

EFFECTS OF MINDFULNESS PRACTICES ON WORKING MEMORY CAPACITY AND VERBAL REASONING OF COLLEGE STUDENTS

by Dr. Ram Kalap Tiwari

ABSTRACT

Mindfulness refers to the ability to direct the attention to experience as it unfolds, moment by moment, with open minded curiosity and acceptance. It is natural and cultivatable skill associated with psychological well being in adolescents. The present investigation was conducted to examine the effects of mindfulness practices on working memory capacity and verbal reasoning of college students. 80 undergraduate students from Saket college, Avadh University, Faizabad, were randomly selected to participate in the study. OSPAN and GRE measures were applied to the participants. Results demonstrated that a three week mindfulness training program increased working memory capacity and superior reading comprehension on GRE. Mindfulness training improved cognitive function and minimized mind absentness of college students.

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INTRODUCTION

The term mindfulness refers to the ability to direct the attention to experience as it unfolds, moment by moment, with open minded curiosity and acceptance (Kabat-Zinn, 1996). Mindfulness, which is natural and cultivatable cognitive skill, is associated with psychological well-being in adults and adolescents (Kabat-Zinn, 1982; Brown and Ryan, 2003; Miners, 2008). Mindfulness is characterized by awareness and acceptance of present moment thoughts, emotions and physical sensations (Kabat-Zinn, 1982) and can be deliberately developed using secular technique derived from Buddhist meditation practices. Mindfulness training programmes have been extensively trialled in adults and to a lesser extent with children and adolescents (Grossman, Neimann, Schimidt and Walach, 2003; Burke, 2000). The realization that mindfulness has the potential to promote young people's social and emotional functioning (Miners, 2008) and improve their academic performance (Semple, Reid and Miller, 2005; Beauchemin, Hutvchin and Patterson, 2008) has led to the development of programmes to teach mindfulness in schools.

Mindfulness is defined as “the awareness that emerges through paying attention on purpose, in the present moment, and non judgmentally to the unfolding of experiences moment by moment” (Cabat-Zinn, 2003). Mindfulness is an active process; it involves active attention which leads to awareness. Mindfulness regard the present, rather than the past or future. The definition emphasizes that attention is non judgmental and accepting, without thinking that the experience of the present moment is good or bad; right or wrong; important or not. It involves attending to the external environment such as sights, sounds and smells, as well as to internal

bodily sensation, thoughts, and feelings. In practicing mindfulness, one becomes aware of the current internal and external experiences, observes them carefully, accepts them, and allow them to be let go of in order to attained to another present moment experience. It is often learned and practiced through experiences (Baer, 2003). The goal of mindfulness is not to become more relaxed, but to be aware of and accepting of whatever state the body and mind are in. Mindfulness can be practiced through meditation, but unlike other techniques, mindfulness can be practiced through mindful eating, driving, walking or any experiences in our lives (Dimidjian and Linehan, 2003).

Miners' (2008) investigation of the effects of trait and state mindfulness in adolescents established that the former is associated with adolescents social and emotional well-being. It correlates positively with positive emotion popularity and friendship- extensiveness, and negatively with negative emotions and anxiety (Baer and Roemer, 2011). Cullen (2011) describes the explicit emphasis in mindfulness-based interventions (MBI) on using experience as a (Laboratory) within which to investigate the internal factors which engender happiness and unhappiness, allowing moderation of the cognitive and behavioral patterns. The benefits of mindful training are not restricted to people with psychological and physical illness. Typical people's depression, anxiety and stress scores also improve significantly (Schreiner and Malcolm, 2008). It improves working memory, ability to orientate and sustain attention (Chuen and Allen, 2008), increases resilience to physical discomfort (Perlman et al. 2010) and to unpleasant events (Ostafin et al. 2006) protects memory and reduces emotional reactivity in high stress context (Jha et al., 2010). Cultivating mindfulness has diverse benefits on well-being (Shapiro et al., 2008) and improving social and cognitive functioning (Mental health foundation, 2010). Few days of mindful training is sufficient to improve mindfulness, visual-spatial memory, working memory and sustained attention (Zeiden et al., 2010). Mrazek (2013)

conducted a study on mindfulness training on college students and found that mindfulness training showed improved accuracy on the GRE and higher memory capacity.

Mindfulness is being used to treat many physical and psychological problems, including stress, anxiety, depression, borderline personality disorder, chronic pain, addicting and eating disorder (Baer, 2003). There are various addition specific potential benefit relevant to children.

Mindfulness may improve memory. Children often forget things simply because they are not pay attention. Children will remember things better if they are: aware of them, attending to them, and focused, which may help with both learning and sports (Fontana and Slack, 1997). It may be useful for aggressive children, as it promotes self-control and self-management. Furthermore, children, by becoming more self aware and by focusing on themselves, will learn how their mind works and about their thinking process, promoting greater self understanding of their own experiences of the world, which they do not typically experience (Fontana and Slack, 1997).

Mindfulness training has at least five broad beneficial effects:

- i. Increases sensory awareness
- ii. Greater cognitive control
- iii. Enhanced regulation of emotion
- iv. Acceptance of transient thoughts and feeling
- v. The capacity to regulate attention.

Mindfulness requires that we practice it, live it, be it, and practice it some more before we offer it to others. A way to introduce the concept of mindfulness to children is through directing their attention to things in their environment. Some steps are important in mindful practice:

- i. Awareness of the object: Select the object and draw a picture

- ii. Awareness of self in environment: Focus on the attention of themselves
- iii. Attending the senses
- iv. Awareness of the moment
- v. Meditation and the breath

Sages have long advocated the value of cultivating an ability to mindfully focus on the here and now, and conversing scientific evidence has begin to corroborate this view. Mindfulness training prevents the deterioration of working memory capacity during period of high stress (Jha et al., 2010), improves visual-spatial processing efficiency, increases backward digit memory span (Chambers, Lo, and Allen, 2008).

In the present investigation, it was examined whether mindfulness training was more effective than control program in (a) improving reading comprehension, which is among the most important skills in modern society; (b) enhance performance on the working memory capacity measure most highly predictive of performance across a range of context; and (c) reducing distracting thought during the completion of both a reading-comprehension measure (based on the GRE) and the WMC measure. It was hypothesized that improvement in working memory capacity and GRE performance would be modified by a reduction in mind absentness.

METHOD

1. Participants

80 undergraduate students from Saket College, Avadh University Faizabad, Utter Pradesh, India (60 male and 20 female mean age = 19.25, S.D.= 2.11) were randomly selected to participate in the investigation. They were assigned to a mindfulness training class (N=60) or a simple study class (N=20) using a mixed factorial pre-test post-test design. Classes met for 20 min. four times a week for 3 weeks and were trained by experienced teachers with expertise knowledge in their respective fields.

2. Materials and Procedure of Investigation

Mindfulness class emphasized the physical posture and mental strategies of focused attention meditation. It required participants to integrate mindfulness into their daily activities and to complete 10 min. of daily meditation outside of class. During class, participants sat in a circle. Each class included 10 to 20 min of mindfulness exercises requiring focused attention to some aspect of sensory experiences (e.g. sensation of breathing, sounds of an audio recording). Participants shared their experiences with the class and received personalized feedback from the expert teacher. Class content was designed to provide a clear set of strategies for and a conceptual understanding of how to practice mindfulness. Class focused on (A) sitting in an upright posture with legs crossed and gaze lowered, (B) distinguishing between naturally arising thoughts and elaborated thinking, (C) minimizing the distracting quality of past and future concerns by reframing them as mental projection occurring in the present, (D) using the breath as an anchor for attention during meditation, (E) repeatedly counting up to 21 non consecutive exhalations, and (F) allowing the mind to rest naturally rather than trying to suppress the occurrence of thoughts. The control group has not participated in these activities but they performed their class activities seriously.

Within a week before and within a week after classes, participant completed in a counterbalanced order a WMC task and a verbal reasoning section from the GRE (20 min allotted for completion), which was modified by the researcher excluding vocabulary-focused question. WMC was assessed via the wisely used operation span task (OSPAN). This measure is highly predictive of an individual's performance across a range of context. In this complex span task, presentations of to- be- remembered stimuli were alternated with an unrelated processing task (e.g. participants had to verify the accuracy of presented equations). In each of 15 trails the to-be-remembered items were sets of 3 to 7 letters chosen from a pool of

12 letters and presented for 250 ms each. At the end of each trial, participants selected the presented items in the order in which they had appeared stimuli for the OSPAN were chosen randomly for a list of letters and equation, which ensured that participants would not encounter the same pattern of stimuli across the two testing session. WMC was calculated as the proportion of total letters recall across all trails.

Mind absentness during the OSPAN was measured with a widely used retrospective measure of task-unrelated thought administered after the OSPAN. During the GRE, absent mind was measure with both thought sampling and participant's self-reports of instances of mind absent. Eight through-sampling probes were presented at unpredictable *quesirandam* intervals and asked participants to indicate the extent to which their attention was focused on the task or on task unrelated concern using a 5 point Likert scale (1= completely on task, 2= mostly on task, 3= both on the task and on unrelated concerns, 4= mostly on unrelated concern, 5= completely on unrelated concerns). Participants also used a written form to count instance in which they caught their minds absent independently of thoughts probes. Participants of the control groups were assured that any observed improvements in task focus and performance were a direct result of the mindfulness training.

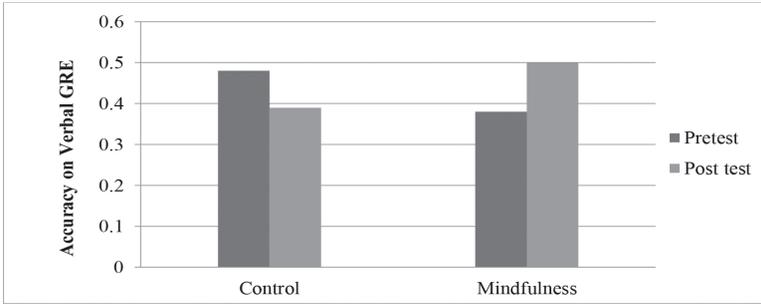
3. Results

A mixed-model analysis of variance (ANOVA) was conducted with condition (mindfulness training vs without mindfulness training or control conditions) entered as a between-subject factor and testing session (before training vs after training) entered as a within-subject factors. Prior to training, there were no significant difference in GRE accuracy, in WMC and self reported mind absentness. Analysis showed a significant main effect of session only for WMC, $F = 17.10$, $p < .001$ (all other $P > .05$).

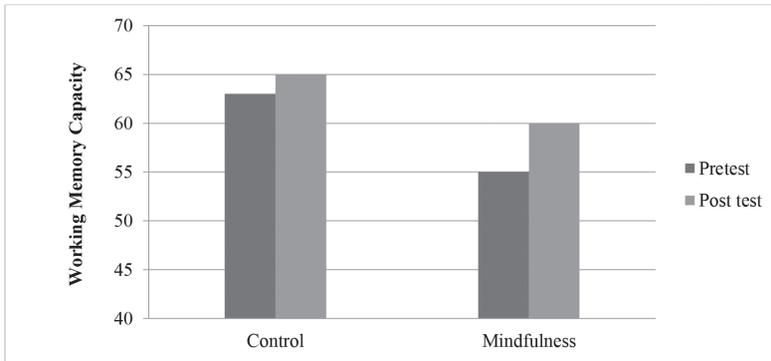
More important, the condition-by session interaction was significant for each of the performance and mind absentness

variables. Follow up t-tests indicated that the mindfulness training led to significant improvements in performance and reduction in mind absentness across all variables ($p < .05$). (Figure 1)

(A)



(B)



Given that only participants whose mind had absent at pretesting could measurably improve their focus, next researcher examined whether improvement in WMC and GRE performance following mindfulness training was mediated by reduced mind absentness specifically among participants who were prone to mind absentness at pretesting. Researcher conducted a test of moderated mediation examining whether the effect of condition on change in performance was mediated by change in mind absentness, specifically for participants with high level of baseline mind absentness, Table 1

Table 1: Moderated Mediation results

Predictor	β	SE	Statistical test	P
	Predicting the mediator			
Constant	1.13	0.37	t = 3.15	.003
Condition	-0.74	0.26	t = -3.26	.002
	Predicting the outcome variable			
Constant	-0.18	0.20	Z= -0.91	.374
Condition	0.14	0.14	Z= 1.51	.144
TuT change	-0.13	0.08	Z= 1.62	.125
TuT base line	0.027	0.077	Z= 0.35	.727
TuT change X TuT baseline	-0.18	0.58	Z= -3.08	.004

Researcher examined the indirect effect of condition change in performance through change in mind absentness at three conditional values of baseline mind absentness (Corresponding to the mean, 1 S.D. above the mean, and 1 S.D. below the mean). The indirect effect was significant only at 1 S.D. above the mean (Table 2). Change in mind absentness therefore significantly mediated the effect of mindfulness training on change in performance among participants who exhibited a tendency to mind- absentness at pretesting.

This finding demonstrates that mindfulness training enhanced performance that was mediated by reduced mind absentness among participants who had been prone to mind absentness at pretesting.

Table 2: Mediation effects according to baseline level of mind absentness

TuT baseline	Indirect effects	SE	Z	P
-0.82 (1 S.D. below than mean)	-0.014	0.08	-0.20	.835
0.00 (Mean)	0.09	0.07	1.36	.174
0.82 (1 S.D. above the mean)	0.20	0.70	2.11	.035

3. DISCUSSION

The present study demonstrates that a 3 week mindfulness

training program can elicit increased WMC and superior reading comprehension on the GRE. The practice of mindfulness encouraged sensations of breathing. The findings suggest that when ability to concentrate is redirected to a challenging task, it can prevent the displacement of crucial task-relevant information by distractions. The results suggest that the enhanced performance derived from mindfulness training results from a dampening of distracting thoughts.

Mindfulness training leads to reduced activation of the default network, a collection of brain regions that typically show greater activation at rest than during externally directed cognitive task. Participants showed reduced activation of the default network and it has been associated with marker of mind absentness. Mindfulness training improves cognitive function and minimizes mind absentness suggests that enhanced attentional focus may be key to unlocking skills that were viewed as immutable.

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