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An Assessment of Brain Electrical Activities of Students toward Teacher's Specific Emotions

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***Abstract*—**In this study, the signal of brain electrical activities of the sixteen students selected from the Department of Electrical and Energy at Usak University have been recorded during a lecturer performed happiness emotions for the first group and anger emotions for the second group in different time while the groups were in the classroom separately. The attention and meditation data extracted from the recorded signals have been analyzed and evaluated toward the teacher's specific emotion states simultaneously. Attention levels of students who are under influence of happiness emotions of the lecturer have a positive trend and attention levels of students who are under influence of anger emotions of the lecturer have a negative trend. The meditation or mental relaxation levels of students who are under influence of happiness emotions of the lecturer are 34.3% higher comparing with the mental relaxation levels of students who are under influence of anger emotions of the lecturer.

***Keywords*—**Brainwave, attention, meditation, education.

I. Introduction

EDUCATION of students in a classroom is associated with classroom environment, education materials, instruction level and emotions of teachers. Emotions generated by brains are physical and mental states and plays important role in decision-making [1]. Brígido and colleagues have performed a descriptive and correlation analysis for relationships between self-efficiency and emotions [2]. In higher education, researches on teaching connected on a variety of emotions are scares in [3]. In the mid of 1990s researches on teachers' emotions have been appeared and some of them reported in [4]-[8]. A study has been examined on teachers' emotion regulation and classroom management [9].

Attention is important term in educational settings [10] and may effects learning processes positive or negative according to its level. Meditation is a pedagogical tool as an alternative way of knowing that fills in conventional learning approaches and many researches on it in higher education has been showed that it is a useful for enhancing the physiological well-being of students [11], [12]. Both of attention and meditation levels can be measured using brainwave detectors on top of subjects' head and the measures were reported in [13], [14]. In our previous study, effectiveness of classroom lighting colors toward students' attention and meditation extracted from brainwaves has been investigated [15].

In this study, the signal of brain electrical activities of the sixteen students selected from the Department of Electricity and Energy at Usak University have been recorded during a lecturer performed happiness emotions for the first group and anger emotions for the second group in different time while the groups were in the classroom separately. The attention and meditation data extracted from the recorded signals have been analyzed and evaluated toward the teacher's specific emotion states simultaneously.

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II. Brainwaves

Neurons generate electric voltage fields in the brain and these fields can be read using electrodes on the [16]. Electroencephalograph (EEG) is a system which records electrical activities generated by brain. In the Fig. 1, an EEG signal during 45 seconds is shown.

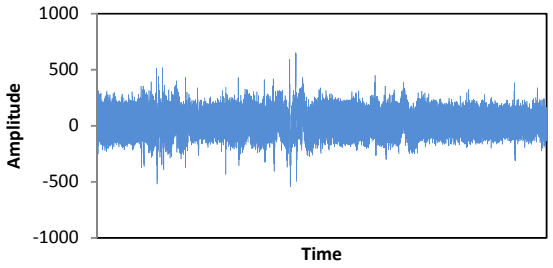

Fig. 1 EEG signal in the time domain

An EEG signal has some frequency bands which delta, theta, alpha, beta and gamma are related to brain states [16]. In Table I, the frequency bands ranges and their mental states and conditions are shown.

The Fast Fourier Transform has been applied to the EEG signal in Fig. 2 and the result has been shown in Fig. 2. Now it can be seen that the frequency bands and their amplitudes of the EEG signal in the range of 0.1-30 Hz can be analyzed easily.

III. Research Method

A. Participants

In this study, participants were 16 students who enrolled in the Department of Electricity and Energy at Usak University. The average age is 20 years old and all male. The participants were split into two equal groups numerically. A lecturer performed happiness emotions for the first group and anger emotions for the second group in different time while the groups were in the classroom separately. The selection criteria of the participants depended on voluntarily.

TABLE I
EEG FREQUENCY BANDS [16]

Brainwave Type	Frequency Range (Hz)	Mental states and conditions
Delta	0.1 - 3	Deep, dreamless sleep, non-REM sleep, unconscious
Theta	4 - 7	Intuitive, creative, recall, fantasy, imaginary, dream
Alpha	8 - 12	Relaxed, but not drowsy, tranquil, conscious
Low Beta	12 - 15	Formerly SMR, relaxed yet focused, integrated
Midrange Beta	16 - 20	Thinking, aware of self & surroundings
High Beta	21 - 30	Alertness, agitation

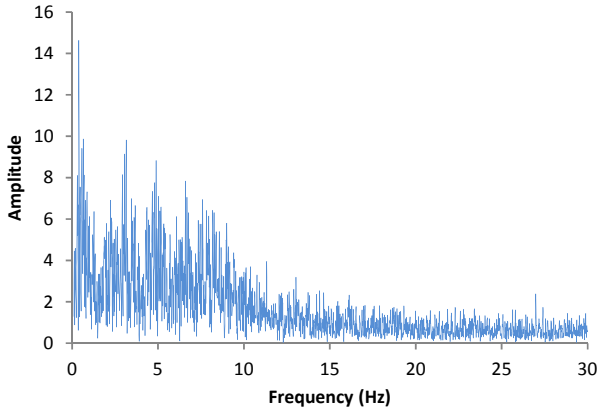

Fig. 2 EEG signal in the frequency domain

B. Instruments

The entire participant wore a headset "MindWave" which is a production of NeuroSky Inc. It reports raw brainwave, information about the frequency bands and attention and meditation level using a special algorithm [16]. The raw wave data transfer into computer via Bluetooth communication at a sample rate of 512 Hz. The headset is shown in Fig. 3.

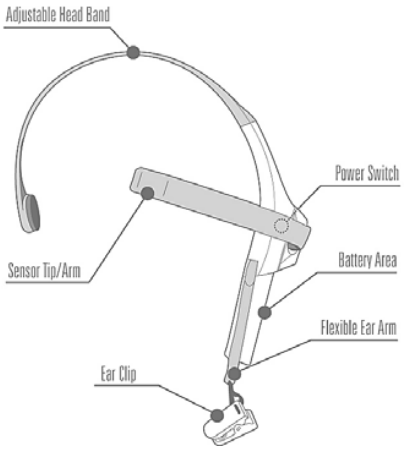

Fig. 3 EEG signal in the frequency domain

The measured raw brainwaves signal is amplified and then ambient noise and muscle movement are removed. A special algorithm is applied to the remaining signal to get attention and meditation level by the chip. The attention and meditation levels indicate mental focus and mental relaxation respectively of users [16].

C. Procedure

The signal of brain electrical activities of the sixteen students selected from the Department of Electrical and Energy at Usak University have been recorded during a lecturer performed happiness emotions for the first group and anger emotions for the second group in different time while the groups were in the classroom separately. The participants were under the influence of the lecturer specific emotions during 45 seconds.

IV. RESULTS

Fig. 4 shows attention levels of the eight participants who were under the influence in the happiness emotions of the lecturer during 45 seconds. Fig. 5 shows attention levels of the eight participants who were under the influence in the anger emotions of the lecturer during 45 seconds. As comparing of the two graphic, attention level of the first group was getting increased and attention level of the second group was getting increased.

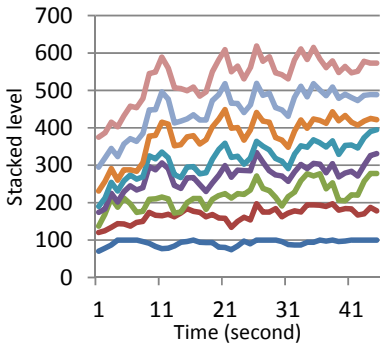

Fig. 4 Happiness attentions

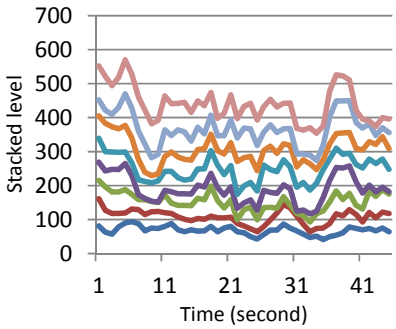

Fig. 5 Anger attentions

Fig. 6 shows meditation levels of the eight participants who were under the influence in the happiness emotions of the lecturer during 45 seconds. Fig. 7 shows meditation levels of the eight participants who were under the influence in the anger emotions of the lecturer during 45 seconds. As comparing of the two graphic, there is no trend difference but the levels.

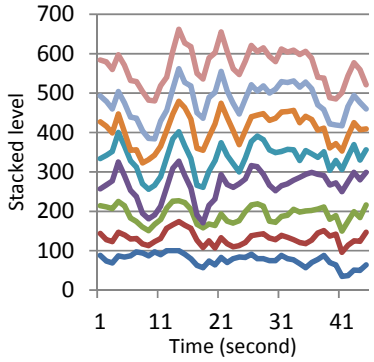

Fig. 6 Happiness meditations

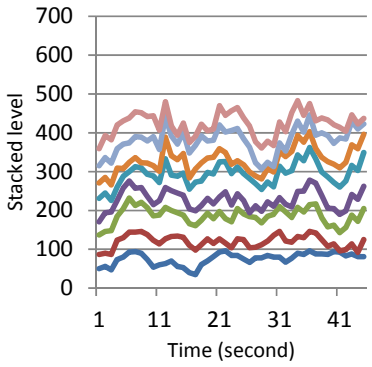

Fig. 7 Anger meditations

Due to the fact that evaluating difficulties of the graphics shown in Figs. 4-7, running averages algorithm was applied to the data of attentions and meditations values of all participants. The window size of this algorithm was chosen 13. Fig. 8 shows the running averages of attentions of the groups under influence of happiness and anger emotions of the lecturer. Fig. 9 shows the running averages of meditations of the groups under influence of happiness and anger emotions of the lecturer.

V. Conclusion

In this study, attention levels of students who are under influence of happiness emotions of the lecturer have a positive trend and attention levels of students who are under influence of anger emotions of the lecturer have a negative trend. The meditation or mental relaxation levels of students who are under influence of happiness emotions of the lecturer are 34.3% higher comparing with the mental relaxation levels of students who are under influence of anger emotions of the lecturer.

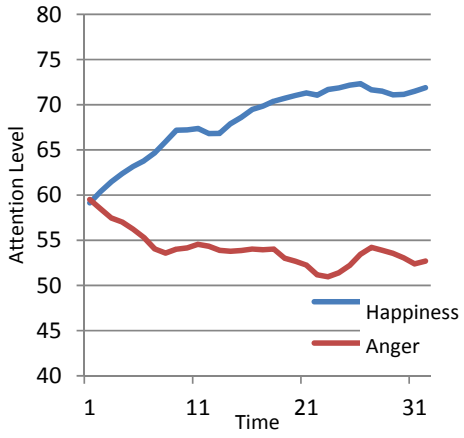

Fig. 8 Running averages of attentions

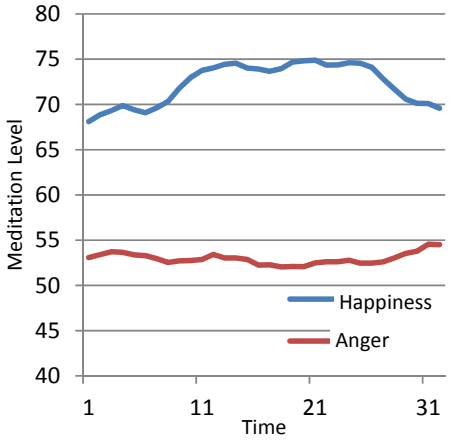

Fig. 9 Running averages of meditations

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