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Evaluation of HeartMath training programme for improving personal resilience and psychophysiological coherence

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Abstract

The goal of this study was to evaluate the influence of a HeartMath training apparatus on personal resilience and physiological coherence. A within group, pre-test and post-test, outcome evaluative design was employed to assess changes in dependent variables. A small convenience sample of 6 participants, 4 women and 2 men, with a mean age of 49 years and an age range from 25 to 68 years, each completed 4 HeartMath training sessions which included 9 tools and techniques. Non-parametric statistical analysis for quantitative data indicated significant increases in physiological coherence and personal resilience perceptions. Thematic content analysis for qualitative data yielded unequivocally positive, experiential descriptions. Integrative findings are discussed in relation to previous and future research.

Keywords: Evaluation, heartmath training, personal resilience, psychophysiological coherence.

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Introduction

The Institute of HeartMath is a non-profit research and educational organization, based in Boulder Creek, California, which has pioneered integral, heart focussed research in order to facilitate personal, social and global coherence (Childre & Martin, 1999). The HeartMath system includes a scientifically validated set of tools and technologies for transforming stress, building resilience and promoting optimal performance. As indicated in the title the goal of this study was to evaluate the HeartMath Building Personal Resilience training program aimed at improving personal resilience and psychophysiological coherence.

Resilience

The HeartMath system adopts a practical, energy management approach to building resilience, which is defined as the capacity to prepare for, recover from and adapt in the face of stress, challenge or adversity (Institute of HeartMath, 2014). Resiliency is thus essentially concerned with both the amount of energy one has stored within one's "inner battery", for use in physical, mental,

emotional and spiritual domains, as well as the degree or level of coherence, harmony, balance and/or stability that exists among, within and between these domains as conceptualized in the following model of interlocking Venn diagrams. See Figure 1. Energy management involves optimizing coherence as well as ongoing insight and action into energy draining and energy renewing situations, events and habits in all domains, with special attention to the emotional domain that tends to leak most energy in most people.

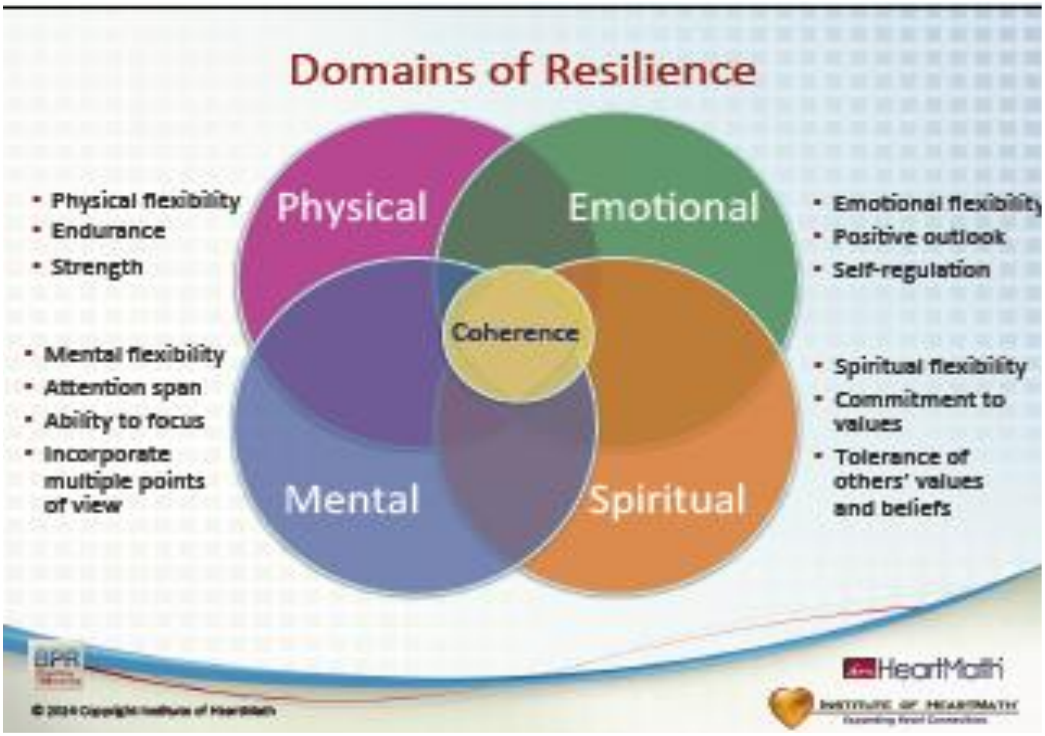

Figure 1: Domains of Resilience (reproduced with permission Institute of HeartMath)

Psychophysiological Coherence

Psychophysiological coherence, also simply termed coherence in this paper, refers to a state of synchronization between positive emotions, cardiovascular, respiratory, immune and nervous systems (McCraty, Atkinson, Tomasino & Bradley, 2009). As depicted in Figure 1, coherence forms the essence, key or underlying core of resilience. From a cardiovascular perspective, coherence is characterized by a heart rhythm pattern of elevated amplitude in low frequency heart rate variability of around 0.1 Hz, indicating harmony between sympathetic and parasympathetic divisions of the autonomic nervous system. The coherent resilience postulate is based on research indicating that the heart's rhythm co-varies, not only with respiration, blood pressure and physical exercise, but also, independently, with positive emotions, which tend to naturally induce a rhythmic HRV sine wave pattern associated with increasing energy renewing hormone dehydroepiandrosterone (DHEA) production. Counteracting the energy depleting

stress hormone of cortisol, "coherence always implies connectedness, correlations, stability and efficient energy utilization" (McCraty & Shaffer, 2015: 55).

Derived from the Latin term, "movere"- "to move," the word emotion literally means "energy in motion". In phenomenological terms, what we think of as emotion is the experience of energy moving through our bodies that generates ANS related physiological and mental reactions, as experienced in such strong feelings as love, joy, sorrow or anger. Feelings generally refer to a vast array of more subtle conscious experiences and sensations. In itself, emotional energy is neutral. Physiological reactions, feelings and thoughts give emotion meaning. Scientific research has repeatedly confirmed that reactive emotional energy manifests in brain activity before thought, that we live in a fundamentally pathic or feeling world, and tend to evaluate everything emotionally as we perceive it before thinking about it afterwards (Benson, 1996; Childre & Martin, 1999; Pert, 1997).

A likely neurophysiological model has been advanced by Thayer and Lane (2000; 2009), which describes a dynamic, central autonomic network (CAN) linking the brain stem NST (Nucleus of the Solitary Tract in the medulla oblongata) with anterior cingulate, insula, ventromedial prefrontal cortex, amygdala and hypothalamus. The model accounts for HRV mediated by the vagal nerve correlating with prefrontal cortical excitatory and inhibitory activity (Thayer, Ahs, Fredrikson, Sollers & Wagner, 2012; Thayer, Hansen, Saus-Rose & Johnson, 2009). In addition to "top-down" communications initiated by the executive management activities of the prefrontal lobe, HeartMath's dynamic, systemically orientated, theoretical and practical, tools and techniques give appropriate emphasis to "bottom up" communication via body, reticular, medullary and limbic systems. Firstly, energy expenditure is required to better self-regulate, as techniques are practised and anchored. Adherence is facilitated by mentoring for sustaining practice and improved self-regulation. In the second phase, the process become less effortful, more automatic and intuitive. Finally continued practice lifts consciousness and brings more consistent, intuitive alignment with the moment to moment intuitive guidance of the deeper Self (McCraty & Zayas, 2014).

Neurophysiological pathways for the cardio-respiratory system, as well as cardiovascular and respiratory subsystems separately, exist in systemic interneurons and premotor neurons along with distinct neuronal populations in the medulla oblongata (McCraty & Shaffer, 2015). Heart focussed, rhythmic breathing is a practical, first step in most tools. This is because longer, slower breathing modulates the heart's rhythmic activity via respiratory sinus arrhythmic activity whereby the heart rate naturally increases during inhalation and decreases during exhalation. Interestingly these increases and decreases occur midway between inhalation and exhalation. This mid phase relationship

probably reflects pre-existing, natural evolutionary resilience, adaptability and/or readiness for flight, fight or freeze, because only perfectly synchronous, zero phase, relationships between respiration and heart rate are associated with optimal coherence and maximal gas exchange in lung alveoli (Lehrer & Gevirtz, 2014). Using breathing as first conscious step slows the rate and increases the depth of the breathing mechanism, modulating efferent vagal traffic and heart rhythm, which then increases both the amount and stability (coherence) of vagal, parasympathetic, afferent nerve traffic, and, in turn, the neural systems involved in regulating sympathetic activity, informing emotional experience and synchronizing neural structures underlying cognitive processes (McCraty & Zayas, 2014: 10). This intimate connection between breathing and feeling is schematically represented in a core HeartMath tool, the Depletion to Renewal Grid (Figure 2).

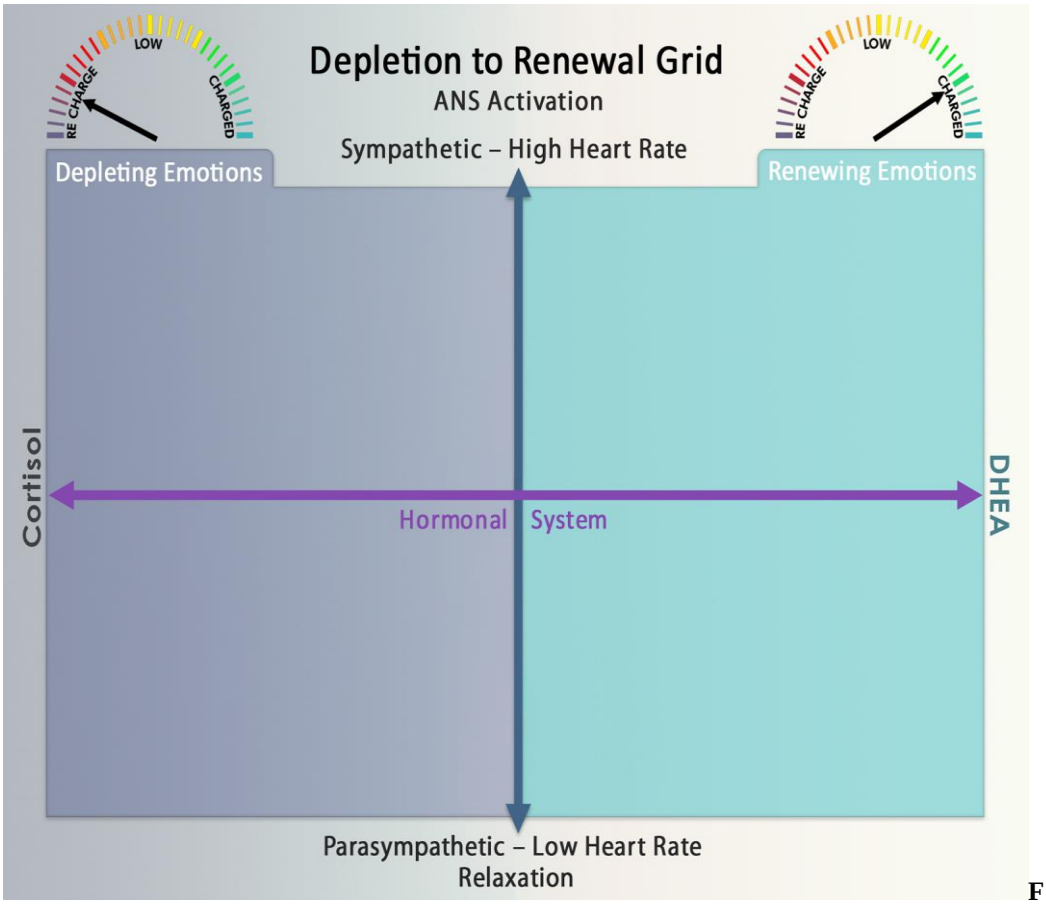

Figure 2: The Depletion to Renewal Grid

In Figure 2, the vertical Y and horizontal X axes correlation may be experientially located as respectively reflecting the intimate relationship between breathing and feeling. Physiologically, the vertical, breath axis, sympathetic activation yields high heart rates and parasympathetic relaxation rate yields low

heart rates, while along the horizontal, feeling axis, depleting, negative emotions are associated with cortisol and renewing positive emotions associated with DHEA. Examples of negative emotions are anger, frustration and anxiety in the felt hand quadrant and burnout, withdrawal and resentment in the bottom left. Positive emotion examples include excitement, courage and passion in the top right and contentment, fulfilment and ease in the bottom right quadrant. The Grid provides a valuable tool for participants to both become aware of such emotional patterns that run through each quadrant on a daily basis and consciously practise using appropriate tools to transform emotions, from negative and depleting to positive and renewing, in the experiential moment. All tools are scientifically researched and evidence provided for such immediate and moment to moment effectiveness.

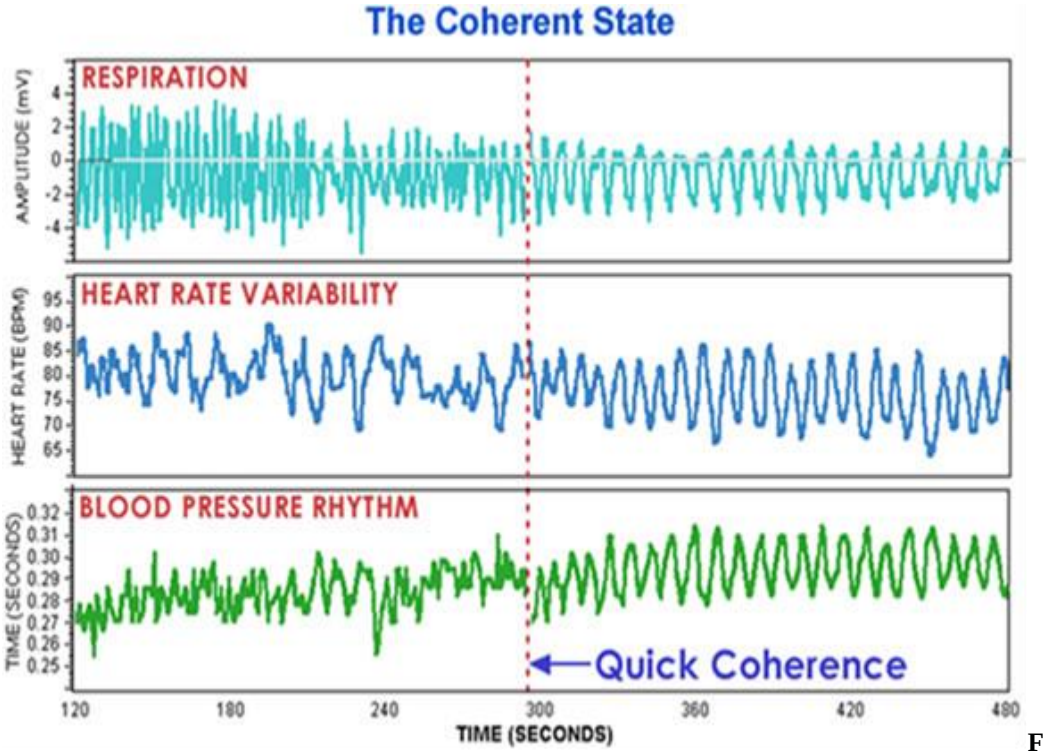

Figure 3: Coherent Respiration, HRV and Blood Pressure Rhythms

Figure 3 provides a graphic evidence of immediate, synchronized, sinusoidal curve rhythms of respiration, HRV and blood pressure, with the application, initiated after five minutes, of the quick coherence tool, which consists of heart focussed breathing, while cultivating a sincere positive emotion from the area of the heart.

Although it was expected that the HeartMath programme resilience and coherence training would be experienced as beneficial qualitatively, owing to the

small number of participants the null hypothesis of no significant changes was set for all quantitative comparisons.

Methodology

Design

This small scale study required a pre- and post-test, within subjects, outcome evaluative design. Integral psychological, mixed, quantitative and qualitative methods were employed (Cresswell & Plano-Clark, 2007; Terre Blanche, Durheim & Painter, 2006; Wilber, 1997; 2000; 2001).

Participants

The participants were a small, convenience sample of 6 adults, selected for their proximity to the researchers, commitment to participate in the research, and willingness to explore, describe, explicate and articulate their experience. While such qualitative research selection criteria have certain advantages in small scale, pilot type, evaluative research as the present study, they do present the methodological limitation of social desirability. This limitation can be addressed through further randomized controlled studies with larger samples. All participants were English speaking. There were 4 women and 2 men, with a mean age of 49 years and an age range from 25 to 68 years.

Procedure

The study was introduced to participants with the HeartMath training rationale of developing consciousness in energy management and learning various tools and techniques for improving personal resilience and psychophysiological coherence. All understood that, as participants, they would be assisting with quantitative and qualitative evaluations of HeartMath training. After pre-testing on all quantitative measures, all participants completed four HeartMath training sessions, learning energy management through identification of and insight into personal energy draining and energy renewing situations, events and habits in physical, emotional, mental and spiritual domains, with special focus on the emotional domain, completing homework assignments on plugging energy drains and building resilience as well as practising the following nine tools and techniques learning during the HeartMath training sessions. At post-testing, all participants were retested on the quantitative measures and provided written descriptions of their experiences and evaluation of the training.

1. The emWave2 biofeedback. See measures section for a description of this emWave2 biofeedback apparatus.
2. The Depletion to Renewal Grid as described previously.

3. Heart focussed breathing a little slower and deeper than usual, while focussing attention on the chest area and imagining the breath is flowing in and out of the heart area.
4. Quick Coherence as described previously.
5. Pre-Shift and Reset-Sustain. This step is a specific practical application of resilience through preparing a calm feeling and/or using any HeartMath tool before any challenging or stressful situation, consciously shifting, resetting and restabilising the energy system when in the challenging event and practising sustaining coherence and resilience throughout the day.
6. Inner – Ease consists of three steps, heart focussed breathing, drawing in the feeling of inner ease with each breath, anchoring this feeling when engaging in projects, daily interactions or challenges.
7. Freeze-Frame. In addition to its depth psychotherapeutic implications, freeze-frame may also be used as one-minute technique that allows a major shift in perception. It consists of five steps. Firstly, a stressful feeling is recognized and "freeze-framed" as a static image. Secondly, heart focussed breathing is practised for at least 10 seconds. Thirdly, a positive, fun feeling or time in life is recalled and sincerely re-experienced. Fourthly, the heart is asked to provide a more efficient response to the stressful feeling and/or situation. Fifthly the heart answer is sincerely listened to.
8. Heart Lock-In – This involves experiencing heart at a deeper level. Firstly there is heart focus. Secondly a positive feeling of love, care or appreciation for someone or context is cultivated. The feeling is maintained for five to fifteen minutes. The feeling of love or appreciation is then radiated to self and/or others to provide physical, mental and spiritual regeneration.
9. Coherent communication – This consists of three steps: (a) cultivating personal coherence before communicating, (b) listening to the essence of another person's communication without any prejudgements before the communication is complete, (c) confirming the essence of the communication heard from the other.

Ethics

All participants were informed of the nature of the research and provided written consent with regard to the use of the information for publication purposes and were fully informed as to HeartMath research and the Building Personal Resilience Programme. Participants were guaranteed nominal confidentiality and advised as to their right to withdraw from the research at any stage.

Measures

The emWave2 biofeedback apparatus was used in this study. When attached to a laptop computer, the instrument gives readings of heart rate variability, time elapsed, as well as low, medium and high levels of physiological coherence as defined above. Feedback consisted of red, blue and green coloured bars with

percentage indications and accompanying tones for low, medium and high coherence levels respectively. Further feedback was provided by a cumulative coherence graph with a demarcated area for coherence indicating the zone of optimal autonomic nervous system functioning. A feedback tone is provided when 100 coherence points accrue. The apparatus, some 2 by 3 inches in size, can be hand held or attached to a computer, for physiological coherence biofeedback purposes.

The Profile of Mood States (POMS) is an extremely well researched mood scale assessing 6 factors of tension, depression, anger, vigour, fatigue and confusion, which show a typical mental health or 'iceberg profile' (elevation of vigour above the norm in comparison to the other five factors below the norm) across many elite athlete populations (Rehor & Knickey, 2001). From POMS research with various sporting groups, Morgan (1985) developed a mental health model, which suggests that positive mental health is directly related to athletic success and that successful athletes will exhibit more mental health than less successful athletes. The POMS was originally developed as an 'economical method of identifying and assessing transient fluctuating affective states' (McNair, Lorr & Doppleman, 1971:5), with special reference to the therapeutic relationship. It consisted of sixty-five adjectives rated along a five point intensity scale ranging from "strongly disagree" to "strongly agree". More recently, a 6 item Brief Assessment of Mood States (BAMS) has been found to be a valuable, pragmatic alternative (Dean, Whelan & Meyers, 1990). An even briefer adaptation of the BAMS utilised in this research consisted of the total score of 5 reverse scored responses on negative items: i.e. feeling anxious, sad, confused, angry and tired respectively, and one normal scored response on the positive item "feeling energetic". This created a mood scale, consisting of the abovementioned feelings, ranging from the lowest possible negative feeling score of 6 to the highest possible positive feeling score of 30.

The Brief Resilience Scale (Smith, Dalen, Wiggins, Tooley, Christopher & Bernard, 2008) had 6 items: which were equally positively and negatively phrased, along a 5 point Likert-type scale with requested answers ranging from "strongly disagree" to "strongly agree". Cronbach's alphas for the BRS in six samples were found to be .836, .902, .877, .798, .754 and .702 (Smith, Epstein, Ortiz, Christopher & Tooley, 2013).

Data analysis

Quantitative data were analysed using the computer based Statistical Package for the Social Sciences (SPSS), with specific reference to comparisons of means and non-parametric Wilcoxon *Z* statistics. Qualitative information was thematically content analysed (Terre Blanche, Durrheim & Painter, 2006).

Results and Discussion

Quantitative physiological coherence and psychological findings

Table 1 refers to pre-test and post-test means and standard deviations (SD) for measures of low (LO), medium (ME) and high (HI) physiological coherence, Coherence level, Achievement, Resilience and Mood scores in terms of positive feelings.

Table 1: Pre-test and post-test means and standard deviations (SD) for measures of low (LO), medium (ME) and high (HI) physiological coherence levels, coherence score, Achievement score and perceptions of resilience and mood in terms of positive feelings.

Measure	Pre-test	SD	Post-test	SD	Wilcoxon *Z*	Probability
Low	64.17	35.97	25.17	20.76	2.20	.028*
Medium	13.83	16.69	21.67	18.36	1.36	.17
High	19.33	34.33	53.17	37.11	2.20	.028*
Coherence	.58	.63	2.03	1.96	2.02	.043*
Achievement	33.83	35.37	125.00	122.61	2.20	.028*
Resilience	16.17	7.68	22.50	1.64	2.21	.027*
Mood	13.00	4.60	18.33	2.50	2.21	.027*

Specifically there were significant decreases in low physiological coherence: $Z = 2.20$, $p = .028$; significant increases in high physiological coherence: $Z = 2.20$, $p = .028$; significant increases in coherence level: $Z = 2.02$, $p = .043$ and significant increases in achievement level: $Z = 2.20$, $p = .028$. This was associated with significant increases in resilience perceptions: $Z = 2.21$, $p = .027$ and significant increases in mood perceptions: $Z = 2.21$, $p = .027$. Thus findings from the physiological coherence, resilience and mood measures all provided support for an alternative research hypothesis that the HeartMath training was significantly influential in increasing physiological coherence, resilience and mood. Obviously this is an extremely small sample and no great value can be attached to these findings, the fact that all participants individually increased in all dependent variables and increased significantly as group on all dependent variables, except for medium coherence level, which in itself is simply a ratio between low and high coherence and as such has no has no real value, provides consistent evidence in support of the research hypothesis of general effectiveness of the HeartMath training programme. This research hypothesis received unanimous qualitative support from all six participants' positively phrased experiential descriptions and evaluations of the programme as follows.

Qualitative findings

Qualitative descriptions and group summaries of the 6 participants follow, coded A to F, respectively.

Experiential descriptions

A. It was very enlightening and helped in a lot of areas in my life and within myself. I found that these are easy techniques that can change your life if you choose to believe in them and yourself.
B. I found the training very enlightening and helpful in day to day living and in getting a balance in life. Now whenever I get very stressed I breath, relax and talk to my heart,
C. I thoroughly enjoyed the course and found that through practicing the Inner Ease technique, concentrating on heart focused breathing outcomes on decisions were made clearer. It was difficult at first but with a little practice and putting some time aside and help from my Coach it becomes easier and the more coherent you become. I have been using these techniques I learned almost every day as situations arise and decisions have to be made. I have learnt not to get so frustrated with a situation but handle it with more ease and a far more positive outcome is achieved. I evaluate the course 9/10 excellent and highly recommend it for everyone.
D. I had a wonderful experience of the course. It taught me how to ease my mind and rejuvenate my outlook. It has taught me a deeper sense of heart focused breathing and coherence, and that it is something which I will incorporate into my everyday life. I think that this is an insightful course, and that there is much still to be expanded upon. One takes a lot out of this course and finds that what you are being taught is implemented into daily situations.
E. The Building Resilience programme has been of significant use to me, particularly the Heart Focused Breathing. My particular heart problem leaves me breathless and tired with even the easiest of movements or tasks. When I stand after being seated I go through the early stages of fainting sometimes almost blacking out. This undermines not only my ability to work properly but my very way of life, my self-confidence. There are occasions when I am fearful both of passing out and causing stress or even hurt to others, or worse still, dying. I cannot seek respite through sleep due to a combination of factors, particularly two brought on by medication – regular and vivid dreams which can go as far as throwing myself out of bed and striking my wife, as well as diuretic promoted frequent visits to the toilet. The use of biofeedback to monitor, amongst other things, my breathing and heart rate, has trained me in a breathing technique which limits the duration and impact of both short term physical exertion and the fainting spells whenever and wherever they occur. The technique does not prevent the sleep disturbance but it provides a way to get back to sleep more quickly. The coherence feedback is consciously controlled to start with but is prolonged by a diversion such as sport on the television or reading.

F. A very welcome and positive experience as the benefits are soon felt. The programme was very well presented and inspired confidence as the coach is so well informed.

The specific, uniformly positive responses, attest to the "life changing" value of the training as experienced and evaluated by participants. The central theme is of an "enlightening" transformation of consciousness and behaviour, related to "positive" experiences of simple, practical "techniques", especially heart focussed breathing, inner ease, "heart talk" and relaxed focussed coherence, that can be "implemented into "daily situations" and/or "used in decisions" to change negative feelings such as "stress" and "frustration" into "positive outcomes".

Integrative evaluation

In addition to endorsing the value and effectiveness of the HeartMath system in general and the Building Personal Resilience Programme (Institute of HeartMath, 2014) in particular, the results extend the findings of an earlier study on coherence and resilience (Edwards, Edwards, Buscombe, Beale & Wilson, 2015). Qualitative experiential and evaluative descriptions meaningfully endorse the quantitative physiological and psychological findings with regard to the perceived value and effectiveness of HeartMath training programme on physiological coherence, resilience and perceptions of mood in terms of positive feelings. The null hypothesis of improvements in coherence, resilience and mood was rejected in favor of the alternative research hypotheses. Since this was a very small-scale study, findings should obviously be treated with caution. Further research is needed to generalize and/or transfer findings in different contexts with other participant samples. From a quantitative perspective, randomized controlled studies are recommended to control for experimenter effect of enhanced expectancies of informed participants and for causal inferences to be postulated. From a qualitative perspective, further investigations are needed to explicate depth subtle features of coach and participant expectancies, personality, non-specific relationship variables, learning and teaching styles as well as instructional context. Finally, although further research is clearly needed, integrative findings provide no reason to doubt the integrity, reliability, validity, dependability and transferability of the programme. Findings unequivocally support the claims of HeartMath training programmes in promoting personal coherence and resilience. Further information can be found on the websites www.heartmathsouthafrica.co.za, www.Heartmath.org and www.glcoherence.org.

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