scale consists of 14 items answered on a 4-point Likert scale, ranging from 1 (does not apply at all) to 4 (applies very strongly). Sample items include "I enjoy dealing with new and unusual situations" and "I get over my anger at someone reasonably quickly". The scale was found to have good reliability in the current study (Cronbach's alpha at time 1 = 0.656 and at time 2 = 0.743), and has been shown to have good reliability and validity with a moderately sized (N=104) student sample (Block & Kremen, 1996).

To measure well-being, the Warwick-Edinburgh Mental Well-being scale (WEMWBS; Tennant et al., 2007) was used. The scale is designed to capture a broad conception of well-being including affective-emotional aspects, cognitive-evaluative dimensions and psychological functioning. The scale consists of 14 items answered on a 5-point Likert scale, ranging from 1 (none of the time) to 5 (all of the time). Sample items include "I've been feeling optimistic about the future" and "I've been feeling close to other people". The scale focuses entirely on the positive aspects of mental health including positive emotions, satisfying interpersonal relationships and positive functioning. The scale was found to be reliable in the current study (Cronbach's alpha at time 1 = 0.745 and at time 2 = 0.830), and has been shown to have good validity, internal consistency, and test-retest reliability with a large (N=354) sample of students and a very large (N=2075) sample of the general population (Tennant et al., 2007).

To measure personality, the Big-Five personality dimensions were assessed (McCrae & Costa, 1987). These measure extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience. The measure used was the Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow & Swann, 2003), which is designed to measure personality in situations where the use of longer personality instruments is not practical. The scale consists of 10 items (two for each personality dimension) answered on a 7-point Likert scale ranging from 1 (disagree strongly) to 7 (agree strongly). Sample items include "I see myself as extraverted, enthusiastic" and "I see myself as critical, quarrelsome". The five sub-scales have been shown to have moderate internal consistency (as a function of only having 2 items per sub-scale), and good test-retest reliability and validity with a very large (N=1813) sample of university students (Gosling et al., 2003; McCrae & Costa, 1987). Personality was measured at baseline only because it is regarded as a stable trait. In the current study the internal consistencies (Cronbach's alpha) were as follows; extraversion = 0.57, agreeableness = 0.11, conscientiousness = 0.49, emotional stability = 0.56, and openness to experience = 0.26.

At follow-up, participants in the mindfulness condition were also asked a series of questions about the number of times they had practised mindfulness outside of class, how much they felt they had learned during the course, how much they enjoyed the course, how helpful they found it, whether the training course was the right length, and whether they thought they would continue to practice mindfulness.

### *Data analysis*

Statistical analysis was conducted on participants who did not have missing data on the questionnaires. 155 participants had complete data at baseline and 134 at follow-up (78 in the mindfulness and 56 in the control condition). Missing data only occurred when a participant provided data at Time 1 but not Time 2 or vice versa. Imputation is not an advisable method for dealing with missing data in this circumstance, so we used listwise deletion. Baseline data were analysed by analysis of variance (ANOVA). Analysis of change post-training utilised a

residualised difference measure rather than simple difference scores, as recommended by Zumbo (1999) and Williams & Zimmerman (1983) who judged residualised differences to provide a more reliable indicator of change<sup>1</sup>.

## Results

### *Baseline Comparisons*

To test whether there were any pre-existing differences on the outcome measures between the control and mindfulness groups, a one-way independent groups ANOVA was run using the Time 1 scores for mindfulness, resilience and well-being. No significant differences were found, indicating that there were no pre-existing differences on the measures between the two groups (CAMS-R:  $F(1,153) = 0.483$ , *ns*; ERS:  $F(1,153) = 0.606$ , *ns*; WEMWBS:  $F(1,153) = 0.612$ , *ns*). Since there were no significant group differences, the baseline data for the 155 students were combined to evaluate how 14/15 year-old boys score on these questionnaires which were originally developed for adults (Table 1). It can be seen that this sample performed on average at the middle or upper end on all these scales, and inspection of the frequency distributions (not shown) indicates that for all measures, there was a relatively normal distribution of scores. Pearson bivariate correlation coefficients were calculated for each pair of outcome measures at baseline. Unsurprisingly, all the measures were found to be significantly related such that greater mindfulness was associated with greater resilience ( $r=0.33$ ;  $p < .01$ ) and greater well-being ( $r=0.40$ ,  $p < .01$ ), and greater resilience was associated with greater well-being ( $r=0.55$ ,  $p < .01$ ).

We also explored the relationship between personality and the psychological measures at baseline. A series of standard multiple regression analyses was performed, incorporating all five personality variables (extraversion, agreeableness, conscientiousness, emotional stability and openness to experience) for each of the psychological measures (CAMS-R, ERS, WEMWBS). The results are reported in Table 2.

In Multiple Regression, the  $\beta$  weights indicate the slope of the regression line and the direction (positive or negative) of the relationship; this is expressed as the change in the standardised outcome measure associated with a one standard deviation change in the predictor variable if all other predictor variables are held constant (Tabachnick & Fidell, 1996). In addition, the squared semi-partial correlation ( $sr^2$ ) provides an indication of effect size; this is expressed as the proportion of unique variance in the outcome measure explained by each predictor variable (Tabachnick & Fidell, 1996).

For the mindfulness scale (CAMS-R), there was a significant overall effect of personality ( $F(5,149) = 10.38$ ,  $p < 0.001$ ) with conscientiousness ( $\beta = .244$ ,  $p < .001$ ) and emotional stability ( $\beta = .403$ ,  $p < .001$ ) contributing positively and significantly to the mindfulness score. For the Ego Resiliency Scale there was a significant overall effect of personality ( $F(5,149) = 16.57$ ,  $p < .001$ ), with extraversion ( $\beta = .232$ ,  $p < .001$ ), agreeableness (marginal,  $\beta = .126$ ,  $p < .10$ ),

---

<sup>1</sup> Simple difference scores are the difference in a participant's score between time 1 and time 2. Residualised difference scores can be thought of as the amount an individual would have changed if all participants had the same initial score. Residualised difference scores are considered to be a more reliable indicator of change than simple difference scores in situations where the ratio of time 1 and time 2 measure standard deviations are greater than the correlation between the measures at times 1 and 2. This was found to be the case for all three dependent measures and hence, residualised difference scores were used in each case.

conscientiousness ( $\beta = .195, p < .001$ ), emotional stability ( $\beta = .169, p < .05$ ) and openness to experience ( $\beta = .383, p < .001$ ) all contributing positively and significantly to resilience. For the WEMWBS there was a significant overall effect of personality ( $F(5,149) = 21.72, p < .001$ ), with extraversion ( $\beta = .355, p < .001$ ), conscientiousness ( $\beta = .141, p < .05$ ), emotional stability ( $\beta = .340, p < .001$ ) and openness to experience ( $\beta = .182, p < .001$ ) contributing positively and significantly to well-being.

In light of the strong baseline association between personality and the outcome measures, all subsequent analyses include personality variables.

### *Post-intervention changes*

Initial analyses consisted of multiple regressions to assess the effect of condition (mindfulness training or control) and personality on the standardised residual outcome measures (mindfulness, resilience and well-being).  $R$  was not found to be significantly different from zero for any of the analyses. Condition was found to contribute marginally significantly to change in well-being ( $\beta = .15, p < .10$ ), and openness to experience was found to contribute marginally significantly to change in resilience, ( $\beta = .174, p < .10$ ).

To follow up on the marginal effect of condition on well-being and to assess whether a certain level of engagement with the mindfulness content was a pre-requisite for a change in the outcome variables, a second regression model, including amount of practice as an explanatory variable, was run. Because students in the control condition were not given any equivalent material to practice, it was not appropriate to include them in this analysis. Thus, the analysis was conducted only on data from students who were in the mindfulness condition, and the model consisted of outcome variables predicted by amount of practice and personality variables.

One third of the group (33%) practised at least three times a week, 34.8% practised more than once but less than three times a week, and 32.7% practised once a week or less (of whom 7 respondents, 8.4%, reported no practice at all). Only two students reported practicing daily. The practice variable ranged from 0 to 28 (number of days of practice over four weeks). The practice variable was found to be highly skewed, with 79% of the sample obtaining a score of 14 or less (skewness = 0.68, standard error of skewness = 0.25). Practice was therefore normalised using a square root transformation (skewness = 0.40, standard error of skewness = 0.25).

A series of standard multiple regressions was performed, once on each of the psychological outcome measures (CAMS-R, ERS, WEMWBS), examining the effect of practice on the residualised difference scores and adjusting for the five personality variables. The results are reported in Table 3. It can be seen that the overall regression model was marginally significant for the mindfulness measure ( $F(6,71) = 1.94, p < .10$ ) and for the resilience measure ( $F(6,71) = 2.01, p < .10$ ), and statistically significant for the well-being measure ( $F(6,71) = 2.98, p < .05$ ). Practice was found to contribute significantly to the prediction of change in mindfulness ( $\beta = .245, p < .05$ ) and to the change in well-being ( $\beta = .23, p < .05$ ) but not to the change in resilience. The change in well-being was also associated with several of the baseline personality measures; agreeableness ( $\beta = .32, p < .01$ ), emotional stability ( $\beta = -0.24, p < .05$ ), and openness to experience (marginal,  $\beta = 0.19, p < .10$ ). There was a marginally significant association between emotional stability and the prediction of change in resilience ( $\beta = -0.28, p < .10$ ).

The analyses discussed above were all completed using residualised difference scores as described. To provide a visual representation of the effect of the mindfulness training on the

psychological outcome measures, the mean difference scores across levels of practice are presented in Figure 1. Low practice was defined as an average of once a week or less (32.7%), medium practice was defined as practising on average more than once but less than three times per week (34.8%) and high practice was defined as practising on average at least three times per week (33.0%). Negative values indicate a decrease in scores on the outcome measure, while positive values indicate an improvement.

#### *Additional outcome measures*

Beyond the scale-based psychological measures described above, participants in the mindfulness group were asked single-item questions about their attitude to the course and to mindfulness and its usefulness more generally. A summary of the responses to these questions is shown in Table 4. It can be seen that the majority of students who experienced mindfulness training found it to be a positive experience, and 74% said they thought they would continue with the practice. Most students thought the course was about the right length, but a sizeable proportion (43%) thought it should be longer.

## **Discussion**

Few published studies have examined the use of mindfulness training in a normal adolescent sample. The present study shows that a short, modified form of Mindfulness-Based Stress Reduction (MBSR) is well accepted by adolescents and there is some evidence of improvement in their well-being related to how much they have practiced. Sixty-nine percent of the students in the mindfulness group reported that they had enjoyed learning about mindfulness, and 74% thought they would continue with the mindfulness practice.

The main finding of this study was a significant improvement on measures of mindfulness and psychological well-being related to the degree of individual practice undertaken outside the classroom. Previous studies in adults have also shown that positive benefits are associated with a greater amount of practice (eg Carmody and Baer 2008; Carson et al, 2004). Carmody and Baer reported that time spent engaging in home practice of formal meditation exercises was significantly related to extent of improvement in most facets of mindfulness and several measures of symptoms of psychological well-being. Furthermore, in the present study, the impact of practice on psychological well-being and mindfulness was significant after allowing for the influence of personality. It should be noted that the significant impact of amount of practice on mindfulness and well-being occurred in the context of a marginally significant multivariate model. We chose to interpret this result as meaningful given the exploratory nature of the study.

The lack of a significant overall group difference between the intervention and control classes may reflect the small amount of exposure to MBSR that was provided in the study. Adults typically receive eight 2-hour sessions of training and are encouraged to do around 40 minutes per day of individual practice. In contrast, the adolescents in this study received only four 40-minute sessions and were encouraged to do 8 minutes per day of individual practice. In fact, daily practice was rare and only one-third of the group practised three times a week or more, while another third practised once a week or less. Our finding that amount of practice was significantly related to improvements on two of the three outcome measures (mindfulness and well-being), despite students having had less than 3 hours of mindfulness training (compared with typically 16 hours for adults), suggests that this is a very promising intervention for adolescents. The effects may well be stronger if training time is increased. It is noteworthy that 43% of the students reported that they would have liked the training course to be longer (Table 4).

It may be surprising that scores on the mindfulness scale did not show a significant benefit in the intervention compared to the control condition, since training in mindfulness would be expected to improve scores on a mindfulness scale. However, it is possible that when a

person first begins learning about mindfulness, one of the key early realisations is that they are not very mindful in their daily life. Hence, their ratings of their levels of mindfulness may show an initial decrease, until training is sufficient to lead to an improvement in day-to-day mindfulness skills. Whether or not this is an explanation for the lack of a main effect of mindfulness training on scores in the mindfulness scale, it is consistent with our finding of a significant improvement in mindfulness scores in relation to the degree of practice.

The questionnaire measures used in this study have all been developed and validated for adult samples, although in some cases the validation includes participants as young as 17 (eg WEMWBS, Tennant et al 2007). However, the data from the baseline phase indicate that in terms of their distributional properties, these measures appear to perform well in this adolescent sample.

We further explored the baseline data by combining the baseline scores of the two groups, since there were no significant differences between them. This revealed some interesting associations between the psychological measures and personality variables, using the Big Five model of personality (McCrae & Costa, 1987). High levels of conscientiousness and emotional stability were associated with high baseline scores on all three psychological measures - mindfulness, resilience and well-being. In addition, high scores on extraversion and openness to experience were associated with high scores on resilience and well-being. High scores on agreeableness were associated only with resilience.

We also examined whether personality might predict the benefit derived from mindfulness training. We found that personality was significantly associated with the degree of change in well-being in the mindfulness group, after adjusting for the amount of mindfulness practice undertaken. This finding indicates that beyond the baseline association between personality and the outcome measures, personality influenced the amount of change observed. Specifically, the higher the agreeableness and the lower the emotional stability, the greater the improvement in well-being. Agreeableness was assessed by two items: being critical or quarrelsome; being sympathetic or warm. Students who are less critical or questioning and more sympathetic or warm appear to benefit more from the mindfulness training. The finding that benefit is also related to emotional stability is particularly interesting. It indicates that adolescents who are higher in anxiety or neuroticism (low emotional stability), and who arguably are most in need of an intervention, showed greater benefit from the mindfulness training. Personality was unrelated to change on the measures of mindfulness and resilience.

Among the strengths of the study are the relatively large sample size, the inclusion of a control group and the use of quantitative measures. There are also a number of limitations, such as the gender restriction, the lack of random allocation to intervention and control groups, the use of a short personality inventory, and the use of subjective measures only. Future studies should examine the effectiveness of mindfulness training in both boys and girls. It is likely that mindfulness practices will be more readily accepted by girls, as they are by women (Samuelson, Carmody, Kabat-Zinn & Bratt 2007), perhaps because females are more open to the idea of a psychological intervention. From this perspective, it is particularly encouraging that we found a positive effect with adolescent boys.

It is important that future studies should also involve random allocation of pupils or classes to the intervention and control conditions, in order to reduce the likelihood of inherent bias. For example, in the present study, the intervention classes had different teachers to the control classes so the observed benefits may have been related in part to differences between teachers. Further, the control group should ideally be a placebo control, i.e. receive and intervention of a different type which also involves home practice, but whose benefits are different to those of mindfulness training. For instance, a few studies in adults have used relaxation training as the control condition and demonstrated significant benefits of mindfulness

over and above the benefits of relaxation, eg Tang et al (2007). It is also important that future studies incorporate more lengthy and reliable measures of personality. In the current study, the internal consistencies for the agreeableness and openness to experience scales were quite low, so further studies should consider the impact of mindfulness training in the context of more in-depth measures of personality. Finally, although it is important to include self-report measures in a study of this type, there would be added value from incorporating objective measures of improvement, such as performance on tests of attention and emotion regulation, or data on academic achievement.

In conclusion, the significant findings relating to the degree of mindfulness practice from this preliminary study, using only a short intervention, have encouraged us to design a more definitive randomised control trial of the effects of mindfulness training for adolescents in the school context. A new curriculum has been designed based on feedback from the pupils and teachers involved in this study as well as additional consultation with colleagues and consideration of the particular capabilities and needs of adolescents (Burnett, 2009). The new study will involve more class sessions and will be administered to boys and girls in both state-funded and fee-paying schools. In addition to online questionnaires, pupils will complete online tests of attention and emotion regulation, and both immediate and longer-term outcomes will be evaluated. We understand that studies of this type are ongoing in other locations, and we look forward to the accumulation of a body of knowledge which will advance our understanding of how best to enhance the well-being of children and adolescents.

### *Acknowledgements*

*We warmly acknowledge the role played by two inspiring teachers, Richard Burnett at Tonbridge School and Chris Cullen at Hampton School, who were closely involved in this project from its inception and undertook the mindfulness training in their classes. We are extremely grateful to the other teachers who participated in the study, including Father Beaumont who also taught a mindfulness class. We are grateful to Michael Chaskalson, an experienced MBSR trainer who recorded the practice CD, and to senior students at Tonbridge School whose feedback helped to make the recording suitable for young people. Finally, our thanks go to all the school students who participated in the study.*

## References:

- Baer, R. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice*, 10, 125–143.
- Beauchemin, J., Hutchins, T. L., & Patterson, F. (2008). Mindfulness meditation may lessen anxiety, promote social skills, and improve academic performance among adolescents with learning difficulties. *Complementary Health Practice Review*, 13, 34–45.
- Block, J., & Kremen, A. (1996). IQ and Ego-Resiliency: Conceptual and empirical connections and separateness. *Journal of Personality and Social Psychology*, 70(2), 349-361.
- Bogels, S., Hoogstad, B., van Dun, L., De Shutter, S., & Restifo, K. (2008). Mindfulness training for adolescents with externalising disorders and their parents. *Behavioural and Cognitive Psychotherapy*, 36, 193–209.
- Bowen, S., Witkiewitz, K., Dillworth, T.M., Chawla, N., Simpson, T.L., Ostafin, B.D., Larimer, M.E., Blume, A.W., Parks, G.A., & Marlatt, G.A. (2006). Mindfulness meditation and substance use in an incarcerated population. *Psychology of Addictive Behaviors*, 20(3), 343-347.
- Burke, C. (2009). Mindfulness-Based Approaches with Children and Adolescents: A Preliminary Review of Current Research in an Emergent Field. *Journal of Child & Family Studies*. Retrieved 27 June 2009 DOI 10.1007/s10826-009-9282-x
- Burnett, R. (2009). Mindfulness in Schools. Learning lessons from the adults – secular and Buddhist. Report, June 2009.
- Carmody, J., & Baer, R. A. (2008). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms, and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine*, 31, 23-33.
- Carson, J.W., Carson, K.M., Gil, K.M., & Baucom, D.H. (2004). Mindfulness-based relationship enhancement. *Behavior Therapy*, 35, p471–494.
- Davidson, R. J., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S., et al. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic Medicine*, 65, 564–570.
- De Neve, K.M., & Cooper, H. (1998). The happy personality: a meta-analysis of 137 personality traits and subjective well-being. *Psychological Bulletin* 124, 197-230.
- Diener, E., & Lucas, R.E. (1999). Personality and subjective well-being. In *Well-Being: The Foundations of Hedonic Psychology* (eds. D. Kahneman, E. Diener and N. Schwarz). Sage Found: New York.
- Emmons, R.A., & McCullough, M.E. (2002). *The psychology of gratitude*. Oxford University Press.
- Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J-P. (2006). Mindfulness and emotion regulation: The development and initial validation of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). *Journal of Psychopathology and Behavioral Assessment*, 29(3), 177-190.

Fredrickson, B. L. (2001). *The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions*. *American Psychologist*, 56, 218-226

Garrison Institute Report. (2005). *Contemplation and education: A survey of programs using contemplative techniques in K-12 educational settings: A mapping report*. New York: The Garrison Institute.

Gillham, J. E., Reivich, K. J., Freres, D. R., Chaplin, T. M., Shatté, A. J., Samuels, B., Elkon, A. G. L., Litzinger, S., Lascher, M., Gallop, R., & Seligman, M. E. P. (2007). School-based prevention of depressive symptoms: A randomized controlled study of the effectiveness and specificity of the Penn Resiliency Program. *Journal of Consulting and Clinical Psychology*, 75, 9-19.

Gosling, S.D., Rentfrow, P.J., & Swann, W.B. Jr. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality*, 37, 504-528.

Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research*, 57(1), 35-43.

Grossman, P., Tiefenthaler-Gilmer, U., Raysz, A., & Kesper, U. (2007). Mindfulness Training as an Intervention for Fibromyalgia: Evidence of Post-Intervention and Three Year Follow-Up Benefits in Well-Being. *Psychotherapy and Psychosomatics*, 76, 226-233.

Huppert, F.A. (2009). Psychological well-being: Evidence regarding its causes and consequences. *Applied Psychology: Health and Well-being*, 1(2), 137-164.

Irving, J.A., Dobkin, P.L., & Park, J. (2009). Cultivating mindfulness in health care professionals: A review of empirical studies of mindfulness-based stress reduction (MBSR). *Complementary Therapies in Clinical Practice*, 15, 61-66.

Jha, A.P., Krompinger, J., & Baime, M.J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive, Affective, & Behavioural Neuroscience*, 7(2), 109-119.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice*, 10, 144–156.

Kabat-Zinn, J., Lipworth, L., & Burney, R. (1985). The clinical use of mindfulness meditation for the self-regulation of chronic pain. *Journal of Behavioral Medicine*, 8, 163-190.

Keyes, C.L.M. (2002). Promoting a life worth living: Human development from the vantage points of mental illness and mental health. In R.M. Lerner, F. Jacobs, & D. Wertlieb (Eds.), *Promoting positive child, adolescent and family development: A handbook of program and policy innovations* (Vol. 4, ch. 15, pp. 257–274). Thousand Oaks, CA: Sage.

Kristeller, J., & Hallett, C. (1999). An exploratory study of a meditation-based intervention for binge eating disorder. *Journal of Health Psychology*, 4(3), 357-363.

Lyubomirsky, S., King, L., & Diener, E. (2005). The benefits of frequent positive affect: Does happiness lead to success? *Psychological Bulletin*, 131, 803–855.

Mental Health Foundation. (2010). *Be Mindful Report*. The Mental Health Foundation.

- Ma, S., & Teasdale, J. (2004). Mindfulness-based cognitive therapy for depression; Replication and exploration of differential relapse prevention effects. *Journal of Consulting and Clinical Psychology, 72*(1), 31-40.
- McCrae, R.R., & Costa, P.T. Jr. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality & Social Psychology, 52*, 81-90.
- McCullough, M., & vanOyen Witvliet, C. (2005). The Psychology of Forgiveness. In C.R. Snyder & S.J. Lopez *Handbook of Positive Psychology*; Oxford University Press.
- Melbourne Academic Mindfulness Interest Group. (2006) Mindfulness-based psychotherapies: A review of conceptual foundations, empirical evidence and practical considerations. *Australian and New Zealand Journal of Psychiatry, 40*, 285-294.
- Morone, N.E., Greco, C.M., & Weiner, D.K. (2008). Mindfulness meditation for the treatment of chronic low back pain in older adults. *Pain, 134*, 310-319.
- new economics foundation (nef). (2004). The Power and Potential of Well-Being Indicators; Measuring young people's well-being in Nottingham.
- Nyklíček, I., & Kuijpers, K.F. (2008). Effects of Mindfulness-Based Stress Reduction Intervention on Psychological Well-being and Quality of Life: Is Increased Mindfulness Indeed the Mechanism? *Annals of Behavioral Medicine, 35*, 331–340.
- Reivich, K., & Shatté, A. (2003). *The Resilience Factor: 7 keys to finding your inner strength and overcoming life's hurdles*. US: Broadway Books.
- Ryan, R.M., & Deci, E.L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology, 52*, 141–166.
- Ryff, C.D., & Singer, B.H. (1998). The contours of positive human health. *Psychological Inquiry, 9*, 1–28.
- Salmon, P., Sephton, S., Weissbecker, I., Hoover, K., Ulmer, C., & Studts, J.L. (2004). Mindfulness Meditation in Clinical Practice. *Cognitive and Behavioral Practice, 11*, 434-446.
- Samuelson, M., Carmody, J., Kabat-Zinn, J., & Bratt, M.A. (2007). Mindfulness-Based Stress Reduction in Massachusetts Correctional Facilities. *The Prison Journal, 87*(2), 254-268.
- Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression: A new approach to relapse prevention*. New York: The Guildford Press.
- Seligman, M. (2002). *Authentic Happiness*. New York: Free Press.
- Shapiro, S.L., Astin, J.A., Bishop, S.R., & Cordova, M. (2005). Mindfulness-Based Stress Reduction for Health Care Professionals: Results From a Randomized Trial. *International Journal of Stress Management, 12*(2), 164–176.
- Shapiro, S. L., Brown, K. W., & Biegel, G. M. (2007). Teaching self-care to caregivers: Effects of mindfulness-based stress reduction on the mental health of therapists in training. *Training and Education in Professional Psychology, 1*, 105-115.
- Shapiro, S.L., Oman, D., & Thoresen, C.E. (2008). Cultivating Mindfulness: Effects on Well-Being. *Journal of Clinical Psychology, 64*(7), 840-862.

- Shapiro, S. L., Schwartz, G. E., & Bonner, G. (1998). Effects of mindfulness-based stress reduction on medical and premedical students. *Journal of Behavioral Medicine*, *21*, 581-599.
- Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. *Journal of Clinical Psychology: In Session*, *65*, 467-487.
- Singh, N. N., Lancioni, G. E., Singh Joy, S. D., Winton, A. S. W., Sabaawi, M., Wahler, R. G., et al. (2007). Adolescents with conduct disorder can be mindful of their aggressive behavior. *Journal of Emotional and Behavioral Disorders*, *15*, 56–63.
- Speca, M., Carlson, L.E., Goodey, E., & Angen, M. (2000). A randomized, wait-list controlled clinical trial: the effect of a Mindfulness Meditation-Based Stress Reduction Program on mood and symptoms of stress in cancer outpatients. *Psychosomatic Medicine*, *62*, 613–622.
- Steel, P., Schmidt, J., & Schultz, J. (2008). Refining the relationship between personality and subjective well-being. *Psychological Bulletin* *134*, 138-161.
- Tabachnick, B., & Fidell, L. (1996). *Using Multivariate Statistics: Third Edition*. New York, New York: HarperCollins College Publishers.
- Tang, Y.Y., Ma, Y., Wang, J., Fan, Y., Feng, S., Lu, Q., Yu, Q., Sui, D., Rothbart, M.K., Fan, M., & Posner, M.I. (2007). Short-term meditation training improves attention and self-regulation. *Proceedings of the National Academy of Sciences of the United States of America*, *104*, 17152–17156.
- Tennant, R., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Weich, S., Parkinson, J., Secker, J., & Stewart-Brown, S. (2007). The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): development and UK validation. *Health and Quality of Life Outcomes*, *5*(63).
- Tugade, M., & Fredrickson, B. (2004). Resilient individuals use positive emotions to bounce back from negative emotional experiences. *Journal of Personality and Social Psychology*, *86*(2), 320-333.
- UNICEF. (2007). Child poverty in perspective: An overview of child well-being in rich countries. A comprehensive assessment of the lives and well-being of children and adolescents in the economically advanced nations. Innocenti Report Card 7. UNICEF Innocenti Research Centre, Florence.
- Vreeman, R.C., & Carroll, A.E. (2007). A systematic review of school-based interventions to prevent bullying. *Archives of Pediatrics & Adolescent Medicine*, *161*(1), 78-88.
- Wall, R. B. (2005). Tai Chi and mindfulness-based stress reduction in a Boston Middle School. *Journal of Pediatric Health Care*, *19*, 23–237.
- Weissberg, R.P., & Kumpfer, K.L. (Eds) (2003). Special Issue: Prevention that works for children and youth. *American Psychologist*, *58* (6/7), 425-496.
- Williams, K., Kolar, M., Reger, B., & Pearson, J. (2001). Evaluation of a wellness-based mindfulness stress reduction intervention: A controlled trial. *American Journal of Health Promotion*, *15*(6), 422-432.

Williams, R., & Zimmerman, D. (1983). The comparative reliability of simple and residualized difference scores. *Journal of Experimental Education*, 51, 94-97.

Zumbo, B. (1999). The simple difference score as an inherently poor measure of change: Some reality, much mythology. In B. Thompson (Ed) *Advances in Social Science Methodology* (pp. 269-304). Greenwich, CT: JAI Press.

Zylowska, L., Ackerman, D. L., Yang, M. H., Futrell, J. L., Horton, N. L., Hale, S. T., et al. (2007). Mindfulness meditation training with adults and adolescents with ADHD. *Journal of Attention Disorders*, 11, 737–746.

**Table 1. Baseline data on the self-completion questionnaire (n=155)**

	Mean	SD	Median	Observed range	Possible range
Mindfulness (CAMS-R)	30.9	4.5	31.0	20-41	12-48
Resilience (ERS)	39.8	4.9	40.0	26-51	14-56
Well-being (WEMWBS)	49.5	5.9	49.0	31-65	14-70
Personality (TIPI):					
Extraversion	9.5	2.6	10.0	2-14	2-14
Agreeableness	8.8	1.9	9.0	3-14	2-14
Conscientiousness	9.8	2.8	10.0	2-14	2-14
Emotional Stability	9.7	2.7	10.0	2-14	2-14
Openness to Experience	10.6	2.1	11.0	5-14	2-14

**Table 2. Regression analysis showing the relationship between personality variables and baseline scores on the questionnaires.**

	Mindfulness (CAMS-R)			Resilience (ERS)			Well-being (WEMBS)		
	R <sup>2</sup>	β	sr <sup>2</sup>	R <sup>2</sup>	β	sr <sup>2</sup>	R <sup>2</sup>	β	sr <sup>2</sup>
Model	.264**			.357**			.422**		
Extraversion		-0.025	.00		0.232**	.05		0.355**	.11
Agreeableness		0.083	.01		0.126 <sup>+</sup>	.01		0.097	.00
Conscientiousness		0.244**	.06		0.195**	.04		0.141 <sup>*</sup>	.02
Emotional Stability		0.403**	.13		0.169 <sup>*</sup>	.02		0.340**	.09
Openness		0.027	.00		0.383**	.14		0.182**	.03

\*\* p < .01, \* p < .05, + p < .10

Beta weights indicate the expected change in the standardised predictor measure for a one standard deviation change in the outcome measure when the other independent measures are kept constant.

Squared semi-partial correlations indicate effect size expressed as the proportion of unique variance in the outcome measure explained by each predictor variable.

**Table 3. Regression analysis showing the extent to which the amount of mindfulness practice and personality predicted change on the psychological outcome measures.**

	Mindfulness (CAMS-R)			Resilience (ERS)			Well-being (WEMBS)		
	R <sup>2</sup>	β	sr <sup>2</sup>	R <sup>2</sup>	β	sr <sup>2</sup>	R <sup>2</sup>	β	sr <sup>2</sup>
Model	.141 <sup>+</sup>			.145 <sup>+</sup>			.201 <sup>+</sup>		
Practice		0.245 <sup>+</sup>	.06		0.139	.02		0.23 <sup>*</sup>	.05
Extraversion		0.047	.00		-0.107	.01		0.076	.01
Agreeableness		0.116	.01		0.185	.03		0.324 <sup>**</sup>	.09
Conscientiousness		0.167	.03		0.184	.03		0.011	.00
Emotional Stability		-0.203	.03		-0.247 <sup>+</sup>	.05		-0.243 <sup>*</sup>	.04
Openness		0.132	.02		0.196	.03		0.194 <sup>+</sup>	.03

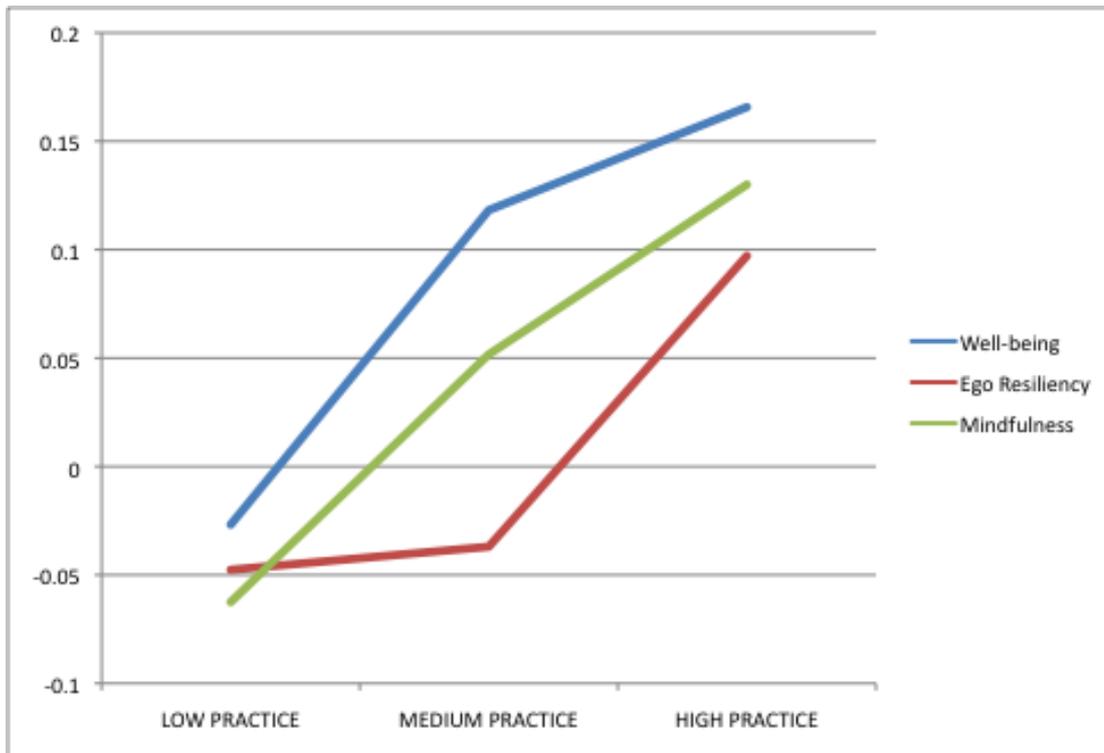
\*\* p < .01, \* p < .05, + p < .10

Beta weights indicate the expected change in the standardised predictor measure for a one standard deviation change in the outcome measure when the other independent measures are kept constant.

Squared semi-partial correlations indicate effect size expressed as the proportion of unique variance in the outcome measure explained by each predictor variable.

**Table 4. Responses to the additional follow-up questions in the mindfulness group.**

	<b>Below Mid-point</b>	<b>On Mid-point</b>	<b>Above Mid-point</b>
How much do you think you have learnt during the course?	20%	18%	62%
How easy was it to learn about mindfulness?	28%	13%	69%
How much did you enjoy learning about mindfulness?	15%	16%	69%
How helpful do you think mindfulness will be in your life?	22%	18%	60%
	<b>Not Long Enough</b>	<b>Right Length</b>	<b>Too Long</b>
How would you rate the length of the training course?	43%	52%	5%
	<b>Continue</b>	<b>Not Continue</b>	
Do you think you will continue with the mindfulness practice?	74%	26%	



**Figure 1. Improvement on the psychological outcome measures is related to the amount of mindfulness practice.** ( Low = once a week or less; medium = more than once a week and less than three times a week; high = three times a week or more.)