

# **MINDFULNESS BIOFEEDBACK TREATMENT FOR IMPROVED ATTENTION AND OTHER COGNITIVE FUNCTIONS: TECHNIQUE, TOOLS AND APPLICATION FOR CLINICIANS AND RESEARCHERS**

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## **Abstract**

The purpose of this workshop is to help mental health professionals increase knowledge of combining brief mindfulness induction and biofeedback for improved focused attention and its application to other cognitive functioning. *Background:* Selective attention task including other cognitive tasks can be negatively impacted by individual emotional arousal levels such as overstimulation or underarousal (boredom). Impairment of emotion regulation can impact academics and sports performance in children and individuals across all ages with or without disabilities. Many individuals with OCD, ADHD, depression and anxiety have difficulty with emotional control, outbursts, and rage. Often individuals have learned tools to regulate emotions for improvement in focus and attention. However, the effectiveness of emotion regulation tools is often reliant on outcome such as increased focus, sustained attention, remembering names, executing task and achieving goals. Real time feedback on psychophysiological effects of emotion regulation tools such as mindfulness can improve individual's skills, awareness, and confidence in applying learned skills. Additionally, individuals can see in real-time through biofeedback the effects of emotion regulation skills on their psychophysiological responses and are more prone to trust and transference skills to real life situations. The lack of early detection/identification of emotions can lead to difficulty in regulating the escalation of emotions and achieving optimal states of cognitive functioning. *Key points:* Psychophysiological measures of the autonomic nervous system (Electrodermal Activity, Heart Rate, Breaths Per Minute, Temperature, Muscle Tension with the use of non-wearable and wearable sensors. Techniques for Biofeedback training and Cognitive tasks with the use of Multiple Object Training Task. Review and demonstration of Mindfulness biofeedback for improved cognitive functioning. Brief review of research will be presented in the area of Mindfulness Biofeedback. *Procedure:* Information will be presented by an expert in a discussion format, with interaction and questions from attendees. A brief demonstration of Biofeedback technique with an attention task will be provided. *Description of the workshop participants:* The workshop is for mental health professionals and/or researchers who wish to develop knowledge in Multi-modal emotion regulation technique such as Mindfulness based Biofeedback treatment for disorders that impact cognitive functions. Maximum number of participants will be 50.

**Keywords:** *Biofeedback, mindfulness, emotion regulation, component process theory.*

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## **1. Introduction, theory and background**

Cognitively demanding tasks such as focused attention tasks (i.e. academic tests, assignment, listening, and reading) can be negatively impacted by the individual's emotional arousal level (i.e. overstimulation or underarousal (boredom) (Yerkes & Dodson, 1908). Impairment of emotion regulation can impact work, academic and sport performance for individuals across all ages with or without disabilities. Many individuals with OCD, ADHD, depression and anxiety have difficulty with emotional control, outbursts, and/or rage. Normal day to day distractions and stressors can make it challenging to begin time sensitive tasks. Emotional episodes or experiences can change from moment to moment (Scherer et al., 2001). The Component Model of Emotions (CPM) (Scherer et al., 2001) describes emotional responses as emergent processes that are generated by physiological and cognitive appraisals and other components that synchronize as an adaptive reaction to internal or external environments.

The application of Scherer's model to emotion regulation theory as in Gross' Process Model of Emotion Regulation (PMER) (Gross, 1998) provides a theoretical framework for the development and application of emotion regulation techniques. This framework accounts for the fluid moment to moment changes in internal and external emotional experiences. Psychophysiological feedback or Biofeedback provides a self-regulatory method for the individual to get moment-to-moment feedback while in the process of regulating an emotional episode. This ER method is a response focused process and is inline with PMER theoretical components: attention (attention deployment/mindfulness), appraisal and reappraisal (cognitive/physiological change) (Gross, 1998) This model provides a theoretical foundation for the multimodal use of Biofeedback that is combined other ER techniques, such as Mindfulness. The advancement of technology provides the biofeedback tools to self-monitor changes in our emotional experiences in real-time. With early detection and identification of emotions individuals can learn to can prevent the escalation of emotion, and identify individualized levels of emotional arousal for achieving optimal states of cognitive functioning such as improved attention. Real time feedback of the psychophysiological effects of emotion regulation strategies can improve transference of emotion regulation skills to real world situations; increase understanding, awareness, and confidence in applying learned skills.

## **2. Purpose of workshop**

The purpose of this workshop is to provide mental health professionals and researchers with an understanding of the Process Model of Emotion Regulation: Biofeedback with Mindfulness Induction for improving attention on a cognitive task (Schnabel, 2021).

## **3. Workshop outline and key points**

### **3.1. Description and demonstration of biofeedback**

Biofeedback is an emotion regulation technique that involves the identification and voluntary regulation of autonomic responses to stress with feedback equipment such as heart rate monitors, temperature sensors, or electrodermal sensors. Biofeedback can enhance and support the natural reallocation and adaptive process of emotion during selective-attention tasks. It allows the individual to identify and recognize an attention state and the moment-to-moment changes in psychophysiological arousal that occur when faced with a cognitively demanding task. Biofeedback provides the individual the opportunity to self-regulate with the presence of visual and/or auditory cues to their arousal state (Pusenjak et al., 2015; Wilson et.al., 2006; Wilson & Peper, 2011). This type of awareness can increase one's ability to recognize and regulate one's thoughts, feelings, and behaviour. In biofeedback methods, relaxation or self-alerting protocols are implemented to train emotional arousal and stress self-regulation. This is an adaptive emotion-regulation strategy to help one regulate one's stress and negative affect (Gross, 1998; Hofmann et al., 2010; Wilson & Peper, 2011).

### **3.2. Example of multimodal biofeedback treatment: mindfulness based biofeedback (MB)**

Biofeedback can be combined with other treatment Modalities. This workshop's focus is the application of brief Mindfulness induction (i.e., < 15 minutes) for shifting into the present in conjunction Biofeedback. In this multimodal approach, the effects of mindfulness can increase the mind-body connection through the use of applied sensors and software that allow the individual to observe psychophysiological changes in real-time. MB is a combined self-regulation method that includes the individual as the agent of change (Khazan, 2015). Furthermore, the MB method allows for a closer examination of a participant's self-regulation experience and the dynamic relationship between cognition and emotion (Schnabel, 2021).

### **3.3. Recent research in MB for improving attention with a cognitive task**

The multimodal technique of MB has been shown to significantly effect cognitive function such as focused attention. A randomized control study from the Emotion and Learning Optimization Lab at the University of Toronto, Canada was conducted to examine the effects of MB with electrodermal feedback for optimization of attention scores in a sample of 75 scholar athletes. Significant results showed improvement in standardized attention scores for the group who received MB training (Schnabel, 2021).

### **3.4. Practical applications**

With the advanced progression in technology, in the development of wearable sensors, biofeedback training that is learned in the clinician's office could now be practiced by clients/patients

in-between clinic sessions and in virtual follow-up sessions with the clinician. Clinicians are encouraged to train participants in person/in office with medical grade biofeedback equipment first and then supervise and guide the client/patient with the transfer of training to personal wearable sensors. The emotion regulation skills learned in biofeedback sessions can then be practiced and transferred to real life scenarios (i.e., in school settings, for test anxiety; in work settings, prior to a presentation or an important meeting; for sport prior to initiating target shooting or other attention demanding sports).

#### 4. Procedure

Information will be presented by an expert in a discussion format, with interaction and questions from attendees. A demonstration of mindfulness-based biofeedback protocol used in a recent research study with scholar athletes with volunteers from the workshop attendees will be conducted. Biofeedback equipment with Electrodermal, Heart Rate and Peripheral Temperature sensors (Thought Technology™) will be used for demonstrating common techniques and MB intervention.

#### 5. Conclusion

Through the lens of a Process Model framework, biofeedback can be used as a clinical tool to help clients/patients to capture, recognize and retrieve self-regulatory experiences and strategies needed for improving attention and other possible cognitive functions. Clinicians and clients can simultaneously see changes in internal and external emotional experiences (i.e. sympathetic and parasympathetic reactions). The application of Biofeedback technique can effectively provide immediate feedback and awareness of the mediating effects of emotion regulation strategies on an emotional episode and on performance in cognitively demanding task. The process of self-awareness can significantly impact appraisal and self-confidence, which can then result in generalization and persistence of the self-regulatory experience (Schnabel, 2021; Lazarus, 1984; Volpe, 1975, Meichenbaum, 1976). The workshop is geared towards information for mental health professionals and/or researchers who wish to develop knowledge in a multi-modal emotion regulation technique such as Mindfulness based Biofeedback treatment. Maximum number of participants will be 50.

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