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IN EVERY GIVEN MOMENT

THE AFFECTIVE, COGNITIVE AND PHYSIOLOGICAL CONCOMITANTS OF MINDFULNESS

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A dissertation submitted in partial fulfilment of the requirements
for the award of the degree Masters of Arts in Psychological Research

Faculty of the Humanities

University of Cape Town

2005

DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature: _____ Date: _____

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ACKNOWLEDGEMENTS

I would like to extend a special thanks to those who made this research study possible. First and foremost to my supervisor Professor Johann Louw and co supervisor Associate Professor Alan St Clair Gibson, who provided direction, support and valuable guidance, to Dr Laurie Rauch for his assistance with the Stroop and SART computerised tests, and to Lize Haveman, for her assistance during the data collection process. I would also like to express my sincere gratitude to all of the participants who gave up their time to take part in the research, and to my family for their patience and encouragement.

University of Cape Town

ABSTRACT

An impressive collection of research has shown that mindfulness – described as a heightened awareness of the present moment – nurtures inner resources for reducing stress, and improving well-being. The aim of this study was to further validate, and add to these findings by illustrating the relationship between mindfulness and affect, cognition and physiological reactivity to stress. Here *mindfulness* was defined as a state of heightened present-moment awareness engendered through attentional-control training, *affect* was studied according to self-reports of subjective well-being, *cognition* was explored in terms of attention, and *physiological reactivity to stress* was evaluated on the basis of respiratory patterns. The study was designed as a cross-sectional investigation of three sample groups ($N = 33$), in which purposive sampling was used to recruit (a) mindful participants ($n = 11$), (b) control participants ($n = 11$), and adult participants with attention deficit disorders ($n = 11$). One-way analyses of variance were computed separately for each of the variables, and planned comparisons were used to determine whether hypothesised increases in performances emerged across the groups. Further to this, correlation analyses were conducted on the full complement of data to establish the overall relationship between mindfulness and the affective and attentional variables. Individual testing sessions were conducted in which participants (a) completed two questionnaires, the Mindfulness Attention Awareness Scale (MAAS), and the Satisfaction with Life Scale (SWLS), (b) provided self-reported ratings of emotional well-being, (c) completed computerised versions of the Stroop Task of selective attention and Sustained Attention of Response Test (SART), and (d) underwent a verbal Digit Span test of attentional capacity. In addition to the psychological tests, a breath-by-breath Oxycon Alpha Analyser measured oxygen consumption (VO_2), metabolic consumption of oxygen (RQ) and respiratory rates (V_e), for a five-minute baseline interval prior to the commencement of cognitive testing, throughout the cognitive testing, and for a further four-minute resting interval following testing. As predicted there were significant differences in the group mean scores, with increased test performances in the mindful group compared to the control group, and in the control group compared to the attention deficit group, in mindfulness ($p < .01$), satisfaction with life ($p < .01$), emotional well-being ($p < .01$), selective attention ($p < .05$), sustained attention ($p < .05$) and

attentional capacity ($p < .01$). In addition, a reduced baseline stress pattern was noted in the mindful group compared to the control group, and the control group compared to the attention deficit group in terms of oxygen consumption (VO_2) ($p < .05$), but not in the metabolic consumption of oxygen (RQ) and respiratory rates (Ve), and an improved ability to regulate the stress response was noted in the mindful group compared to the control group, and the control group compared to the attention deficit group in terms of oxygen consumption (VO_2) ($p < .05$) and metabolic consumption of oxygen (RQ) ($p < .05$), but not in respiratory rates (Ve). In addition, correlation analyses across the groups revealed significant associations between mindfulness and satisfaction with life, emotional well-being, sustained attention and attentional capacity.

CHAPTER ONE

INTRODUCING THE STUDY AND ITS AIMS

Through attention, the human being is able to choose and sculpt how our ever-changing minds will work, choose who we will be the next moment in a very real sense...those choices are left embossed in physical form on our material selves.

William James

The study of enhanced human functioning is atypical in psychological research when compared to a domineering interest in psychopathology. In contrast, an interest in mechanisms which maximise physical, mental and emotional well-being lies at the heart of this empirical study, which is designed to illustrate the relationship between mindfulness, an acquired mental state that heightens present-moment awareness, and associated psychological and physiological parameters. In a cross-sectional investigation of three sample groups, the study illustrates the association between learnt mindfulness and affect, cognition and physiological reactivity to stress.

At the broadest level, this study was inspired by an interest in the power of the mind and the ability of willed mental control to induce changes at a physical and emotional level. In recent years the increasing sophistication of neuroimaging technology has allowed scientists to better understand the anatomy and functionality of the brain, and within the evolving field, increasing attention has been paid to the role of willed mental control – primarily as brought about through practices of meditation – and its potential to elicit improved states of mental and physical health (Davidson et al., 2003). Research has shown that the application of such mental control has the potential not only to enhance mood states but to rewire neurocircuitry in a process known as neural plasticity (Schwartz, 2003). Neural plasticity, or neuroplasticity as it is also referred to, is now believed to hold the potential for restoring and promoting health (Restak, 2003). This research study is a preliminary

exploration of a willed mental control strategy – namely mindfulness – and its ability to enhance psychological and physical functioning. The findings of this study will form a foundation on which to base further investigation illuminating the neuroanatomical correlates of mindfulness through the application of neuroimaging techniques such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG), and so, build on the current body of neuroscientific knowledge on willed mental control.

Contextualising the study

Ultimately, all activities within the profession of psychology – whether academic or practical – are directed towards mental health. However, since the inception of psychology as a science in the late nineteenth century, *Psychology Abstracts* has reported over 168 000 published articles on anger, anxiety and depression, and less than 4000 on mental wellness (Myers, 2004). Clearly during this time, the majority of professional attention has been devoted to understanding, delineating, categorising and treating mental illness. But an alternative paradigm of psychology has evolved alongside this mainstream occupation, summoning its scholars to focus their efforts on understanding optimal functioning, what it is and how it may be induced. Within this *positive psychology* paradigm, mental health is seen as more than the absence of disease, but the presence of wellness, a premise that provided the backbone for this dissertation.

The scientific study of optimal mental functioning – defining it and learning how to foster it – can be well justified given the human preoccupation with *how to live a good life*. This question is as prevalent today as it was some 2400 years ago when posed by Socrates (Haybron, 2000). In the late 1800s William James initiated a tradition of positive psychology when he brought the question of ‘how to live more fully’ to the door of science, and made it his life’s work to contemplate life ideals, learn how to transcend normal experiences and stimulate optimal functioning; convinced that how to gain, keep and recover happiness is the “secret” motivation behind all human action (Myers, 2004). Inspired by the work of James, psychologists working with the positive paradigm continued to propose theories on advancing the human condition throughout the twentieth century, both guiding practice at a clinical level and being reciprocally influenced by the evolution of individualisation in

western society, and the preoccupation with personal growth and self-actualisation (Jansz & Van Drunen, 2004). The evolution of this positive paradigm in psychology and the growing body of accompanying research, justified the launch of a *Journal of Happiness* and *Journal of Positive Psychology* in the late twentieth century along with the establishment of an official Positive Psychology movement. Martin Seligman, a forefather of this movement, set an agenda for scholars within the field; to articulate a vision of the *good life* and isolate what actions lead to individual, community and societal well-being (Linley & Joseph, 2004). To this end Positive Psychologists contemplate the average person with an underlying appreciation for their inherent potentials, motives and capacity, in an endeavour to understand the nature of effective functioning and how it may be engendered (Sheldon & King, 2001).

In this study the value of such scientific inquiry is acknowledged and the broader aims fall within the ambit of these Positive Psychology ideals – namely to assess the merit of a mental technique, specifically mindfulness, in enhancing mental and physical performance and well-being. Empirical research of this type stands to contribute to the development of theory at an academic level and the development of workable techniques for application in the practical sphere, in a progressive process ultimately leading to an improved understanding of optimal human functioning and its cultivation.

On a more modest scale, and bringing the study's relevance to the local community setting, understanding the benefits of learnt mindfulness may endorse related training, which may be able to promote well-being and justify the application of mindfulness interventions in primary preventative healthcare. The South African Department of Health has prioritised the expansion of such prevention programmes in both the *National Guidelines on Primary Prevention of Chronic Diseases of Lifestyle* of 2001 and the *National Health Act* of 2003, an interest stimulated in part by the rising costs of curative health interventions as well as by limited access to treatment in the local community, in the hope that preventing physical and mental illness through nurturing wellness, will save money and lives. This study includes affective, cognitive and physiological variables to cover both psychological and physiological health correlates of learnt mindfulness, thus embracing a spectrum of functioning for overall evaluation.

Mindfulness in South Africa

Arguably the most saleable quality of mindfulness training in the Western world is its claimed potential to nurture stress coping mechanisms (Kabat-Zinn, 1993).

Investigation over the last three decades describes stress as a common factor underpinning mental and physical illness, with as many as 60 to 90 per cent of doctor visits resulting from stress-related illness (Benson, 1996). Mindfulness is believed to improve stress coping mechanisms by nurturing the ability to disengage from counterproductive thoughts and negative feelings during stressful times, which ultimately escalate stress and emotional upset, and initiate receptivity to alternative thoughts and actions (Bishop, 2002). Mindfulness interventions have been widely deployed in the United States to reduce stress and elicit coping mechanisms in patients with chronic diseases, corporate executives, and even healthcare professionals (Kabat-Zinn, 1995).

However improved stress management is not the only outcome of mindfulness training that could benefit the South African population. The practice of mindfulness is also believed to cultivate tolerance, acceptance, compassion and non-judgement through a similar mechanism to which it reduces stress – mindfulness is believed to foster a *quality of consciousness*¹ that emancipates one not only from habitual views of the self, but also of others and the world, allowing new and alternative responses to be flexibly considered. By paying attention to automatic thought sequences, negative thinking patterns are revealed and an openness to alternative perspectives is made possible, which in turn allows for intentional, as opposed to automatic responding in any given situation – a process Martin (1997) refers to as *deautomization*. The possibility of engendering such qualities has been cited as a major contribution to societies around the world in alleviating discrimination, prejudice and destructive emotions in general (Goleman, 2004). An effort to introduce insightful ways to deal with ethnic diversity would be of particular benefit to the multi-cultural South African community in the country's current climate of transition. Internationally, mindfulness interventions are being employed in a variety of environments to engender these positive mental qualities including hospitals, educational institutions and even correctional service systems, based on studies which show the positive effect of

¹ In this text *quality of consciousness* refers to extended consciousness, as defined by Damasio (1999) as the component of consciousness responsible for evaluating what is being consciously perceived.

mindfulness on emotional well-being, stress reduction and improved coping, and on the treatment of impulse control disorders, addiction, hostility and violence. More broadly speaking, international mental health professionals working with mindfulness interventions are currently exploring the feasibility of establishing *mental gymnasiums* where mindfulness training can be made available to community members at large, to promote mental health and emotional balance (Goleman, 2004).

In recent years mindfulness training interventions have also been administered across a variety of population groups in clinical and corporate settings in South Africa, primarily for the purpose of developing stress coping resources. However, on the basis of favorable outcomes of local research, such as this study, it could be justifiable to deploy mindfulness training to a wider South African audience, to teach stress management and enhance positive mental states that support tolerance and overall psychological well-being.

MINDFULNESS

Only that day dawns to which we are awake

Henry David Thoreau

Mindfulness is an art of attentional control that heightens present moment awareness by intentionally directing the conscious mind to what is taking place *here* and *now*. In this way distractions that divide, or entirely hijack our attention are silenced through willed mental control, freeing the conscious mind to become absorbed in the present and allowing a full and vivid experience of every given moment. In addition to focusing attention on the present moment, mindfulness is also a *quality of consciousness* that is free of judgment, attachment and analytical contemplation. Succinctly speaking then, mindfulness can be described as an attentional control strategy that heightens awareness of the present and allows every moment to be embraced with receptivity and flexibility.

One of the earliest scientific inquiries into mindfulness was the work of Ellen Lange in 1975. Lange's initial interest lay in *mindlessness* and her pioneering studies revealed the detrimental effects of this mental state on human functioning. In Lange's words mindlessness is a type of mental *automaticism*, in which mental operations become so well practiced that they are executed automatically and no longer mediated

by thought – this leads to categorical thinking and acting from a single-perspective (Lange, 1989). Mindlessness, according to Lange, induces a narrow mindset that depends on fixed mental categories and thus fails to take alternatives into account, leading to learnt helplessness, diminished self-esteem and single-minded attitudes. In general, day-to-day actions are all too frequently driven by impulses that stream through the mind in this mindless way, rather than being directed with full conscious intention. “We get caught up in the torrent and it winds up submerging our lives as it carries us to places we may not wish to go and may not even realize we are headed for” (Kabat-Zinn, 1994, p. 9). Mindfulness on the other hand, involves attending to each task with care and discernment; an intentional focus that brings with it a clear and deep understanding of the present moment. In the words of Lange, mindfulness is a creative cognitive process unfolding when an individual creates new categories, is open to new information and becomes aware of more than one perspective at any point in time.

Mindfulness finds its origins in Eastern philosophical traditions, and for the most part, it is the application of mindfulness within these traditions that has inspired scientific inquiry. In Buddhism, mindfulness is linked to attention and in some contexts referred to as *bare attention* (Schwartz, 2003). Bare attention is described a state of mind in which a person becomes the observer of their own sensations and thoughts with the calm clarity of an external witness. A similar notion was broached by eighteenth-century Enlightenment philosopher, Adam Smith, who developed the idea of *the impartial and well-informed spectator* (Smith, 1976). Smith described his theory as an act of mental exertion dividing the mind into experiencer and observer; the latter examining and monitoring the conduct of the former in an attempt to uphold overall behavioural integrity. Going back to Eastern philosophy, cultivating mindfulness, or such bare attention, is one of the single most important ambitions of meditation practice and ultimately believed to advance spiritual enlightenment. Meditation is a collective description for a number of discrete attentional control strategies aimed at calming and focusing the mind, which sets the stage for mindfulness. Meditation pivots around two central skills; *concentration*, pointed attention to a single percept; and *insight*, full awareness of the present moment (Goleman & Epstein, 1980). Although mindfulness has strong associations with both of these skills, the hallmark of the practice lies in the latter, namely insight, and is thus also referred to as *vipassana*, or insight meditation (Kabat-Zinn, 1993). This

insight is said to evoke a mental weightlessness, flexible yet sharp enough to respond with clarity to successive moments of perception.

West meets East

In Lange's (1989) texts on mindfulness, she specifically draws a distinction between her account of the concept and its use in Eastern philosophy, however it must be said that the difference in the definitions are unexceptional. One notable difference in Lange's approach to mindfulness however, is her almost exclusive focus on *naturally occurring* mindfulness as opposed to the enhancement of mindfulness through training. While intermittent experiences of mindfulness are common to all human beings, these naturally occurring levels fluctuate within and between individuals, with most enjoying no more than fleeting moments of the limber mental state, in contrast, *learnt* mindfulness is the activity of nurturing the ability to attend to the present moment. Since Lange's initial research, mindfulness has been studied by Western scientists precisely as it is contemplated by Eastern philosophers and reference is commonly made to its philosophical descent, however, instead of examining the role of mindfulness in engendering spiritual enlightenment, the majority of scientific investigation has focused on assessing its ability to promote stress coping mechanisms and mature emotional well-being. In addition Western science has developed its own training interventions to engender the mental state, incorporating, but not restricted to meditation. One of the most prominent training interventions is Mindfulness Based Stress Reduction (MBSR), a programme developed in 1979 by Jon Kabat-Zinn at the University of Massachusetts Medical Center, under the auspices of mind-body medicine.

MBSR was developed as an eight-week training intervention comprising formal and informal practices of mindfulness. *Formal practice* refers to a collection of activities including body scan, sitting meditation and sequences of Hatha yoga: Body scan involves slow and systemic movement of attention through the body, noting sensations and tensions and intentionally and progressively calming each region of the body until full relaxation is achieved. Sitting meditation involves assuming a seated posture and focusing on the breath while observing passing thoughts, sensations and sounds but not reacting to them – thus assuming an observational, not reactive, perspective (Goleman, 2004). Hatha yoga further

complements formal MBSR practice, nurturing musculoskeletal strength, balance and flexibility and so nurturing a greater awareness of the physical body (Kabat-Zinn, 1993). The *informal practice* of mindfulness involves intermittently and spontaneously reminding oneself during the course of everyday life, to focus on the present moment, and as one acquires more experience in the formal practice of mindfulness, so the informal practice increases habitually. Much of the research into mindfulness since the development of MBSR in 1979 has been designed around pre- and post-intervention measures of selected variables to evaluate the benefit, or the overall worth of engendering mindfulness.

The scientific exploration of mindfulness

The corpus of research conducted into the clinical use of learnt mindfulness, applied as a cultivated self-help tool, has shown its benefits in eliciting three essential outcomes, (a) improved psychological well-being, (b) reduced stress, and (c) improved stress coping resources.

Perhaps the most outstanding outcome of MBSR training shown in the research to date, is that of the enhanced psychological well-being. Looking at a cross-section of research findings, this improved psychological well-being has been described as an increased experience of positive affect and decreased experience of negative affect, as well as enhanced self-confidence, assertiveness, motivation and a greater sense of control over life and ability to respond to stressful circumstances. In a study investigating naturally occurring mindfulness, as a predictor of day-to-day self-regulation and well-being, Brown and Ryan (2003) found mindfulness to be associated with more autonomous activity and lower levels of unpleasant affect, measured both in terms of intensity and frequency. The study also noted a positive relationship between mindfulness and positive experiences across three outcomes: higher levels of autonomy, more intense and frequent pleasant affect, and less intense and frequent unpleasant affect. Research has also shown mindfulness to be associated with improved social functioning, role-emotion and mental health (Reibel, Greeson, Brainard & Rosenzweig, 2001), as well as to bear some relation to *emotional intelligence* through its ability to engender perceptual clarity of emotional states (Salovey et al., 1995). Additionally, mindfulness relates to aspects of the *openness to experience* dimension of personality involving receptivity to new experiences (Brown

& Ryan, 2003). Moreover, but probably less surprisingly given the role of mindfulness in Eastern philosophy, mindfulness correlates highly with *spiritual growth* and understanding (Shapiro, Schwartz & Bonner, 1998), which has in turn shown to be associated with decreased negative psychological symptoms and enhanced physical and psychological well-being. These authors suggest that learnt mindfulness evokes spiritual experiences through the practice of attending with compassion, impartiality and acceptance of self and others, which enhances a feeling of being part of a “greater purpose” enabling affiliation and connectedness, as described by research participants, the latter of which has also shown to correlate positively with improved well-being.

Looking specifically at the effect of mindfulness training on psychological disorders, research has shown MBSR to assist in the treatment of depression and anxiety. In terms of depression, a study conducted by Teasdale, Segal and Williams (1995) found that when incorporating mindfulness techniques in group interventions to treat patients with recurrent depression in remission, the combined therapy effectively halved relapse rates in patients with three or more previous episodes of depression. Later research by Teasdale et al. (2000) further revealed the positive effect of mindfulness training, when combined with cognitive-behavioural therapy, in abating recurrent episodes of major depression, while other researchers showed it to play a more direct role in actually reducing depression by increasing the frequency of positive affect (Fennell, 2004; Ma & Teasdale, 1999). Mindfulness training has also been successfully applied in the treatment of anxiety disorders (Delmonte, 1985; Kabat-Zinn, et al. 1992). One of the first investigations of mindfulness training among anxiety and mood disorder patients, showed pre- to post-intervention improvements in mental health outcomes with an effect size of 0.7 (Deatherage, 1975). Such research findings have supported the inclusion of mindfulness training in psychotherapy, and given life to a form of therapy called *mindfulness-based cognitive-behavioural therapy*.

Mindfulness training has also been widely administered to nurture stress coping resources, and thus reduce stress, in a variety of population groups, as well as alleviate the symptomatology in physical and psychological stress-related disorders. As stated in the introduction of this text, mindfulness is believed to improve stress coping mechanisms by nurturing the ability to step back from thoughts and feelings during stressful times, instead of engaging in worry or negative-thinking patterns that

could escalate stress and heighten emotional distress (Bishop, 2002). Mindfulness practice develops a deeper perspective on reactions to everyday stress through promoting intentional awareness of thoughts, while at the same time, the meditation component of mindfulness practice induces deep states of relaxation, which relieves muscle tension. Studies have validated stress reduction as an outcome of MBSR practice (Chang, 2004; Marcus, 2003). In a randomised control study, Astin (1997) recruited participants with stress-related disorders to take part in an eight-week MBSR intervention after which the experimental group showed significant reductions of overall psychological symptomatology and significant improvements on sub-scales of depression, anxiety, obsessive-compulsive behaviour, somatization, interpersonal sensitivity, and psychotic and paranoid ideation. The experimental group additionally showed significant increases in spiritual experience, overall domain-specific sense of control and the degree of self-acceptance and perceptions of self-agency.

It is unclear as to whether mindfulness has the potential to actually reverse the disease process, but according to current literature, training does appear to empower people to deal more effectively with their life circumstances. This was noted in a clinical randomised control trial that showed MBSR to significantly improve mood and symptoms of stress in cancer outpatients (Speca et al., 2000). Mindfulness practice appears to relieve the suffering associated with disease and assist in the self-regulation of chronic pain by increasing awareness of bodily sensation and emotional reactions to such sensations, and seeing these entities as distinguishable facets (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth & Burney, 1985). In the same way, mindfulness training has also been shown to bring about significant improvements in stress-related factors, mental adjustment and locus of control in breast cancer patients (Tacon, Caldera & Ronaghan, 2004). Research investigating the role of mindfulness training in supporting the physical healing process and has shown MBSR to reverse fibromyalgia disease progression (Kaplan, Goldenberg & Galvin-Nadeau, 1993), as well as speed skin clearing rates in patients with psoriasis (Kabat-Zinn et al. 1998). Less directly, but equally important, increased mindfulness has shown to improve health-related attitudes and behaviours, ultimately improving health directly, or compliance with healthcare regimes (Reibel, Greeson, Brainard & Rosenzweig, 2001). According to Shapiro, Schwartz & Bonner (1998), mindfulness training can thus be considered a preventative medicine strategy.

One of the most remarkable investigations into learnt mindfulness, and one of the most recent, was conducted by Davidson et al. (2003), in which electroencephalography analysis and immunological response to influenza vaccination were explored in a randomised control study. MBSR successfully brought about significant increases in activity in left-sided prefrontal brain activity – a pattern associated with improved positive affect – as well as significant increases in antibody titers to the influenza vaccine in the experimental group. These findings confirmed the author’s hypothesis that “a short programme in mindfulness produces demonstrable effects on brain and immune functioning” (Davidson et al., 2003, p. 564).

Accounting for the positive outcomes of mindfulness training

According to Kabat-Zinn (1993), one of the most elemental reasons for the positive outcomes of MBSR training, is that it teaches patrons to focus on what is *right* with their functioning and not what is *wrong*; this approach, he believes, mobilizes inner strength for changing behaviour in positive ways. Brown and Ryan (2003) offer that increased levels of mindfulness contribute to well-being by not only adding clarity and vividness to every moment, but more scientifically speaking, by fostering informed and *self-endorsed behavioural regulation* by disengaging automatic thinking, habits and unhealthy behaviour patterns. Such self-endorsed behaviour has long been associated with improved well-being and is a key aim of mindfulness training. Martin (1997) explains this mechanism in different words: Mindfulness, he says, fosters a kind of “psychological freedom” as moment-to-moment experience “disidentifies” one from any sense of permanence, and as such, emancipates the trainee from stereotypical psychological schemata, or habitual views of the self and the world, allowing the development of fresh awareness and insight – a process referred to earlier in this text called deautomization. Incidentally, this process is a critical component of psychotherapy (Bohart, 1983). Using his own terminology, Bohart describes the process as *detachment* – distancing oneself from problems in an attempt to disengage from automatic maladaptive schema. Whether it is labelled self-endorsed behavioural regulation, deautomization or detachment, the process described by these various authors has been shown to be a key outcome of mindfulness practice and one of the central mechanisms through which it elicits positive outcomes.

In summary, a recent meta-analysis of 20 studies on the health benefits of mindfulness training concluded that increased levels of mindfulness help a broad range of individuals to cope with clinical and non-clinical problems (Grossman, Niemann, Schmidt & Walach, 2004). “The consistent and relatively strong level of effect sizes across very different types of samples indicates that mindfulness training might enhance general features of coping with distress and disability in everyday life, as well as under more extraordinary conditions of serious disorders or stress” (Grossman, Niemann, Schmidt & Walach, 2004, p. 39). On the basis of all of these findings, it is plausible to assume that learnt mindfulness has the potential to elicit a heightened awareness of the present moment, which brings with it, reduced negative affect, increased positive affect, improved coping resources and reduced stress. In closing, no studies to date have shown mindfulness training to elicit negative mental or physical effects.

SUBJECTIVE WELL-BEING

*Happiness, though an indefinite concept,
is the goal of all rational beings*

Immanuel Kant

The study of happiness, as stated earlier in this text, has occupied a minor interest in the discipline of psychology, despite the condition intriguing and bewildering the human species since the dawn of time. William James’s (1902) interest in the role of transcendent experiences in stimulating optimal human functioning was among the first well-being investigations in psychology, and numerous theoretical approaches to understanding the nature of well-being and how to evolve a positive disposition followed in the twentieth century. These theoretical approaches include Carl Jung’s role of individuation, Carl Roger’s notion of the fully functioning individual, Abraham Maslow’s theory of self-actualisation, and themes on the constituents of mental health and the mature individual. More recently Ryff (1989) and her colleagues pooled together previous research to present the concept of *psychological well-being*, which is defined as ‘the engagement with the existential challenges of life’. Around the same time, Myers and Diener (1995) introduced the holistic concept of *subjective well-being*, which is defined as a subjective evaluation of one’s life,

relative to subjective expectations, values and previous experiences (Diener & Lucas, 2000). The body of research collected over the last century on happiness has produced theories and tools to describe, measure and objectify the concept in a bid to understand its causes and the process that produce it.

Although there are subsequently a number of theoretical approaches to the study of happiness, each of which defines the concept in slightly different terms (Haybron, 2000), Myers and Diener's concept of subjective well-being is a hybrid definition and has come to be used interchangeably with happiness in contemporary psychological literature (Argyle, 2001). Subjective well-being has been divided into (a) a cognitive component – *satisfaction of life*, or the degree to which a person judges their quality of life as a whole favourably, and (b) an affective component – *emotional well-being*, or frequency of positive affect and infrequency of negative affect. In measuring subjective well-being it has been deemed impossible to reach accurate conclusions from observing overt behaviour, mainly due to the individual nature of expressing happiness and unhappiness, which has isolated self-reporting as the only reliable way to ascertain subjective well-being, and despite the doubts surrounding the validity of self-reports, empirical investigation has failed to reveal significant distortions in this form of well-being assessment (Veenhoven, 1991).

Moving on to the equally controversial question of whether subjective well-being levels *can* be altered, research has produced a mixed bag of results. Two traditional theories imply that enduring change is not possible and attempts to improve subjective well-being may be in vain: The *Zero Sum* theory maintains that mood is cyclical and positive and negative moods ultimately neutralise one another, while the *Fixed Trait* theory suggests subjective well-being levels remain stable throughout life, attributable to a fixed neurological makeup. Subsequent studies have offered support for the latter theory, finding that frontal brain asymmetry predicts qualities of dispositional mood and other emotion-relevant biological indices, and related measures of hemispheric asymmetry are present within the first year of life and remain stable over time (Davidson, 1992). Having said this, recent research has demonstrated the brain's ability to rewire itself in the process of neuroplasticity (Restak, 2004; Schwartz, 2003), and on the basis of such findings, it is plausible to assume that long-term affective changes may indeed be possible. In any event, contemporary happiness researchers have produced evidence to counter the Zero Sum and Fixed Trait theories and reject traditional views that happiness levels are fixed

(Veenhoven, 1991). These researchers have shown that numerous qualities related to subjective well-being can be learnt and may predispose one to a “happier life”; some of these include identity integrity, ego strength, mental maturity, inner control, social ability, activity and perceptual openness. In studies on learnt mindfulness, findings have shown the mental training to enhance these very qualities, specifically *identity integrity*, through enhancing self-awareness (Kabat-Zinn, 1995), *mental maturity*, through nurturing emotional intelligence (Salovey et al., 1995), *inner control* through improving self-regulation and internal locus of control (Tacon, Caldera & Ronaghan, 2004), and *perceptual openness*, through evolving receptivity to new experiences (Brown & Ryan, 2003).

In this study subjective well-being is contemplated as it is defined by Myers and Diener (1995), as (a) satisfaction with life, and (b) frequent positive affect and infrequent negative affect, and the study adopts the assumption that improved subjective well-being can be cultivated in a process where positive emotional states are brought to the foreground through mindfulness practice. Further to this, the study relies on self-reports, considered the sole reliable method of assessing subjective well-being (Veenhoven, 1991). In closing, it was decided to include the subjective well-being variable in the current study to further validate empirical findings on the association between learnt mindfulness and mental well-being, through cross-sectional investigation.

COGNITION

*Intelligence is the door to freedom
and alert attention is the mother of intelligence*

Nisargadatta Maharaj

Cognition is a collective term used to describe thinking skills encompassing attention, perception, consciousness, memory, knowledge representation, language, problem solving and decision-making. In this study particular focus is given to the cognitive faculty of attention.

William James (1890) described attention as “taking possession” of the mind, withdrawing from some things to deal more effectively with others (as cited in Schwartz, 2003). Seen in this way attention allows one to use limited mental

resources judiciously by selecting from multiple external and internal stimuli and focusing on what is applicable; this heightened focus increases the chance of responding accurately and speedily to incoming information (Sternberg, 1999). As to *how* we attend, numerous models have offered insight over the last century. Early theories of attention postulate that some information is blocked out (Broadbent, 1958) or attenuated as it passes through an attentional filter in the brain, either just after sensation and prior to perception, or after some perception has already occurred (Deutsch & Deutsch, as cited in Sternberg, 1999). More recently, *attention-resource theories* steer away from the signal-blocking or attenuated models and maintain that attention is the art of apportioning limited resources to bring into awareness what is interesting or relevant (Sternberg, 1999). The latter theories maintain that people have a specified capacity for attention and decide how to allocate it according to the task at hand. Later, task-specific and guided-search theories expanded on this model, offering an explanation for exactly how attention is allocated. In terms of neuroscientific understanding of attention, evolving research suggests that the attentional process involves more than one single region of the brain. Posner and Raichle (1994) identified one attentional network in the frontal lobe and another implicating parts of the parietal lobe, thalamus and midbrain. The former network is involved primarily in awareness tasks and selective attention and the latter in visuospatial attention and the shifting of attention from one stimulus to another.

Moving away from theories on the *process* of attention, a dominating theme in current cognitive research is that of attention deficits and the related disorders that are described as the ‘brain syndromes’ of the information age (Restak, 2003). Acquired attention deficits are often the result of having to juggle more incoming stimuli than ever before as technology fastens the pace of life and streams a continual flow of messages: “The clutter, noise and constant barrage of information that surrounds us daily contributes to the hectic pace of our modern lives, in which it is often difficult simply to remain mindful in the moment” (Tan & Wingfield as cited in Restak, 2003). This begs the question of how attentional acuity can be maintain, or even maximised in this contemporary environment, or said differently, how best to deal with incoming information. Multi-tasking has become one widespread solution but has failed to prove a very successful endeavour; switching between tasks involves time-consuming alterations in brain processing that essentially reduce performance (Just et al., 2001; Kieras, Meyer, Ballas, & Lauber, 2000; Rubinstein, Meyer & Evans, 2001). The

findings of these studies suggest that the brain works most efficiently when focusing on a single task and for sustained, rather than intermittent periods of time. Further to this, heightened attention, brought about through the use of higher order executive attention networks, has been related to improved decision-making, self-regulation (Carver & Scheier, 1981) and clarity of experience (Brown & Ryan, 2003). On the basis of these findings, it is likely that mindfulness training, which is designed to enhance sustained attention and interference control, would benefit overall attentional acuity. Attention is clearly related to mindfulness, not just because mindfulness is described as an *attentional strategy*, but because the act of focussing on the present moment and quietening distracting stimuli provides practice in attentional dexterity.

In accord with the above, the theoretical approaches that explain the attention *process* have been considered for a basic understanding of the cognitive faculty, but a primary interest is in the *effects* of the concentrated use of attentional resources, and whether such concentrated use correlates positively with mindfulness. Tackling this question from a different perspective, the study also takes an interest in how attention deficits relate to mindfulness, for further insight into how attention and mindfulness may be related. In this study defines attention as a means of processing selective information through senses, stored memories and other cognitive processes, both above and below the threshold of consciousness (Sternberg, 1999). What is evident from the literature reviewed thus far is that attention involves distinct processes that together determine its overall integrity (Ratey, 2003), and for this reason, the study includes three critical aspects of attention in an attempt to cover the faculty as holistically as possible. These aspects include selective attention, sustained attention and attentional capacity (working memory). *Selective attention* is the act of choosing to attend to some stimuli and ignoring others; this concerted focus enhances the ability to manipulate received information for other cognitive processes, such as comprehension or problem solving (Sternberg, 1999). *Sustained attention* employs vigilance, or said differently, paying attention for extended periods of time; it is the ability to self-sustain mindful, conscious processing of stimuli avoiding habituation or the degrading of attention (Roberston et al., 1996). *Attentional capacity*, or working memory, is the capacity to temporarily store and manipulate information needed in the execution of complex cognitive tasks (Baddeley & Hitch, 1976). Attention capacity is thus the amount of information that can be held in conscious awareness in any given moment. Adding to this, the study relies on Barkley's (1997) hybrid model

to understand attention deficit disorders, which cites the primary deficiency to lie in behavioural regulation, including inhibiting a prepotent response, stopping an ongoing response and controlling interference. The deficiency in behavioural inhibition has a subsequent impact on working memory – or attentional capacity as it is referred to in this study – self-regulation of affect, motivation and arousal, internalisation of speech and reconstitution. Together, these secondary deficits effect motor control fluency and syntax.

Despite the apparent association between attention and mindfulness, this is the first study to scientifically investigate the relationship between the constructs, and it has done so by evaluating the differences in the selective attention, sustained attention and attentional capacity performances of three population groups; a mindfulness group, a control group and a group of adults with attention deficit disorders.

PHYSIOLOGY

*When the breath wanders the mind also is unsteady. But when
the breath is calmed the mind too will be still*

Svatmarama

Respiration is the inspiration of oxygen (O₂) and the expiration of carbon dioxide (CO₂) in a life-giving process designed to oxygenate the cells of the body.

Respiratory parameters can be categorised in different ways: In terms of the volume and timing of oxygen consumption, the fluctuations of oxygen consumption, the exchange between oxygen inspiration and carbon dioxide expiration, and also the difference between the amount of oxygen consumed and the amount used in the metabolic process. The analysis of respiration is by far and away a more popular topic of study in the health sciences, but psychologists have examined measures of breathing too, primarily as an indicator of stress reactivity (Cannon, 1929; Suess et al., 1980) or as a tool to induce relaxation and alleviate anxiety disorders marked by hyperventilation (Benson, 1984; Han et al., 1996).

In 1929 Cannon developed what is well known in current psychological literature as the *flight or fight response*, also referred to as *the stress response*. According to this theory, each human being has a unique homeostatic level of arousal for premium functioning and when presented with events that significantly increase

this level of arousal, such as fearful or stressful circumstances, the body releases chemicals that trigger increases in heart rate, blood pressure, muscle tension, pupil dilation and rapid and shallow respiration. These responses prepare the body for either fight or flight depending on the context and situation (Cannon, 1929). This was the first scientific theory to link respiration and stress. Later in the twentieth century, Benson (1984) identified the opposite bodily reaction to stress and termed it *the relaxation response*. This response is believed to reduce the negative impacts of stress by consciously slowing the pace and volume of breath in stressful situations to combat the automatic stress response. The two basic components to the relaxation response do not differ tremendously from the efforts of mindfulness practice and include (a) maintaining a non-judging, passive attitude towards everyday thoughts and (b) concentrating on the breath. In both mindfulness practice and the relaxation response the emphasis is on diaphragmatic breathing, which exercises the diaphragm in the breathing cycle as opposed to the intercostal muscles, the latter of which is considered abnormal breathing and associated with hyperventilation, anxiety and panic attacks (Han et al., 1996). Diaphragmatic breathing involves contracting the diaphragm muscle, which sinks the lungs downward, causing them to fill and flare the ribs outwards, as such the chest and abdominal muscles are not used and this type of breathing alters the autonomic nervous system. In line with Benson's theory, modifying and regulating respiration helps to reduce somatic complaints, anxiety levels, decreases the frequency and intensity of panic attacks and improves stress coping (Han et al. 1996). Regulating respiration additionally helps to reduce subjective distress (Clark et al., 1985; Grossman et al., 1985).

The sub-discipline of psychophysiology in psychology has produced additional evidence that different respiratory patterns are associated with different emotions (Bloch et al., 1991). Having said this, contemporary respiratory research is sparse when compared to investigations into the relationships between emotion and cardiovascular variables and skin conductance, and the reason is mostly due to the setbacks associated with respiratory measuring techniques, which are either too invasive, too complicated or too imprecise (Boiten, Frijda & Wientjes, 1994). Nevertheless studies that have been conducted on the relationship between respiration and positive affect, affirm what one would expect, that relaxed and calm states are related to slow breathing (Nakamura, 1984). Furthermore, many negative emotional states appear to correspond with an *increase* in respiratory activity (Boiten, Frijda &

Wientjes, 1994), and in particular, an increased respiratory rate combined with an excessive elimination of CO₂ compared to that produced by the metabolic process (Suess et al., 1980). It has further been suggested that respiratory rates can be voluntarily slowed to better cope with stressful situations (Grossman, 1983). Moreover, effortful cognitive tasks requiring concentrated sensory attention and the suppression of distracting thoughts and movements, coincide with a decrease in depth and variability of breathing and also an increase in respiratory rate (Boiten, Frijda & Wientjes, 1994). This is particularly pertinent evidence for this study of mindfulness, which employs respiration testing as a marker of stress response and stress coping during demanding cognitive tasks requiring sustained attention and inhibition.

In this study respiration is a key variable measured in terms of oxygen consumption (VO₂), metabolic consumption of oxygen (RQ), and respiratory rates (Ve), for a comprehensive understanding of how respiratory patterns relate to mindfulness and whether those associated with mindfulness indicate reduced stress levels and an enhanced ability to self-regulate the stress response. Oxygen consumption (VO₂) refers to the amount of oxygen intake in millilitres per minute, metabolic consumption of oxygen (RQ) refers to how much of that oxygen is actually used by the body in the metabolic process, and acts as a marker for sympathetic nervous activity and stress response. Respiratory rate on the other hand, refers to the number of inhalations per minute, with an increased rate of inhalations suggesting higher levels of anxiety and stress. It is assumed that the mindfulness group will show a significantly reduced respiratory rate compared to the control and attention deficit groups, during an initial baseline recording – as an indicator of positive affect and relaxation – the groups will respond equally to the stressful task, indicated by significantly increased and shallow respiratory patterns, and the mindful group will be significantly quicker to regulate the stress response, indicated by a sharper return to baseline measures following the cognitive tasks. These assumptions are based on the fact that mindfulness training employs breath-control to induce relaxation as a means of stress coping.

While it is obvious that the literature on emotion-respiration relationships is still relatively scarce and many studies that do exist, are weakened by methodological shortcomings, it can be deduced that certain patterns of respiration do correlate with dimensions that define aspects of emotions, and particularly relevant to this study, is

the fact that the rapid shallow breathing pattern is certainly the most extensively documented and well-associated with taxing mental tasks and stress in general.

AIMS OF THE STUDY

In summary, this study sets out to illustrate the relationship between mindfulness and affect, cognition and physiology, through a cross-sectional examination of three sample groups; one high in mindfulness, one normal control group, and one attention deficit group. In this study *mindfulness* is defined as a state of heightened present-moment awareness engendered through attentional-control training, *affect* is studied according to self-reports of satisfaction of life and emotional well-being, *cognition* is explored in terms of selective attention, sustained attention and attentional capacity, and *physiological reactivity to stress* is evaluated on the basis of respiration measures including oxygen consumption (VO_2), metabolic oxygen consumption (RQ), and respiratory rates (V_e).

The greater body of mindfulness research to date relies on pre- and post-mindfulness intervention self-reports of functioning and psychological well-being. Although this study relies in part on self-reports, *its particular contribution* lies in exemplifying the attentional and physiological correlates of mindfulness – measures less susceptible to manipulation under the sway of social desirability. In addition to the value of introducing direct testing of the physical and mental correlates of mindfulness, this is the first scientific study to delineate attentional concomitants of mindfulness – even though mindfulness is considered an attentional control strategy. The findings of this research thus stand to contribute to the current body of knowledge on mindfulness, by scientifically exploring this fundamental premise. This is also the first study of its kind to explore the relationship between mindfulness and respiratory patterns, as markers of physiological stress reactivity – contributing in the form of scientific investigation, to the assertion that mindfulness nurtures stress coping resources.

Chapter Two of this dissertation offers a detailed account of the methodological approach to the study, and this is preceded by a presentation of the results in Chapter Three, and a discussion of the findings in Chapter Four.

CHAPTER TWO

RESEARCH DESIGN AND METHOD

REITERATING THE PURPOSE AND AIMS OF THE STUDY

The current study adopted positive psychology ideals in an endeavour to ascertain whether learnt mindfulness augments well-being and mental performance. To this end the study set out to examine the relationship between learnt mindfulness and affect, cognition and physiological reactivity to stress, in an investigation of three sample groups, one trained in mindfulness (mindful), one control group (control) and one group of adults with attention deficit disorders (attention deficit). *Affect* was studied according to subjective well-being, comprising satisfaction with life and emotional well-being, *cognition* was studied according to attention, comprising selective attention, sustained attention and attentional capacity, and *physiological reactivity to stress* was studied according to respiratory patterns of oxygen consumption (VO_2), metabolic consumption of oxygen (RQ) and respiratory rates (V_e). It may be summarised then that in a quantitative empirical exploration, a cross-sectional survey design was applied and the variables comprised (a) learnt mindfulness, (b) satisfaction with life, (c) emotional well-being, (d) selective attention, (e) sustained attention, (f) attentional capacity, (g) oxygen consumption, (h) metabolic consumption of oxygen, and (i) respiratory rates.

Subjective well-being was delineated in terms of satisfaction with life and emotional well-being with the latter defined as a frequent positive affect and infrequent negative affect (Myers & Diener, 1995). These variables were assessed using self-reports, which are considered a reliable method of measuring the constructs (Veenhoven, 1991). The subjective well-being construct was included in the study to add to the current body of literature demarcating the relationship between the two variables, through the first cross-sectional investigation of their association. *Cognition* was explored through the faculty of attention, and although mindfulness is commonly referred to as an attentional control strategy, scientific evidence of a relationship between the two constructs is notably absent in the corpus of mindfulness research, and it was thus decided to research the seemingly obvious association. In studying the

relationship between learnt mindfulness and attention, concentrated uses of attentional resources were evaluated in the three groups. Attention was defined as a means of processing selective information through the senses, stored memories and other cognitive processes, both above and below the threshold of consciousness (Sternberg, 1999). Lastly, respiration was considered a key variable in the study as a *physiological marker of stress* – certain respiratory patterns are indicative of the stress response (Boiten, Frijda & Wientjes, 1994) as well as self-regulation of the stress response (Grossman, 1983). Two respiratory patterns were hypothesised: Significantly reduced respiratory patterns in the mindfulness group during baseline recordings compared to the control and attention deficit groups, indicative of positive affect and reduced stress (Nakamura, 1984), and a significantly sharper return to baseline respiratory patterns from the attention deficit group to the control group, and from the control group to the mindfulness group, following the cognitive tasks, indicative of an improved self-regulation of the stress response. This research study was designed around eight primary hypotheses and five secondary hypotheses.

Hypotheses

Primary hypotheses

1. There is a significant difference in group mean scores of mindfulness, with increased levels in the mindful group compared to the control group, and in the control group compared to the attention deficit group.
2. There is a significant difference in group mean scores of satisfaction with life, with increased levels in the mindful group compared to the control group, and in the control group compared to the attention deficit group.
3. There is a significant difference in group mean scores of emotional well-being, with increased levels in the mindful group compared to the control group, and in the control group compared to the attention deficit group.
4. There is a significant difference in group mean scores of selective attention, with increased levels in the mindful group compared to the control group, and in the control group compared to the attention deficit group.
5. There is a significant difference in group mean scores of sustained attention, with increased levels in the mindful group compared to the control group, and in the control group compared to the attention deficit group.

6. There is a significant difference in group mean scores of attentional capacity, with an increased capacity noted in the mindful group compared to the control group, and in the control group compared to the attention deficit group.
7. There is a significant difference in group mean baseline respiratory patterns, with reduced patterns in the mindful group compared to the control group, and in the control group compared to the attention deficit group.
8. There is a significant difference in group mean percentage decreases in return to baseline respiratory patterns, with increased percentages in the mindful group compared to the control group, and in the control group compared to the attention deficit group.

Secondary hypothesis

9. There is a significant correlation between mindfulness and satisfaction with life.
10. There is a significant correlation between mindfulness and emotional well-being.
11. There is a significant correlation between mindfulness and selective attention.
12. There is a significant correlation between mindfulness and sustained attention.
13. There is a significant correlation between mindfulness and attentional capacity.

RESEARCH METHOD

Research design

The development of the MBSR programme in 1979, provided researchers with a tool to measure mindfulness increases and concomitant increases in a variety of psychological and physiological parameters. The bulk of subsequent research has applied *longitudinal designs* to measure pre- and post-intervention scores to better understand the impact of mindfulness on mood, empathy, compassion, self-regulation and stress reduction, with a negligible few adopting *randomised controlled* techniques. The interest of this study however, lay not in the *concurrent fluctuation* of psychological and physiological parameters as mindfulness increases over time, but in establishing the *relationship* between mindfulness, subjective well-being, attention and respiratory patterns in populations presenting varying *degrees* of mindfulness. As such, a cross-sectional survey design was favoured. This is also one of the first

mindfulness studies to adopt such a research design, therefore adding significantly to the understanding of these relationships. Secondly, the cross-sectional survey design made it possible to conduct this study within the timeframe stipulated for an MA dissertation.

Sample

A cross-sectional survey design assumes that the groups employed in the study differ in terms of the criteria being measured. In accord, specific inclusion and exclusion criteria governed the recruitment of participants in each of the three sample groups in this study – the inclusion and exclusion criteria are laid out in Table 1. Explicitly, the mindful group was expected to represent a population trained in mindfulness, with no prior history of attention deficit or mood disorders, the control group was expected to represent the normal population, with no exposure to mindfulness nor history of attention deficit or mood disorders, and the attention deficit group was expected to represent a population of attention deficit disorder sufferers, with no prior exposure to mindfulness nor history of mood disorders. By placing the mindful group and the attention deficit group at two ends of a continuum in the research design, with the control group setting the benchmark performance, it became possible to take a comparative look at how mindfulness relates to potentially different attentional performances. By including the attention deficit group it also became possible to evaluate the relationship between attention deficits and subjective well-being, and attention deficits and reactivity to stress, two immature areas of research.

In order to ensure that the groups included in the study met the inclusion and exclusion criteria, and that differences between them were amplified, a *purposive criterion sampling procedure* was employed. Although these criteria added to the challenge of finding suitable participants, every effort was made to reduce variability between the groups in terms of sex, age and occupational status. Participants in each group were recruited using a *snowballing technique*; mindfulness practitioners were requested to take part in the study and asked to extend this invitation to colleagues, individuals representing the normal population were invited to form part of the control group and asked to invite the participation of peers, and attention deficit support group facilitators were asked to assist in the recruitment of adults with attention deficit disorders, also representative of the total sample.

Table 1

Criteria governing the inclusion and exclusion of participants

Group	Inclusion Criteria	Exclusion Criteria
Mindful	Subjects who had undergone MBSR training and practiced for a minimum of six-months after completing the intervention	Subjects who had previously been diagnosed with an attention deficit or mood disorder
Control	Subjects considered representative of the normal population	Subjects who had undergone meditation or mindfulness training, or been diagnosed with an attention deficit or mood disorder
Attention deficit	Subjects diagnosed with an attention deficit disorder by a healthcare professional	Subjects who had undergone meditation or mindfulness training, or been diagnosed with a mood disorder

The research procedure

The three groups that took part in the study were subjected to the same testing procedures and the testing of participants from each group was randomised to control for internal bias. The testing took place in an experimental laboratory at the Sports Science Institute of South Africa, in Cape Town, and participants were tested individually in sessions lasting approximately one hour. Prior to the commencement of each session, a 30-minute laboratory preparation was conducted involving the collection, arrangement and preparation of testing equipment, which included the sterilisation of respiration masks and turbines for physiological testing. In addition, the Oxycon Alpha Analyser was prepared by calibrating the gas meters with a 3-litre syringe and calibrating the analysers with a gas mixture containing 4.5% CO₂. The preparation procedure ensured that the laboratory was orderly and ready for testing to avoid delays, which may have created stress in participants and potentially confounded the test results.

In *phase one* of the testing sessions, participants received a detailed verbal account of the study and its aims and a description of the testing procedure. Brief

patient histories were taken to ensure the absence of recent traumatic events, which also may have interfered with test performances and baseline stress levels. Participants then completed consent and personal information forms for the compilation of descriptive data, and these forms are outlined in Appendices A and B respectively. Once questions regarding the study had been answered, two questionnaires were administered (a) the Mindfulness Attention Awareness Scale (MAAS), and (b) the Satisfaction With Life Scale (SWLS), which have been outlined in Appendices C and D respectively. Participants were then asked to rate their subjective emotional well-being.

Phase two of the testing session involved the physiological and attentional testing. After fitting a respiration mask, five-minute baseline measures of respiration were recorded electronically (epoch I) using the Oxycon Alpha Analyser. During this time subjects were asked to relax and breathe normally. In the sixth minute of respiration recording, the instructions for the Stroop Task were explained and the two-minute test was conducted three times (epoch II and III). The instructions for the Sustained Attentional Response Task (SART) were then communicated and the 4.3-minute test was administered twice (epoch IV and V). Once the attentional testing was complete, participants were invited to sit in quiet contemplation for a further four minutes, in which return to baseline respiration was monitored (epoch VI). Participants then underwent a three-minute Digit Span test of attentional capacity and were invited to share their experiences of the testing procedure, for the benefit of guiding future research. Selected activities during these testing sessions have been photographed and are displayed in Appendix E.

Following each testing session the laboratory and equipment were cleaned and the consent forms, questionnaires and respiration print-outs were collected. The Stroop and SART test results were also calculated and saved onto disk and the data was recorded in electronic files. The final results were transferred to an Excel spreadsheet and once all the testing was complete, the full complement of raw data was captured on Statistica 7 for final analysis.

Measuring instruments

Mindfulness

The Mindfulness Attention Awareness Scale (MAAS)

The MAAS is a six-point scale measuring individual frequencies of mindful states over time. A participant's mindfulness score is calculated as the mean of these 15 items ranging from one to six as mindfulness increases. A population mean of 3.8 ($SD = 0.64$) has been calculated (Brown & Ryan, 2003). The scale was developed by Brown and Ryan in 2003 and has been validated in student, community and clinical samples. In a study exploring the correlation between mindfulness and well-being, the stability of the scale was tested in terms of test-retest reliability and the two values showed a non-significant difference (Time 1 = 3.78 and Time 2 = 3.77). Subsequent studies have confirmed the factor structure and reliability of the MAAS, and internal consistency on a sample of normal adults was reported by Cronbach's $\alpha = .87$ (Brown & Ryan, 2003). In addition incremental validity results have shown that the MAAS well-being relations cannot be explained by social desirability and there is no positive association between the MAAS and public self-consciousness or self-monitoring (Brown & Ryan, 2003). Since the MAAS was only developed in 2003 its application has been limited but following extensive testing of the scale's ability to measure mindfulness as a construct, and specifically in the monitoring of improved well-being, its suitability for this study can be justified. In addition, the instrument has tested effective across clinical and normal population groups and is deemed suitable for the target group in this study.

Subjective well-being

Satisfaction With Life Scale (SWLS)

The SWLS is a short, five-item instrument on a seven-point scale measuring global cognitive judgments about life. The scale takes approximately one minute to complete and has become a popular tool for measuring the *cognitive* component of subjective well-being, namely satisfaction with life. In this endeavour it attempts to assess individual, conscious evaluations or judgements of life, according to their own personal criteria. This scale was developed by Diener (1985) and a Cronbach's α of 0.86 has been reported with a population mean of 23.5 ($SD = 6.43$) (Diener, Emmons, Larsen & Griffin, 1985). The scale has been widely applied in clinical population groups and general population groups (Diener, Emmons, Larsen & Griffin, 1985;

Diener, Suh & Oishi, 1997; Myers & Diener, 1995; Pavot & Diener, 1993; Test et al., 2005).

Emotional well-being

In this measure of emotional well-being, participants were requested to rate their subjective well-being, explained as a frequency of positive emotions and infrequency of negative emotions, on a scale from one to 10; one being low and 10 being high. The test was originally generated for the purpose of this study to evaluate the *affective* component of subjective-well-being, namely emotional well-being. Although multiple-item scales offer improved reliability, emotional well-being has most commonly been measured by means of such simple single-item self-reports and evidence confirms the validity, internal consistency, temporal stability and convergence with non-self-report measures (Diener & Lucas, 2000). In the case of this study, the single-item test was developed based on guidelines provided by Argyle (2001), Diener and Lucas (2000) and Strack, Argyle and Schwarz (1991).

Cognitive Tests of Attention

The Stroop Task

The Stroop task is a common diagnostic tool for testing attentional problems. The *Stroop Effect* or *Interference*, as it is also known, is named after Ridley Stroop who discovered the phenomenon in 1935. The test was initially designed in the form of a reading card, presenting a number of words of colours, printed in different colour inks. The test subject was to respond as quickly and accurately as possible to the *colour* of the word, as opposed to the written word – according to Stroop (1935), the word itself interferes with the task of naming the colour because the process of reading is more automated. The Stroop Task is subsequently a test of selective attention and inhibition, which in the words of Stroop (1935), employs mental flexibility and resistance to interference from outside stimuli that influence the ability to cope with cognitive stress and the processing of complex input. In this study the Stroop Task was applied as a computer test in which 73 words of colours were displayed on a blank screen at intervals of 1600-milliseconds, and printed in one of four different colours. Participants were required to respond to the *colour* of the word by depressing a corresponding key on the keyboard. The test was administered three times and the scores were added and divided by three for a total score on the advice of

the developers (Rauch et al., 2005). Two scores are ultimately produced: (a) accuracy, reflected by the number of errors scores in the series, and (b) speed, the average time taken to respond to the colours. The emphasis in this study lay in accuracy. The Stroop Task has proved to have sound validity and reliability in numerous comparative studies with clinical and healthy samples (MacLeod, 1991), and a slightly revised version of the computerised test used in this study, proved valid in samples of normal and attention deficit disorder groups, and reported a normal population mean (error scores) of 6.3 ($SD = 3.5$) (Rauch et al., 2005).

Sustained Attention to Response Task (SART)

This is a test of *sustained attention* and inhibition in which 225 single digits are displayed on a computer screen over 4.3 minutes. Each digit is thus displayed for 250 milliseconds followed by a 900-millisecond pause. Subjects are required to press a designated key on the computer keyboard each time a digit is displayed, except in the case of the number '3', when a response needs to be withheld. Two scores are ultimately produced (a) accuracy, reflected by the number of errors scores, and (b) speed, the average time taken to respond. Again, a primary interest of this study lay in the accuracy scores. The test was administered twice and the scores were added and divided by two for a total score. In a normal population group, the mean error score on the SART was 4.56 ($SD = 4.88$) and the test has proved reliable and stable over time – when the test was administered on two separate occasions over a two-week period, the Pearson's correlation in the error scores between these times was 0.76 (Roberston et al., 1997).

Digit Span

The Digit Span is a common, albeit a relatively crude assessment of attentional capacity (working memory). The test involves an examiner reading a sequence of random digits (digit span) aloud at a steady rate and at the end of the sequence subjects are expected to repeat the digits in the order they were given. The examiner begins with three digits and advances one digit at a time to arrive at nine digits. The average digit span for normal adults is 6-7 (Iverson & Tulsky, 2003; Karakas et al., 2002; Wechsler, 1981). The Digit Span was first developed by Jacobs in 1887 to assess memory in school children, and it was later included as a measure of short-term memory in the Binet-Simon IQ test in 1905.

Physiological testing

Respiration

Respiration was assessed using the breath-by-breath Oxycon Alpha Analyser to measure uptake of oxygen (VO_2), metabolic consumption of oxygen (RQ) and respiratory rates (V_e) at 30-second intervals. Prior to testing the gas meters were calibrated with a three-litre syringe and the analysers were calibrated with the gas mixture containing 4.5% of CO_2 , the remainder being made up of N_2/O_2 mixture. The participants wore an airtight mask covering the nose and mouth and measures of respiration were taken for a five-minute baseline recording prior to the commencement of attentional testing (epoch I), during the testing (epochs II, III, IV and V), and for a further four-minute interval following the attentional testing (epoch VI), to measure return to baseline patterns. Although it is unusual for the Oxycon Alpha Analyser to be used in research studies investigating the relationship between respiration and emotion, the Analyser was a preferred choice in this study due to its ability to record gas exchange parameters and thus facilitate the measurement of breathing rate, oxygen consumption and metabolic oxygen consumption – a more comprehensive interpretation of respiratory patterns was thus afforded.

Measures of heart rate variability (HRV) were also collected for this study, using the Polar Heart Rate Monitor. Like the respiration measures, heart rate was recorded for a five-minute period prior to the attentional testing, during testing and again for a four-minute period after testing. HRV measures the beat-to-beat fluctuation of the heart's rhythm, indicative of the degree of balance in sympathetic and vagus nerve activity. This variability is a measure of the heart's ability to respond to normal regulatory impulses associated with stress, anxiety and dysphoric mood (Nolan, 2003), while cardiac vagal tone is an accepted means of assessing stress response and the vulnerability to stress (Porges, 1992). It was unfortunately not possible to include the HRV data in the final analysis of the study due to equipment failure, which corrupted a major portion of the HRV results. Having said this, oxygen uptake is an acute physiological measure and sufficient to stand alone as a marker of stress.

ETHICAL CONSIDERATIONS

A research study requesting the participation of human subjects is required to fully brief participants, obtain their written consent to take part and condone their withdrawal from the study at any stage (Mouton, 2003). To adhere to these ethical mandates, participants in this study were fully briefed at the outset of testing, both verbally and in writing, and were requested to sign an informed consent declaration. Participants were also assured confidentiality.

The physiological tests in the study were non-invasive and presented minimal risk to participants. Although participants in the attention deficit group of the study may be considered vulnerable as a result of their clinical diagnoses, it was not envisaged that the testing would cause them any unease, and as a cautionary measure, a clinical psychologist was available for consultation.

Further to this, the test results were made available to participants and they therefore stood to benefit from the study by learning more about their mindfulness levels, subjective well-being, cognitive performance and physiological responses. In addition, the research contributes to the current body of knowledge on mindfulness by validating the association between increased levels of mindfulness, mental performance and physiological states, while providing a platform on which to support further research into the use of mindfulness to enhance attentional performance in those with attention deficits, and to improve general functioning in normal population groups.

CHAPTER THREE

RESULTS

DATA ANALYSIS

Initial descriptive statistics were conducted on the variables age, sex and occupational status in order to delineate the sample profile (Table 3). To test the eight primary hypotheses, one-way analyses of variance (ANOVA) were conducted separately for each of the variables, using planned comparisons to establish whether there was a significant difference between group performances on the tests, and that the mindful group performed better than the control group, and that the control group performed better than the attention deficit group. Planned comparisons are preferable when testing hypothesised *patterns* in group scores, which were proposed prior to the collection of data (Howell, 1997). An alpha level of .05 was used for all statistical tests and the planned comparison coefficients for each group were based on their predicted patterns of performance and are outlined in Table 2. Levene's test of homogeneity was conducted on the raw data for each variable, and although the *mean percentage decrease of oxygen consumption* (VO_2) failed to meet Levene's acceptance criteria, the data was still distributed normally and did not warrant transformation according to specifications stipulated by Howell (1997). Further correlation analyses were performed to test the secondary hypotheses to evaluate the relationship between mindfulness satisfaction with life, emotional well-being, selective attention, sustained attention and attentional capacity.

Table 2

Group coefficients used in the ANOVA planned comparisons

Mindful group	Control group	Attention deficit group
1	0	-1

Sample profile

The sample comprised a total of 33 participants ($N=33$), with $n=11$ in each of the three groups – the mindful group, control group and attention deficit group. A larger sample size would have been preferable, however a total of 50 hours was spent on data collection, including test preparations, to facilitate the individual testing of participants, which is all that could be accommodated within the timeframe allocated for the study. It was preferable to test the participants individually for a number of reasons: To avoid distraction in the attentional tasks, to accommodate the physiological testing, and to enhance the reliability of the test results. Of the full sample 45% were male (M age = 36) and 55% female (M age = 36) with a mean age of 36 ($SD = 9.64$). Occupational status was divided into four categories (a) post-graduate student, (b) support and administration staff, (c) managerial staff/ small-business owner, and (d) professional in private practice. The average occupational status of the full complement of participants was category three ($SD = 1.29$). The descriptive statistics for individual groups have been delineated in Table 3.

Table 3

Sample profiles for each group in the study

	Female	Male	Age	Occupation
Mindful	$n = 6$	$n = 5$	$M = 39, SD = 7.4$	$Mdn = 4$
Control	$n = 8$	$n = 3$	$M = 32, SD = 10.4$	$Mdn = 3$
Attention deficit	$n = 4$	$n = 7$	$M = 38, SD = 10.08$	$Mdn = 3$

PRIMARY ANALYSES

Mindfulness

A one-way analysis of variance with groups as a factor was computed, using planned comparisons, to determine whether there were significant differences in the group mean scores of mindfulness. The group mean scores have been depicted in Figure 1. As predicted, the F -ratio was significant with the mindfulness score of the mindful group being significantly higher ($M = 4.6, SD = 0.4$) than that of the control group ($M = 3.9, SD$

= 0.5), and that of the control group being significantly higher than the attention deficit group ($M = 2.9, SD = 0.8$), $F(1,30) = 47.231, p < .01$; the ANOVA summary table is outlined in Table 4.

Table 4

Analysis of variance for mindfulness

Source	SS	df	MS	F	p-level
Effect	16.288	1	16.288	47.231	<0.01
Error	10.346	30	0.345		

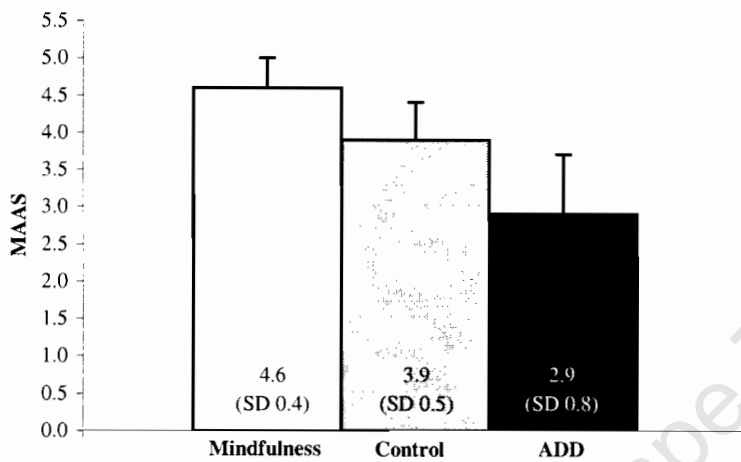


Figure 1. The group mean scores for mindfulness (MAAS)

Subjective well-being

Two separate components of subjective well-being were measured. The first was the cognitive component, satisfaction with life, and the second, the affective component, emotional well-being.

Satisfaction with life

Satisfaction with life was measured using the Satisfaction With Life Scale (SWLS) and a one-way analysis of variance, using planned comparisons, revealed significant differences in the group mean scores, with higher scores in the mindful group ($M = 28.4, SD = 3.04$) compared to the control group ($M = 27.7, SD = 5.82$), and in the control group compared to the attention deficit group ($M = 21.14, SD = 6.22$), F

(1,30) = 10.764, $p < .01$. The ANOVA summary table is outlined in Table 5 and the differences in group means, is depicted in Figure 2.

Table 5

Analysis of variance for satisfaction with life

Source	SS	df	MS	F	p-level
Effect	290.909	1	290.909	10.764	0.003
Error	817.636	30	27.255		

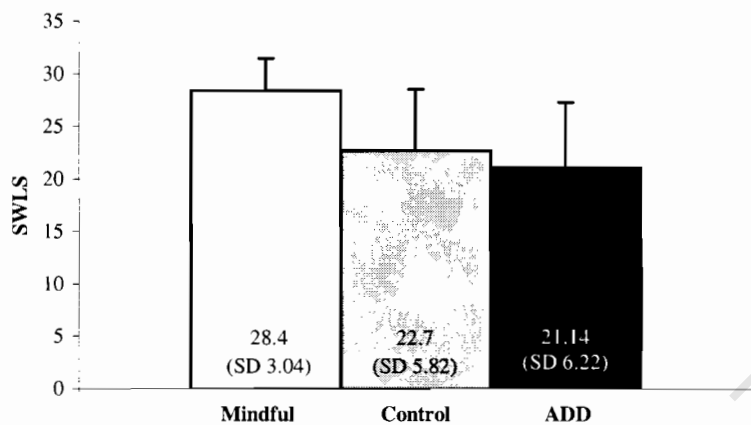


Figure 2. The group mean scores for satisfaction with life (SWLS)

Emotional well-being

Participants rated the second measure of subjective well-being, emotional well-being, on a scale from one-10. A one-way analysis of the variance, using planned comparisons, revealed significant differences in the group mean scores with higher mean ratings of emotional well-being in the mindful group ($M = 7.9$, $SD = 0.8$) compared to the control group ($M = 6.8$, $SD = 1.5$), and in the control group compared to the attention deficit group ($M = 6.4$, $SD = 1$), $F(1,30) = 9.229$, $p < .01$. The ANOVA summary table is outlined in Table 6 and the group mean increases are depicted in Figure 3.

Table 6

Analysis of variance for emotional well-being

Source	SS	df	MS	F	p-level
Effect	12.375	1	12.375	9.229	0.005
Error	40.227	30	1.341		

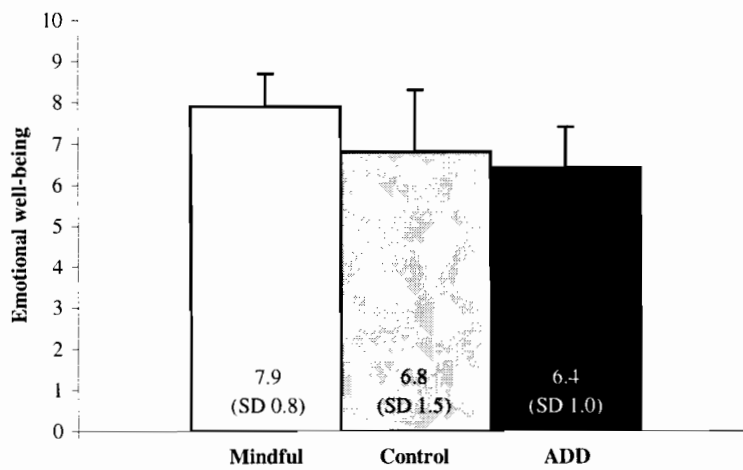


Figure 3. The group mean ratings of emotional well-being

Attention

The cognitive faculty of attention in this study was divided into three components, selective attention, sustained attention and attentional capacity. The selective attention and sustained attention scores were reflected as error scores, thus a lower score implies a better performance.

Selective attention

Selective attention was measured using the Stroop Task and an analysis of variance, using planned comparisons, revealed a significant difference in the group mean error scores with fewer errors made by the mindful group ($M = 5.2$, $SD = 4.7$) compared to the control group ($M = 14.3$, $SD = 9.9$), and fewer errors made by the control group compared to the attention deficit group ($M = 14.5$, $SD = 11.1$), $F(1,30) = 5.861$, $p < .05$. The ANOVA summary table is outlined in Table 7 and the group mean scores are illustrated in Figure 4.

It is also important to mention here that no significant differences were observed in the group mean *response times* on the Stroop Task $F(1,30) = 0.083$, $p = .776$, as outlined in Table 8.

Table 7
Analysis of variance for selective attention error scores

Source	SS	df	MS	F	p-level
Effect	472.909	1	472.909	5.861	0.022
Error	2420.545	30	80.685		

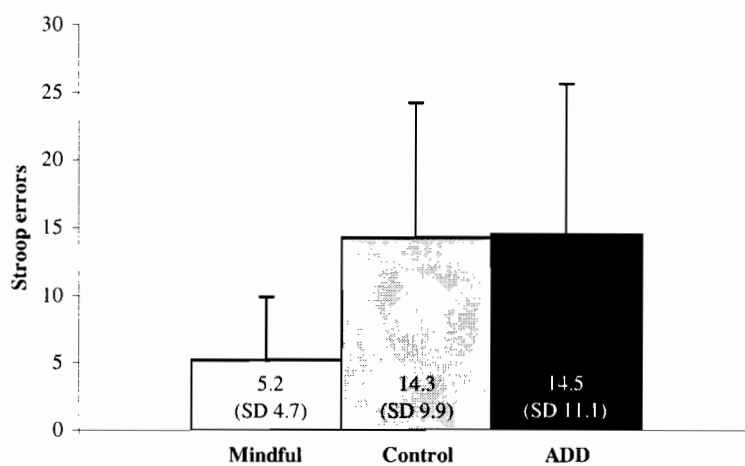


Figure 4. The group mean error scores for selective attention (Stroop Task)

Table 8
Analysis of variance for selective attention response time

Source	SS	df	MS	F	p-level
Effect	840.73	1	840.73	0.083	0.776
Error	305142.2	30	10171.41		

Sustained attention

The SART test was used to measure sustained attention, and a one-way analysis of variance, using planned comparisons, revealed a significant difference between the group mean scores with the mindful group ($M = 3.5$, $SD = 3.0$) making fewer errors than the control group ($M = 4$, $SD = 3.2$), and the control group making fewer errors than the attention deficit group ($M = 7.6$, $SD = 5.7$), $F(1,30) = 5.450$, $p < .05$. The ANOVA summary table is outlined in Table 9 and the differences in mean error scores is depicted in Figure 5.

As with the Stroop Task, the three groups showed no significant difference in their mean *response times* on the SART test $F(1,30) = 0.010, p = .923$, as outlined in Table 10.

Table 9

Analysis of variance for sustained attention error scores

Source	SS	df	MS	F	p-level
Effect	94.102	1	94.102	5.450	0.027
Error	518.05	30	17.268		

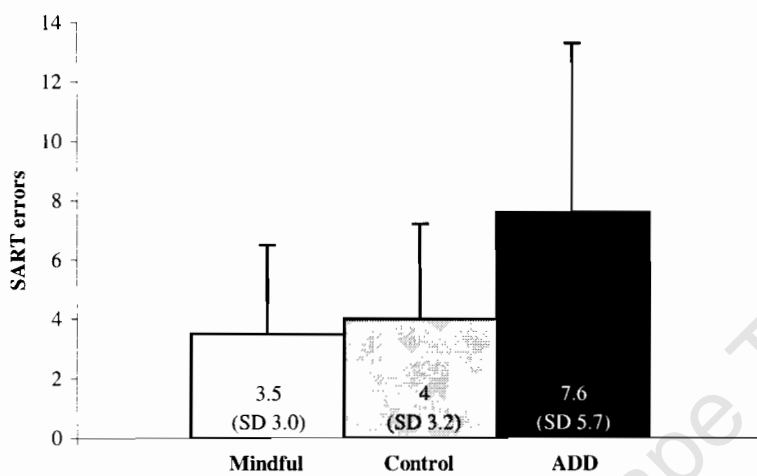


Figure 5. The group mean error scores for sustained attention (SART)

Table 10

Analysis of variance for sustained attention response times

Source	SS	df	MS	F	p-level
Effect	58.909	1	58.909	0.010	0.923
Error	184402.7	30	6146.758		

Attentional capacity

The last test of attention was that of attentional capacity, or working memory, which was measured using the Digit Span test. It was evident from a one-way analysis of variance, using planned comparisons, that the group means were significantly different and that the mindful group ($M = 8.4, SD = 0.7$) scored higher than the control group ($M = 7.3, SD = 0.8$), and the control group scored higher than the

attention deficit group ($M = 6.5$, $SD = 1.4$), $F(1,30) = 20.417$, $p < .01$. The ANOVA summary table is outlined in Table 11 and the group mean scores have been depicted in Figure 6.

Table 11

Analysis of variance for attentional capacity

Source	SS	df	MS	F	p-level
Effect	20.045	1	20.045	20.417	0.0001
Error	29.455	30	0.982		

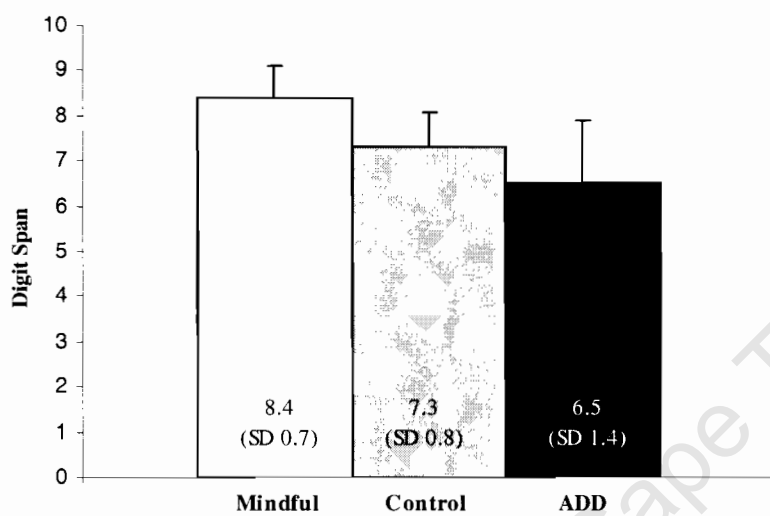


Figure 6. The group mean scores for attentional capacity (Digit Span)

Respiration

Two hypotheses were postulated to predict the respiratory patterns of the groups. The first proposed that significantly reduced respiratory patterns would be observed in the mindful group compared to the control group, and in the control group compared to the attention deficit group during the initial baseline measurements (epoch I) of oxygen consumption (VO_2), metabolic consumption of oxygen (RQ) and respiratory rate (V_e) – a lower mean indicative of a lower stress level and more positive affect (Nakamura, 1984). The second hypothesis proposed that significantly sharper *return to baseline* respiratory patterns, or return to resting patterns, would be observed following the attentional testing in the mindful group compared to the control group,

and in the control group compared to the attention deficit group – a higher percentage decrease indicative of an improved ability to regulate the stress response.

Although data was collected for the full complement of participants in the control and attention deficit groups, only eight out of the eleven sets of respiration data for the mindful group were suitable for analysis due to equipment failure. To test the first of these hypotheses, three analyses of variance were conducted.

Oxygen consumption (VO_2)

Using analysis of variance with planned comparisons, a significant difference was noted between the group means with a lower oxygen consumption (VO_2) in the mindful group ($M = 98.2$, $SD = 85.6$) compared to the control group ($M = 160.1$, $SD = 85.5$), and in the control group compared to the attention deficit group ($M = 230.7$, $SD = 135.9$), as expected $F(1,27) = 7.105$, $p < .05$. The ANOVA summary table is outlined in Table 12 and the group means are depicted in Figure 7.

Table 12

Analysis of variance for baseline oxygen consumption (VO_2)

Source	SS	df	MS	F	p-level
Effect	81366.86	1	81366.86	7.105	0.013
Error	309229.2	27	11452.93		

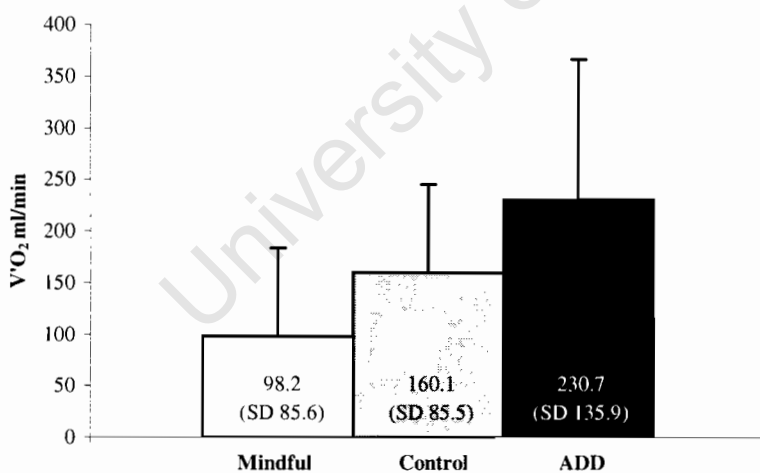


Figure 7. The group means for baseline oxygen consumption (VO_2)

Metabolic consumption of oxygen (RQ)

Using the RQ measure of metabolic consumption of oxygen, an analysis of variance, using planned comparisons, revealed that there was no significant differences in the metabolic consumption of oxygen between the mindful group ($M = 0.9$, $SD = 0.14$), control group ($M = 0.8$, $SD = 0.22$) and attention deficit group ($M = 0.8$, $SD = 0.10$), $F(1,27) = 1.332$, $p = .259$.

Respiration rate (V_e)

Using the V_e measure of respiratory rate, an analysis of variance again produced no significant differences in the baseline group means of the mindful group ($M = 5.3$, $SD = 3.35$), control group ($M = 6.5$, $SD = 2.73$) and attention deficit group ($M = 6.8$, $SD = 3.37$), $F(1,27) = 1.164$, $p = .290$. Having said this, it is apparent that the attention deficit group presented a reduced respiration rate compared to the control group and the control group presented a reduced rate to the mindful group (Figure 8).

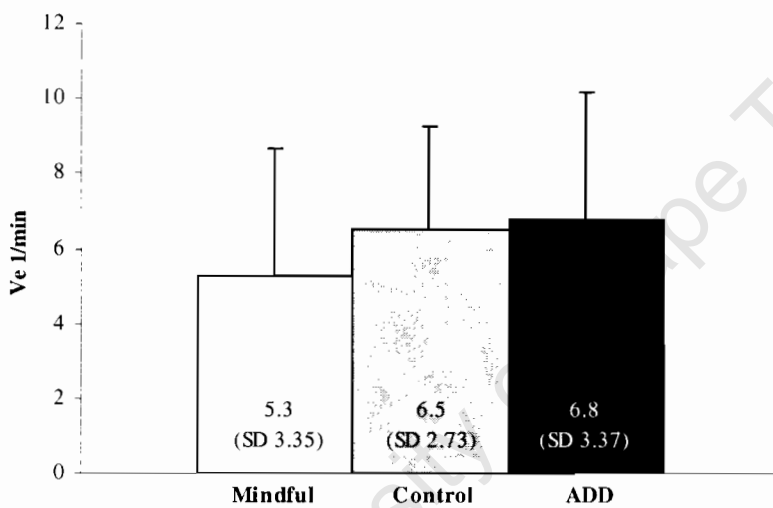


Figure 8. The group means for baseline respiratory rate (V_e)

The second hypothesis regarding respiration proposed that significantly sharper *return to baseline* of oxygen consumption (VO_2), metabolic consumption of oxygen (RQ) and respiratory rates (V_e), would be observed in the mindful group compared to the control group, and in the control group compared to the attention deficit group. To test this hypothesis it was first necessary to calculate the percentage decrease in respiration from epoch II respiration levels, a period of increased stress at the outset of testing, to epoch VI levels, a measure of return to baseline respiration, or resting respiration, following the attentional testing. This was done by dividing the mean

epoch II respiration measurement for each group from the respective epoch VI measurement and multiplying this result by 100. It may be suggested that the greater the mean percentage decrease, the greater the reduction in respiration, and thus the greater ability to self-regulate the stress response.

Oxygen consumption (VO_2)

The analysis of variance of the group mean percentage decreases of VO_2 , using planned comparisons, revealed a significant difference in the group means with the mindful group ($M = 690\%$, $SD = 793$) having a larger percentage decrease compared to the control group ($M = 315\%$, $SD = 344$), and the control group having a larger percentage decrease compared to the attention deficit group ($M = 161\%$, $SD = 82$), as expected, $F(1,27) = 6.578$, $p < .05$. The ANOVA summary table is presented in Table 13 and the data is graphically depicted in Figure 9.

Table 13

Analysis of variance for the percentage decreases of oxygen consumption (VO_2)

Source	SS	df	MS	F	p-level
Effect	1298836	1	1298836	6.578	0.016
Error	5331326	27	197457		

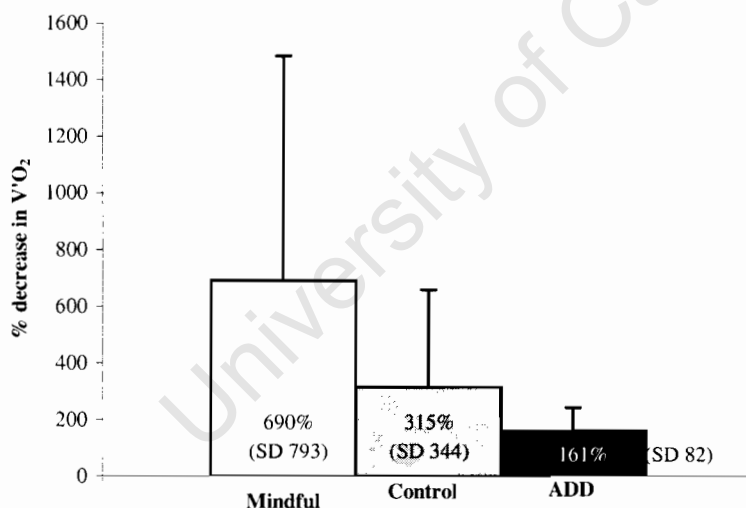


Figure 9. The group mean percentage decreases in oxygen consumption (VO_2)

Metabolic consumption of oxygen (RQ)

Using the percentage decreases of RQ, an analysis of variance, using planned comparisons, also revealed a significant difference in the group means with the

epoch II respiration measurement for each group from the respective epoch VI measurement and multiplying this result by 100. It may be suggested that the greater the mean percentage decrease, the greater the reduction in respiration, and thus the greater ability to self-regulate the stress response.

Oxygen consumption (VO_2)

The analysis of variance of the group mean percentage decreases of VO_2 , using planned comparisons, revealed a significant difference in the group means with the mindful group ($M = 690\%$, $SD = 793$) having an increased percentage decrease compared to the control group ($M = 315\%$, $SD = 344$), and the control group having an increased percentage decrease compared to the attention deficit group ($M = 161\%$, $SD = 82$), as expected, $F(1,27) = 6.578$, $p < .05$. The ANOVA summary table is presented in Table 13 and the data is graphically depicted in Figure 9.

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Error	5331326	27	197457		

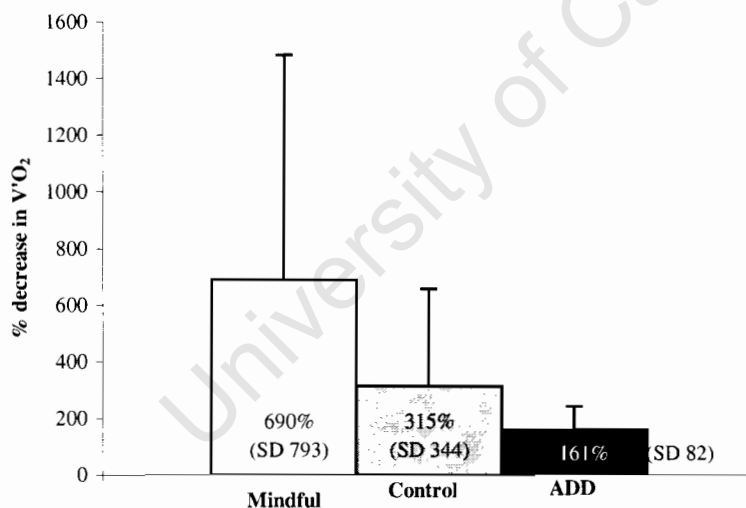


Figure 9. The group mean percentage decreases in oxygen consumption (VO_2)

Metabolic consumption of oxygen (RQ)

Using the percentage decreases of RQ, an analysis of variance, using planned comparisons, also revealed a significant difference in the group means with the

mindful group ($M = 380\%$, $SD = 506$) having an increased percentage decrease compared to the control group ($M = 134\%$, $SD = 94$), and the control group having an increased percentage decrease compared to the attention deficit group ($M = 95\%$, $SD = 11$), as expected, $F(1,27) = 5.376$, $p < .05$. The ANOVA summary table is presented in Table 14 and the mean percentage decreases are depicted in Figure 10.

Table 14

Analysis of variance for the percentage decreases in metabolic oxygen consumption

Source	SS	df	MS	F	p-level
Effect	375151	1	375151	5.376	0.028
Error	1883967	27	69777		

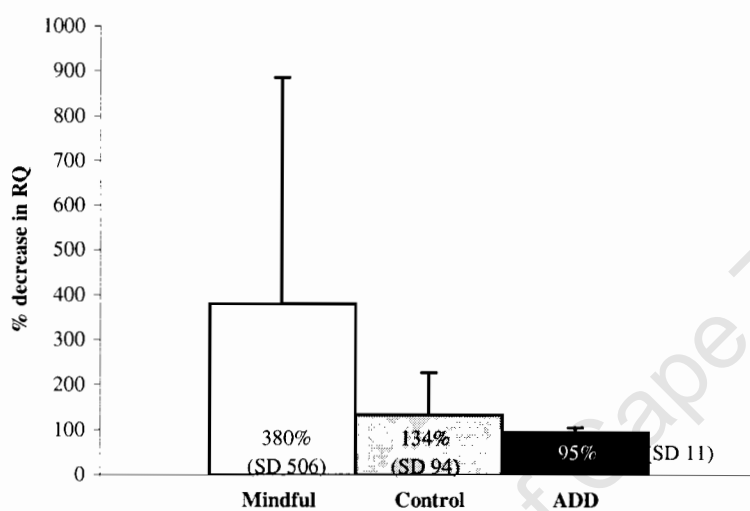


Figure 10. The group mean percentage decreases in metabolic oxygen consumption

Respiration rate (V_e)

Using the percentage decreases of V_e , an analysis of variance, using planned comparisons, revealed no significant differences in the respiratory rate percentage decreases of the mindful group ($M = 111\%$, $SD = 27$), control group ($M = 108\%$, $SD = 45$) and attention deficit group ($M = 100\%$, $SD = 50$), $F(1,27) = 0.308$, $p = .583$. The data are depicted in Figure 11.

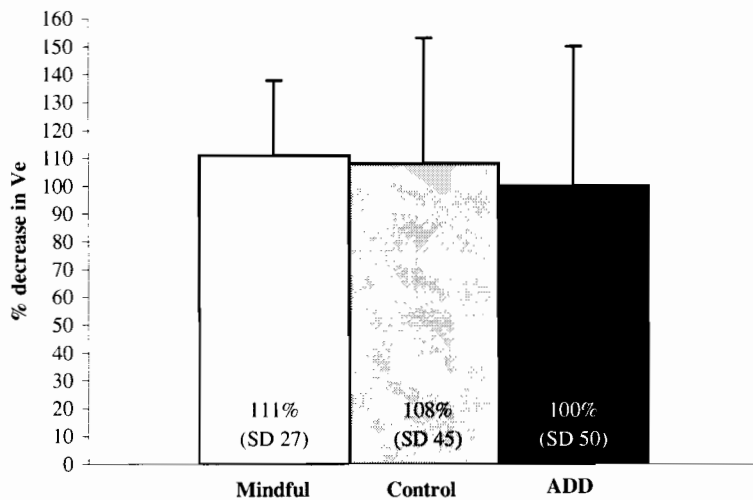


Figure 11. The group mean percentage decreases in respiration rate (Ve)

SECONDARY ANALYSES

Additional correlation analyses were conducted to ascertain the relationship between mindfulness and the subjective well-being variables – satisfaction with life and emotional well-being – and to evaluate the relationship between mindfulness and the attention variables – selective attention, sustained attention and attentional capacity. These analyses provide an overall synopsis of the association between the variables.

Mindfulness and Subjective well-being

Two correlations (Pearson Product Moment Correlation Coefficient) were calculated. The first established a significant relationship between mindfulness and the cognitive component of subjective well-being, satisfaction with life ($r = .63, p < .01$) and the second established a significant correlation between mindfulness and the affective component subjective well-being, emotion well-being ($r = .46, p < .01$), implying the higher mindfulness the higher subjective well-being.

Mindfulness and Attention

Three analyses were performed to determine the relationship between mindfulness and attention. The first correlated mindfulness and *selective attention*, as measured by the Stroop Task and although the correlation was negative, implying that an increase in mindfulness related to a decrease in Stroop errors, the correlation failed to be statistically significant ($r = -.28, p = .116$). The second analysis did however reveal a significant correlation between mindfulness and *sustained attention* ($r = -.41, p < .05$), implying that increased levels of mindfulness relate to a reduced number of errors made on the SART test. Lastly, there was a significant correlation between mindfulness and *attentional capacity*, as measured by the Digit Span test ($r = .62, p < .01$).

CHAPTER FOUR

DISCUSSION AND CONCLUSION

OPENING COMMENTS

The overarching aim of this study was to outline the relationship between mindfulness and three principal constructs – *affect*, *cognition* and *physiological reactivity to stress*. These principal constructs were narrowed down into defining features that were measured in relation to mindfulness. Affect was defined by satisfaction with life and emotional well-being, cognition was defined by attentional faculties of selective attention, sustained attention and attentional capacity, and physiological reactivity to stress was defined by oxygen consumption (VO_2), metabolic consumption of oxygen (RQ) and respiratory rate (V_e). A more general appreciation of the overall association between mindfulness and the three principal constructs was made possible by studying the relationship between mindfulness and these defining variables, and according to the research results, complex and occasional contradictory patterns emerged in these principal relationships. The results of the analyses involving these defining variables will be discussed first and an overall interpretation of how mindfulness relates to the three principal constructs will be reviewed in the concluding comments.

In this discussion, the results of analyses showing a difference in the scores of the mindful group compared to the control group, and the control group compared to the attention deficit group, by deduction, imply a difference in the scores of the mindful and attention deficit group too.

DISCUSSION OF THE FINDINGS

Mindfulness

Mindfulness was measured using the MAAS, which attempts to detect frequencies of mindfulness over time. According to the results, the mindful group was more mindful than the control group, and the control group was more mindful than the attention deficit group. On the basis of these findings, hypothesis one in the study can be accepted: There is a significant difference in group mean scores of mindfulness, with increased levels in the mindful group compared to the control group, and in the control group compared to the attention deficit group.

It can be reasonably deduced then that a relationship exists between MBSR training, combined with continued formal and informal practice of mindfulness, and an overall increase in the mindful state, however caution should be taken in assuming an underlying causal relationship between the constructs. In addition to this, it is possible to reason that the attention deficit group scored lower in mindfulness than the other two groups, due to poor behavioural inhibition and reduced sustained attention, two primary deficits in attention deficit disorders (Barkley, 1997). Behavioural inhibition is the act of withholding a response in order to facilitate intentional goal-directed behaviour, which is also known as reconstitution. This act also sets the stage for self-regulation of affect, motivation and arousal. Mindfulness relies heavily on behavioural inhibition, self-regulation and sustained attention, not only in inhibiting impulsivity, but in maintaining an ongoing awareness of internal and external states, in the interest of responding with purpose to every passing moment.

It is interesting to note that several authors have described attention deficit disorders as pathological fixations on the present moment. In this somewhat ironic portrayal, present-moment fixation refers to the impulsive and habitual behaviour and reasoning exhibited by those with attention disorders (Barkley, 1997; Ratey, 2003). In the context of this discussion it is important to make a distinction between this present-moment fixation and the present-moment awareness in mindfulness: In attending to the present moment mindfully, behavioural inhibition, sustained attention and self-regulation, are all *intentionally* exercised to (a) direct attention to the present, and (b) engage a quality of consciousness that is free of judgement, attachment and analytical contemplation. Conversely the present-moment fixation described in

attention deficit disorders is an *unmanaged* mental state, ruled by distractibility and impulsivity – the defining features of mindlessness, according to Lange (1989).

Subjective well-being

Subjective well-being has been defined by Myers and Diener (1995) as a global satisfaction with life and a frequent positive affect and infrequent negative affect. Accordingly, the construct has been divided into two measures that will be discussed separately – satisfaction with life and emotional well-being.

Satisfaction with life

Satisfaction with life was measured using the Satisfaction With Life Scale (SWLS). In the results of this study, an increase in the variable was noted from the attention deficit group to the control group, and from the control group to the mindful group, as expected. On the basis of this finding hypothesis two may be accepted: There is a significant difference in group mean scores of satisfaction with life, with increased levels in the mindful group compared to the control group, and in the control group compared to the attention deficit group. In addition, there was a significantly positive correlation between mindfulness and satisfaction with life and as such, hypothesis nine can also be accepted: There is a significant correlation between mindfulness and satisfaction with life, or, as mindfulness increases, so too does satisfaction with life.

These results imply that mindfulness is associated with higher levels of life satisfaction, and strictly speaking, that attention deficit disorders are associated with a reduced satisfaction with life. It comes as no surprise that increased mindfulness relates to life satisfaction when considering the relationship between mindfulness and subjective-well described in previous longitudinal studies. Such studies have shown mindfulness training to induce improved self-confidence, social functioning, assertiveness, motivation and to promote a greater internal locus of control (Brown & Ryan, 2003; Martin, 1997; Reibel, Greeson, Brainard & Rosenweig, 2001) – signs of enhanced well-being that could well elevate satisfaction with life. Attention deficit disorder, on the other hand, is closely associated with factors that could potentially hinder life satisfaction: Poor academic performance, poor work performance and family relations, reduced job satisfaction, and reduced self-esteem (Barkley, 1997; Barkley, 1990; Hinshaw, as cited in Barkley, 1997).

Emotional well-being

As with satisfaction with life, an increase in emotional well-being was noted from the attention deficit group to the control group, and from the control group to the mindful group in this study. On the basis of this finding hypothesis three can be accepted: There is a significant difference in group mean scores of emotional well-being, with increased levels in the mindful group compared to the control group, and in the control group compared to the attention deficit group. Further to this, there was a significant correlation between mindfulness and emotional well-being, implying that as mindfulness increases, so does emotional well-being, and on the basis of this finding, hypothesis 10 can also be confirmed.

As stated previously, mindfulness has been associated with enhancements in subjective well-being in numerous longitudinal studies (Brown & Ryan, 2003; Martin, 1997; Reibel, Greeson, Brainard & Rosenweig, 2001), defined not only as improved self-confidence, social functioning, assertiveness, motivation and internal locus of control, but also as a more frequent and intense experience of positive affect, and a less frequent and less intense experience of negative affect, the two defining features of emotional well-being. It has been suggested that mindfulness contributes to emotional well-being by adding clarity and vividness to every moment (Brown & Ryan, 2003), and by fostering self-endorsed behavioural regulation. Bohart (1983) describes the latter as *detachment* – an acquired art of distancing oneself from problems to disengage from automatic maladaptive schema and embrace new perspectives that support positive behaviour. On the other hand, in previous studies of children with ADHD, an underlying deficiency in inhibition and interference control has been associated with poor emotional regulation, leading to uncontrolled emotionality (Kopp, 1989). Furthermore, attention deficit disorders have been associated with anxiety and depression and poor family and peer relationships (Barkley, 1997), both contributors to reduced overall emotional welfare. Lastly, there is every reason to believe that reduced satisfaction with life may compromise emotional well-being.

Attention

In this study three components of attention were studied to assess the relationship between the cognitive faculty and mindfulness as comprehensively as possible. These included, selective attention, sustained attention and attentional capacity.

Selective attention

Selective attention is the act of deliberately attending to some stimuli while ignoring others; a concentrated effort that enhances the ability to manipulate received information. Selective attention was measured in this study using the Stroop Task and *error scores* were assessed to determine performance. By implication, the lower the score, the better the performance. According to the results, the mindful group made less errors than the control group, and the control group made less errors than the attention deficit group, as expected, and therefore hypothesis four can be accepted: There is a significant difference in group mean scores of selective attention, with increased levels in the mindful group compared to the control group, and in the control group compared to the attention deficit group. Surprisingly, the results of this study produced no evidence of an overall association between mindfulness and selective attention, as seen by the non-significant correlation between the constructs. Although the correlation between these constructs was negative, implying that as mindfulness increases so errors scores decrease, hypothesis 11 cannot be confirmed and no inference should be drawn regarding a correlation between mindfulness and selective attention.

These results are somewhat contradictory but nonetheless, the mindful group performed better in the Stroop Task than the control group, and the control group performed better than the attention deficit group. The practice of mindfulness, relies on the astute use of selective attention to focus the mind on what is relevant in the present moment while exercising interference control to sound out irrelevant stimuli from the internal and external landscapes. In addition, mindfulness relies on selective attention to focus the conscious mind on those thoughts and feelings that embrace the present moment with non-judgement and non-attachment while inhibiting habitual responses and appraisals. In this sense high mindfulness should translate into better-

practiced selective attention. In contrast, it has been said that attention deficit disorders are categorised by an inability to regulate executive functions² in an astute manner (Barkley, 1997), resulting in impulsive and automatic responding, which presumably compromises selective attention. A number of previous studies (Krener et al., 1993; Leung & Connolly, 1996; Seidman et al., 1996) provide support for this notion, reporting consistently poor performances on the Stroop Task by children with ADHD, across culture and despite research methodology limitations and sample sizes, based on an underlying deficiency in the control of interference from prepotent responses. The current study takes these findings one-step further by examining adults with attention deficit disorders, who frequently learn coping strategies to better manage their deficiencies, yet still present a deficit in selective attention.

One possible explanation for the insignificant correlation between mindfulness and selective attention rests on research findings from Corkum and Siegel (1993). According to these authors, those with attention deficit disorders display significantly greater variability in tasks involving reaction time and persistence within laboratory contexts, often showing improved performance since anxiety is relieved by the clear stipulation of performance expectations and test end-points.

Interestingly no differences were noted between the group means in terms of *response times* on the Stroop Task, nor was there evidence of predicted increases in response times from the mindful group to the control group, and from the control group to the attention deficit group. In terms of the primary interest in mindfulness here, it can thus be concluded that more mindful individuals appear to be more concerned with accuracy than speed as they were slow and contemplative in their responding but focused and accurate in their performance.

Sustained attention

Sustained attention involves paying attention for extended periods of time to selected stimuli and in this study the construct was measured using the SART. As with selective attention, error scores were calculated and by implication, a low score implies an improved performance. In terms of the error score results, the mindful group performed better in sustained attention than the control group, and the control group performed better than the attention deficit group. On the basis of this finding,

² Executive functioning refers to high-level self-directed cognitive actions that contribute to self-regulation.

hypothesis five can be accepted: There is a significant difference in group mean scores of sustained attention, with increased levels in the mindful group compared to the control group, and in the control group compared to the attention deficit group. Importantly, the overall correlation between mindfulness and sustained attention was also significant supporting hypothesis 12: As mindfulness increase so does the ability to sustain attention.

Sustained attention relies on the ability to regulate arousal, motivation and interference stemming from internal and external sources to maintain focused concentration in line with goal-directed behaviour. In this way, mindfulness relies on sustained attention to stay continuously focused on each successive moment. Conversely attention deficit disorders are associated with deficiencies in these very skills, as mentioned earlier in this text, and as such sufferers should be entitled to deficiencies in sustained attention. Previous research on attention deficit disorders provides further support for this notion, where executive functions providing self-control and task persistence prove disrupted by distraction from irrelevant internal and external stimuli (Shoda, 1990).

As with the test of selective attention, no differences were noted in the mean *response times* of the groups on the SART, and again, predicted patterns of increases from the mindful group to the control group, and from the control group to the attention deficit group failed to emerge. These findings lend further support to the fact that mindfulness is associated with greater accuracy rather than speed.

Attentional capacity

Attentional capacity, or working memory, is a description of the amount of information that can be held in mind at any given time. This memory bank serves to store and manipulate information for use in high-level cognitive processes. Attentional capacity was measured in this study using the Digit Span test and recorded as the amount of digits spontaneously recalled by a participant. According to the results, the mean Digit Span of the mindful group was higher than that of the control group, and the control group Digit Span was higher than that of the attention deficit group, as expected. This implies that the mindful group had a more advanced attentional capacity compared to the control group, and the control group had a more advanced attentional capacity compared to that of the attention deficit group. Based on these findings hypothesis six can be accepted: There is a significant difference in

group mean scores of attentional capacity, with an increased capacity noted in the mindful group compared to the control group, and in the control group compared to the attention deficit group. In addition, and based on the statistically significant correlation between mindfulness and attentional capacity, hypothesis 13 can also be accepted: As mindfulness increases, so does attentional capacity.

It is plausible to assume that mindfulness employs attentional capacity in the *cross-temporal organisation of behaviour*, which involves integrating retrospective memories and prospective goals in one moment, to respond intentionally and appropriately to passing events (Fuster, 1995). This integration and manipulation of information takes place in the working memory bank and therefore relies on attentional capacity. Cross-temporal organisation of behaviour is cited as a notable deficit in attention deficit disorders because of limited attentional capacity (Barkley, 1997) – according to Barkley’s hybrid model of ADHD, this poor attentional capacity and its sub functions are secondary deficiencies of poor behavioural inhibition.

Respiration

In this study respiration patterns were measured as a marker of stress and stress reactivity. To understand this relationship as comprehensively as possible, measures of oxygen consumption (VO_2), metabolic consumption of oxygen (RQ) and respiratory rate (V_e), were recorded. Oxygen consumption (VO_2) refers to the amount of oxygen intake in millilitres per minute. Metabolic consumption of oxygen (RQ) refers to how much of that oxygen is actually used by the body in the metabolic process, and acts as a marker for sympathetic nervous activity and stress response. Respiratory rate refers to the number of inhalations per minute, with an increased rate of inhalations suggesting higher levels of anxiety and stress. The results of two independent analyses are discussed separately, the first focuses on *baseline measures* to indicate normal stress levels, and the second focuses on *percentage decreases in return to baseline respiration* to indicate regulation of the stress response.

Baseline respiration

Baseline measurements of the three respiration indicators were taken for five minutes prior to the commencement of cognitive testing, as a marker of normal respiration, with a low consumption and rate, indicative of a more positive affect and reduced

stress level (Nakamaura, 1984). According to the results, decreases were noted from the attention deficit group to the control group, and from the control group to the mindful group, as expected, implying that less oxygen was consumed by the mindful group compared to the control group, and that less oxygen was consumed by the control group compared to the attention deficit group. Theoretically, these findings suggest that the mindful group was more relaxed and presented with a more positive affect at the outset of testing, and that the attention deficit group was more stressed and presented with a more negative affect. Before accepting this conclusion however, cognisance needs to be taken of the somewhat contradictory findings that emerged from the analyses of metabolic oxygen consumption (RQ) and respiratory rates (V_e). Neither of these analyses produced supporting evidence of a decrease in respiratory patterns in the mindful group and an increase in respiration in the attention deficit group, and thus the statistical results are not conclusive enough to support hypothesis seven, which postulated significant difference in group mean baseline respiratory patterns, with reduced patterns in the mindful group compared to the control group, and in the control group compared to the attention deficit group.

Percentage decrease in return to baseline

A similar pattern of respiration emerged between the three groups in terms of their percentage decreases in return to baseline respiration – the higher the percentage decrease, the sharper the decline in respiration, and thus the greater the ability to regulate the stress response. According to the research results percentage decreases in oxygen consumption (VO_2) and metabolic oxygen consumption (RQ) steadily increased from the attention deficit group to the control group, and from the control group to the mindful group, as expected. These findings offer convincing support that the mindful group was better able to regulate the stress response than the control group, and that the control group was better able to regulate this stress response than the attention deficit group. This deduction however is slightly offset by the fact that no significant differences were observed between the groups in their percentage decreases in respiratory rate (V_e), a shift in percentages from one group to the next was still evident. On the basis of these findings hypothesis eight, strictly speaking, cannot be confirmed, however it is reasonable to assume that an increased sample size may have produced significant result. As such, the insignificant respiratory rate (V_e) results should not be interpreted as an ultimate decree that learnt mindfulness fails to

regulate physiological stress reactivity, especially since oxygen consumption (VO_2) is a more sensitive marker of the respiratory stress response than the other variables.

One possible explanation for the inconsistent respiratory rate patterns pertains to a deficiency in the self-regulation of arousal associated with attention deficit disorders. Numerous reviews of psychophysiological and cognitive literature on children with ADHD note a greater variability in their central and autonomic nervous system arousal patterns and an underactive stimulation in evoked response paradigms (Barkley, 1997). This implies that those with attention deficit disorders may actually present reduced stress responses in stress-induced contexts and offer an explanation for why the attention deficit group in this study did not differ significantly from the other groups on all respiratory measures. Moreover, children with ADHD have also shown to display less anticipatory activities on EEG measures in response to impending events, and PET scans show an overall diminished brain activation in ADHD due to arousal deficiencies (Ernst et al., 1994). This could potentially justify why the attention deficit group did not differ significantly in terms of all of their initial baseline respiratory rates. Although both findings relate to children, and specifically to ADHD, it is possible that these manifestations may be implicit in all attention deficit disorders and may well continue into adulthood. These speculations may offer direction for further research.

LIMITATIONS OF THE STUDY

The most apparent limitation of this research study is the small sample size. Small sample sizes often provide insignificant statistical power for detecting small to moderate effect sizes, and small to moderate effect sizes are common in tests of executive performance (Barkley, 1997). As discussed already, the data collection process in this study was time consuming since participants needed to be tested individually for numerous reasons cited previously, but essentially to enhance the reliability of data, and as such, a larger sample size was sacrificed.

Using the cross-sectional research design also made this study possible to conduct within the specified timeframe, but a standard limitation of the cross-sectional design is its inability to detect changes over time and this limitation should be kept in mind when reviewing the research results. In addition, the cross-sectional

design does not account for the pre-existing well-being and attentional states of the mindfulness group participants, which may have arguably been elevated prior to their mindfulness training and practice, however, previous longitudinal research findings of pre- and post-intervention measures have clearly shown incremental increases in affective well-being and other cognitive outcomes associated with increased mindfulness (Brown & Ryan, 2003; Reibel, Greeson, Brainard & Rosenweig, 2001). As mentioned previously, the cross-sectional design was the logical choice in this study since the primary interest lay not in *concurrent fluctuation* of mental states as mindfulness increases over time, but in establishing the *relationship* between mindfulness, subjective well-being, attention and respiratory patterns in population groups displaying varying *degrees* of mindfulness – thus adding significantly to the understanding of these relationships.

A third limitation of this study pertains to the sampling procedure. Recruiting research participants with psychological disorders is typically a challenging task and as such only the most rudimentary exclusion criteria were stipulated for subjects in the attention deficit group. Attention deficit disorders are traditionally segmented in numerous subtypes however, including attention deficit disorder, ADHD predominantly inattentive, predominantly hyperactive-impulsive, and combined types (DSM-IV; APA, 1994). Representing these separate subtypes in the study would have afforded a more in depth understanding of how they individually relate to mindfulness, attention and stress reactivity. Additionally, and of no less importance, many adults sufferers have learnt coping strategies to deal with their attention deficits and are in many cases medicated, which clearly masks a true picture of how a pure attention deficit disorder would relate to mindfulness, attention and stress in adulthood.

Despite these limitations, the study raised some interesting questions that may provide scope and guidance for future research, and specific suggestions regarding future research are outlined in the concluding comments.

CONCLUDING COMMENTS

In summary, and based on the data collected in this study, it can be concluded that learnt mindfulness, as brought about by MBSR, and continued formal and informal

practice, is associated with higher levels of satisfaction with life, emotional well-being, selective attention, sustained attention and attentional capacity. In addition to this, the study shows that attention deficit disorders relate to decreased mindfulness, satisfaction with life, emotional well-being, selective attention, sustained attention and attentional capacity. The study was also able to provide preliminary evidence that learnt mindfulness may well be associated with more relaxed states and an improved ability to self-regulate the stress response, while attention deficit disorders, appear to be associated with increased stress and a reduced ability to regulate the stress response. It is fair to say then that learnt mindfulness is associated with improved subjective well-being, heightened cognitive performance and, in part, related to reduced stress and improved regulation of the stress response.

Further research, employing larger sample groups and more clearly delineated inclusion and exclusion criteria in the sampling procedure, may provide further support for, and insight into, these associations. In addition, the theme of *which* respiratory patterns are associated with reduced stress and improved regulation of the stress response, and how mindfulness relates to these respiratory patterns, is particularly deserving of further study. At the broader level, investigations into the neural correlates of mindfulness and the cognitive mechanisms behind mindful states would be of particular interest, in addition to those exploring the long-term variability of learnt mindfulness and its affective, cognitive and physiological concomitants.

In conclusion this study offers sound evidence to support the application of mindfulness training, as an intervention to advance affective, cognitive and physiological well-being. More generally speaking, the findings of this study offer preliminary evidence of a relationship between willed mental control and optimal human functioning. More than a century ago William James described willed mental control as the key to sculpting how our ever-changing minds will work and shape who we will be from one moment to the next, and research of this type will continue in the tradition of learning more about volition, well-being and the efficacy of mental effort.

*The beginning of freedom is the realization that you are not
“the thinker”. The moment you start watching the thinker,
a higher level of consciousness becomes activated.*

Eckhart Tolle

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APPENDIX A**STUDY ON MINDFULNESS AND MENTAL FUNCTIONING**

Conducted as part of a Masters research project in the

DEPARTMENT OF PSYCHOLOGY at the UNIVERSITY OF CAPE TOWN

As part of a research project that aims to understand the psychological benefits of a heightened state of awareness in daily life (mindfulness), you are invited to complete the attached questionnaires and participate in the on-screen cognitive tests during which time physiological changes in ventilation and heart rate will be measured. You will only be required to complete these tests once.

Participation in this study is completely voluntary, and you are free to choose not to complete the questionnaires, or *opt out* of the research at any stage. However you are kindly requested to participate as the study stands to enhance the understanding of the relationship between psychological health, improved functioning and heightened awareness. Your answers and individual identity will be kept strictly confidential.

CONSENT

Date _____

Name _____

I hereby consent to participate in this research study with full knowledge and understanding of the nature of the research project and what is expected of me.

Signature _____

APPENDIX B**PARTICIPANT INFORMATION**

Date: _____

Name: _____

Age: _____

Gender: _____

Occupation: _____

Have you ever had any mindfulness/meditation training: _____

Do you regularly practice mindfulness/ meditation: _____

Have you ever been clinically diagnosed with an attention deficit disorder: _____

Have you ever been clinically diagnosed with depression: _____

University of Cape Town

APPENDIX C

Mindfulness Attention Awareness Scale (MAAS)

Instructions: 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. Please treat each item separately from every other item.

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

I could be experiencing some emotion and not be conscious of it until some time later.

1 2 3 4 5 6

I break or spill things because of carelessness, not paying attention, or thinking of something else.

1 2 3 4 5 6

I find it difficult to stay focused on what's happening in the present.

1 2 3 4 5 6

I tend to walk quickly to get where I'm going without paying attention to what I experience on the way.

1 2 3 4 5 6

I tend not to notice feelings of physical tension or discomfort until they really grab my attention.

1 2 3 4 5 6

I forget a person's name almost as soon as I've been told it for the first time.

1 2 3 4 5 6

It seems I am "running on automatic," without much awareness of what I'm doing.

1 2 3 4 5 6

I rush through activities without being really attentive to them.

1 2 3 4 5 6

I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now.

1 2 3 4 5 6

I do jobs or tasks automatically, without being aware of what I'm doing.

1 2 3 4 5 6

I find myself listening to someone with one ear, doing something else at the same time.

1 2 3 4 5 6

I drive places on 'automatic pilot' and then wonder why I went there.

1 2 3 4 5 6

I find myself preoccupied with the future or the past.

1 2 3 4 5 6

I find myself doing things without paying attention.

1 2 3 4 5 6

I snack without being aware that I'm eating.

1 2 3 4 5 6

APPENDIX D

Satisfaction with Life Scale

The SWLS is a short, 5-item instrument designed to measure global cognitive judgments of one's lives. The scale usually requires only about one minute of respondent time. The scale is not copyrighted, and can be used without charge and without permission by all professionals (researchers and practitioners). The scale takes about one minute to complete, and is in the public domain. A description of psychometric properties of the scale can be found in Pavot and Diener, 1993 Psychological Assessment.

Survey Form

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

- 7 - Strongly agree
- 6 - Agree
- 5 - Slightly agree
- 4 - Neither agree nor disagree
- 3 - Slightly disagree
- 2 - Disagree
- 1 - Strongly disagree

____ In most ways my life is close to my ideal.

____ The conditions of my life are excellent.

____ I am satisfied with my life.

____ So far I have gotten the important things I want in life.

____ If I could live my life over, I would change almost nothing.



1. Respiratory testing equipment
2. The test participant workstation
3. Calibrating the Oxycon Alpha Analyser
4. Participant undergoing respiratory testing
5. Participant completing questionnaires
6. Participant undergoing attentional testing



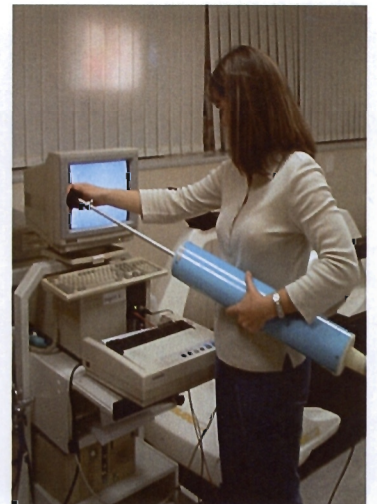
1



2



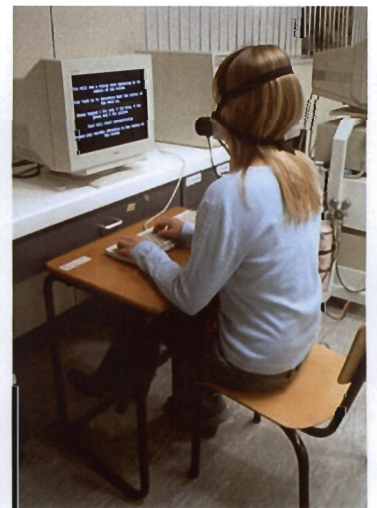
3



4



5



6