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## Psychophysiological treatment in reduced anxiety with biofeedback training for university students

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### Abstract

Researchers found some individuals with anxiety disorders, and most of the university's students suffer from some degree of anxiety level during the academic years. Anxiety was prevalent and persistent in student's population. More than half of students with significant symptoms of anxiety do not receive treatment even over two year periods. This research offers a psychophysiological treatment to reduce anxiety through biofeedback training for university students. A total 35 students were participated during 10<sup>th</sup> sessions training. They are students who have high anxiety level. The psychophysiological arousal was measure used beat-per-minute and breath-per-minute. Repeating measurement of ANOVA was used to evaluate during the 1<sup>st</sup> session, 4<sup>th</sup> session, 7<sup>th</sup> session, and 10<sup>th</sup> session and further compare the differences. The result shows that there is a significant change over time in the beat-per-minute and breath-per-minute through the participants. From the training, it is shown that after 10<sup>th</sup> session, students be able to control their heartbeat and respiration to reduce anxiety level. It is concluded that the psychophysiological treatment with biofeedback training is an effective method to reduce anxiety for university students.

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### 1. Introduction

Researchers found that some individuals with anxiety disorders, anxiety occurs during the university years, especially in first year (McCraty, 2007; Vitasari et al., 2011a). Anxiety has been defined by Spielberger (1983) as a subjective feeling of tension, fear, nervousness, and worry associated with stimulation of the nervous system. According to Ruffin (2007) there are two symptoms that can be identified with anxiety, that is, psychological and psychophysiological. The psychological symptoms of anxiety among students, such as feeling nervous before entering the classroom, panic, fail in examinations, feeling incapable of doing the task, or learning difficulties. The psychophysiological symptoms include sweaty palms, cold, nervous, panic, breathing fast, heartbeat racing, or abdominal pain. Anxiety are prevalent and persistent in student population, most of them do not receive treatment even over two years period (Zivin et al., 2009; Cranford et al., 2009). Generally, universities have academic

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probation program which aimed at improving students' academic performance through workshops, tutorials, counselling, and academic advice. According to Zivin et al.(2009) that knowing more about the persistent mental problems and help seeking is important to understanding of students' problems. High anxiety student too need special attention, and they need to be provided with preventive solutions, such as special training, so as to minimize the problem (Ratanasiripong et al., 2001). However, this study proposes psychophysiological treatment used biofeedback training in reduce anxiety for university students.

Since twenty years ago, biofeedback has evolved from conventional methodology into an application. Currently, it is used to treat certain medical conditions and to improve human performance. The prior study also reported that biofeedback is significant in reducing anxiety levels among students (McCraty et al., 2000). Biofeedback training is a set of intervention techniques and skills to help users overcome psychophysiological disorders such anxiety.

In this paper, we present psychophysiological treatment to reduce anxiety with biofeedback training for university students. A total of 6 engineering students participated in this pilot study. The psychophysiological arousal was measure used beat-per-minute and breath-per-minute. Repeating measurement of ANOVA was used to evaluate during the 1<sup>st</sup> session, 4<sup>th</sup> session, 7<sup>th</sup> session, and 10<sup>th</sup> session and further compare the differences. The result shows that there is a significant change over time in the beat-per-minute and breath-per-minute. From the training, it is shown that after 10<sup>th</sup> session, students be able to control their heartbeat and respiration to reduce anxiety level. It is concluded that the psychophysiological treatment with biofeedback training is an effective method to reduce anxiety for university students.

The rest of this paper is organized as follows. Section 2 illustrates of psychophysiology treatment on anxiety. Section 3 describes effectiveness of biofeedback training. Section 4 describes method. Section 5 explains results and discussion. Finally, the conclusion of this work is described in section 6.

## *1.2 Psychophysiology treatment for anxiety*

Individuals who experience autonomic reactivity as a response to anxiety would likely to develop concerns about arousal related physical sensation. Psychophysiological arousal is defined by the American Psychological Association Dictionary of Psychology as aspects of arousal shown by psychophysiological responses, such as increases in blood pressure and rate of respiration and decreased activity of the gastrointestinal system (Johnson et al., 2009). Other psychophysiological effects of anxiety according to Johnson et al. (2009) include constricted blood vessels, elevated body temperature, increased dilation of the eyes, muscle spasms, raised blood flow to muscles, and decreased blood flow to the skin. The prior study cite that psychophysiological arousal of anxiety is related by heart rate and breathing as reaction of the body (Pougatchev and Pougatchev, 2008). Heart rate should have the most profound oscillation synchronous with breathing, where the heart rate reaches maximum level at the end of deep inhalation and reaches minimum level on the end of exhalation (Pougatchev and Pougatchev, 2008). A number of interventions have been designed to reduce anxiety with breath retraining; relaxation, music therapy, and visualisation are offered by biofeedback protocol.

Various forms of relaxation training have been used to restrain the detrimental effects of anxiety. Researchers have suggested using breathing therapy for the basic handling of anxiety due to psychophysiological arousal (McCraty et al., 2000; Johnson et al., 2009). Researcher reported 75% success among 1000 patients with anxiety and hyperventilation after using breathing therapy (Gill et al., 2004). Breathing is measured by way of lung function parameters such as rate, inhalation, exhalation, pauses, tidal volume, minute volume, flow, O<sub>2</sub> saturation, and end-tidal CO<sub>2</sub> (Gill et al., 2004). The benefits of breathing therapy, at the same time familiarizing with the habit of slower and deeper breathing, increases mental focus and attention (Gill et al., 2004). Deep breathing can be defined as slow diaphragmatic breathing that balances out the oxygen and carbon dioxide levels in the body (Johnson et al., 2009). The purpose of breathing therapy is to enhance awareness by inducing marked improvement in the perceived quality of the natural rhythm (Gill et al., 2004).The benefit of diaphragmatic breathing, it is important that air is inhaled through the nose and exhaled through the mouth and in response to this, the body will react with less severe symptoms in time of high anxiety or panic (Johnson et al., 2009).

One important aspect of breathing exercises is to make the students aware of their breathing hence lowering their heart rate. With controlled respiration, heart rate associated with the lower respiration rate can be reduced and can make the effects of fast heart beat disappear (Gill et al., 2004). According to [9] there were two particular techniques associated with deep breathing and relaxation, and it has been shown to effectively decrease anxiety levels in individual who have difficulty relaxing in anxious situations. Relaxation techniques are commonly used across the physical and manual therapies as well as in various areas of psychological practice (Gill et al., 2004).

According to Prato (2009) relaxation techniques are effective in reducing anxiety and activating the parasympathetic nervous system with decreased heart beat and respiration rates. The purpose of relaxation is to help people gain cognitive control over the autonomic nervous system (Prato, 2009). These techniques can have an effect in increasing an individual's focus on the task with the reduction of their level of anxiety. Lower breathing rates contribute to the state of lower psychophysiological arousal.

### *1.3 Effectiveness of biofeedback training*

The training gives to students a sense of mastery, mental sensation, or control over unpredictable and unpleasant physical situations. According to Moss (2003) biofeedback is a useful tool and is simple to use with the training procedures available so students can learn self regulation skills that can be applied after the training student to enhance academic performance. Prior studies found that biofeedback is effective in improving performance among students. Biofeedback improves mathematics performance as well task behaviour of high school students as their test scores on reading and mathematics have increased (McCraty et al., 2000). Biofeedback also improves student achievement index in test performance as well as effective in reducing test anxiety (Prato, 2009). Researches by HeartMath have found that Biofeedback training is a powerful tool to assist students in using emotion focused techniques effectively and learning to self generate increased coherence (McCraty, 2005). The training aimed to support, motivate, and emotionally engage students who lack a healthy social and emotional environment (Arguelles et al., 2003). Biofeedback studies have been conducted in elementary schools, middle schools, high schools, and colleges and are found to be able to improve emotional well being, classroom behaviour, learning, and academic performance among students (McCraty, 2005; Thurber, 2006). However, in this study biofeedback is used to help students prepare themselves mentally and physically for anxiety during their studies. Students use these techniques to manage anxiety apprehension during study.

## **2 Method**

The method was includes participants selection, procedure of the treatment, and data analysis used to examine the results. These were explained as follow.

### *2.1 Participants*

A total 35 students were willing to participate in this biofeedback training and they were confirmed not to have received any treatments before. Participants must first sign an agreement before involving in this training as a code of ethics, which meant that there was no compulsion in participating. The training group was given full intervention throughout the ten sessions, learning the related techniques.

### *2.2 Procedure*

Biofeedback devices are used to teach and guide the participants to in practising the protocol to reduce study anxiety by looking at the feedback from their own bodies. They learn the techniques of intervention weekly during the biofeedback training in the laboratory. They were then required to practise these techniques for 5-10 minutes thrice daily in the hostel using only the module guidelines and home exercise schedule. Due to the limited number of the biofeedback devices, the participants could not bring the device to the hostel. However, they received a simple module to guide them practise the techniques and to monitor the physiological changes in order to control the progress. Each training session's progress was checked with the Stress Sweeper to look for changes of heart beat and respiration. Nevertheless, the physiological assessment was intended as a way to control the participants while they were practising these techniques. This study used self-awareness approach to bring awareness to the participants in making the daily practice of all techniques that have been taught.

### *2.3 Measurements*

*Beat per-minute (BPM)* : Beat per minute is a measure of heart rate as measured by the electrocardiograph sensor, recorded for five minutes with the accumulated time of one minute (Pougatchev and Pougatchev, 2008).

Mean heart rate is around 70 beats per minute, so participants were instructed to practise breathing exercises, relaxation, and visual relaxation to produce that rate.

*Breath per-minute (bpm)*: Breath per minute is a measure of respiration rate and is measured using the respiratory sensor. The respiration rate was calculated by recording the breathing for five minutes with the accumulated time of one minute (Pougatchev and Pougatchev, 2008).

### 3 Results and discussion

Using repeated measures ANOVA, the physiological data is examined and found to be normally distributed. The data measured during the 1<sup>st</sup> session, 4<sup>th</sup> session, 7<sup>th</sup> session, and 10<sup>th</sup> session was compared for differences (Lehrer and Woolfolk, 2007). Biofeedback device was used to measure changes of heartbeat and respiration rates over the period of the ten training sessions.

#### 3.1 BPM

The results of repeated measures ANOVA shows that there is a significant change over time in the heartbeat rate (beat-per-minute) of the participants with:  $F(3,102) = 22.012$ ,  $p = .000$  with a medium effect size ( $\eta^2 = .393$ ); also, there is a significant difference between the participants:  $F(1,34) = 4.589$ ;  $p = .000$  with a large effect size ( $\eta^2 = .992$ ). There is a decrease in beat-per-minute mean scores for the training group with  $HR_1$  ( $M=83.86$ ,  $SD=9.849$ ),  $HR_4$  ( $M=79.60$ ,  $SD=8.434$ ),  $HR_7$  ( $M=75.03$ ,  $SD=8.726$ ), and  $HR_{10}$  ( $M=72.37$ ,  $SD=5.391$ ). Table 1 shows the change in the heartbeat as follows.

**Table 1: Changes in time of beat-per-minute**

Time	M	SD	F	Sign (p)	Effect size ( $\eta^2$ )
Session 1	83.86	9.849			
Session 4	79.60	8.434			
Session 7	75.03	8.726			
Session 10	72.37	5.391			
Time			22.012	.000*	.393
Between Subject			4.589	.000*	.992

Note: M = mean, SD = standard deviation, \*  $p < .001$

#### 3.2 bpm

Table 2 shows the results of changes in bpm. Repeated measures ANOVA of respiratory data also show a significant difference over time in breath-per-minute with  $F(4,35) = 229.429$ ,  $p = .000$  with large effect size ( $\eta^2 = .871$ ); also there is a significant difference between subjects:  $F(4,35) = 961.347$ ;  $p = .000$  with large effect size ( $\eta^2 = .966$ ). There is a decrease of breath-per-minute mean scores for  $resp_1$  ( $M = 17.31$ ,  $SD = 3.595$ ),  $resp_4$  ( $M = 6.64$ ,  $SD = 1.837$ ),  $resp_7$  ( $M = 7.56$ ,  $SD = 2.295$ ), and  $resp_{10}$  ( $M = 6.64$ ,  $SD = 1.837$ ). There is a significant change of the respiration rate among students over the four sessions.

**Table 2: Changes in time of breath-per-minute**

Time	M	SD	F	Sign (p)	Effect size ( $\eta^2$ )
Session 1	17.31	3.595			
Session 4	7.57	1.996			
Session 7	7.56	2.295			
Session 10	6.64	1.837			
Time			229.429	.000*	.871
Between subjects effect			961.347	.000*	.966

Note: M = mean, SD = standard deviation, \*  $p < .001$

The results consist with the prior studies that breathing therapy is useful technique for the basic handling of anxiety due to psychophysiological arousal (McCraty et al., 2000; Johnson et al., 2009; Lehrer and Woolfolk, 2007). With controlled respiration, heart rate associated with the lower respiration rate can be reduced and can make the effects of fast heart beat disappear (Lehrer and Woolfolk, 2007). Another finding by Johnson et al. (2009) there were two particular techniques associated with deep breathing and relaxation, and it has been shown to effectively decrease anxiety levels in individual who have difficulty relaxing in anxious situations. Other than that, in

preliminary study found significant difference in pre post treatment in reducing anxiety during six sessions (Vitasari et al., 2011b). Finally, biofeedback is a useful tool and is simple to use with the training procedures available for students to practice the techniques in reducing anxiety.

#### 4 Conclusion

Anxiety was prevalent and persistent in student's population. More than half of students with significant symptoms of anxiety do not receive treatment even over two year periods. This research offers a psychophysiological treatment to reduce anxiety through biofeedback training for university students. The result shows that there is a significant change over time in the beat-per-minute and breath-per-minute through the participants. From the training, it is shown that after 10<sup>th</sup> session, students be able to control their heartbeat and respiration to reduce anxiety level. Breathing therapy was useful technique for the basic handling of anxiety due to psychophysiological arousal. It is concluded that the psychophysiological treatment with biofeedback training is an effective method to teach students in reduce their anxiety level.

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