



Evaluation of attention deficit of engineering students via electrooculography assistance

C. Tasdemirci^{1,a}, A. Ozkan¹

¹Kocaeli University, Technology Faculty, Biomedical Engineering, Kocaeli, Turkey.

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Abstract

Improving attention capability in learning activity is very important. But most of the researchers focused on attention deficit and hyperactivity. However day life attention losses are ignored. For this reason, understanding the reasons of attention deficits is important. In this way new education methods and courses plans can make to minimized deficit and lose of attention. In this study, attention level changes of engineering students between the ages of 20 were examined. The reason of the attention deficits was evaluated and methods for improving attention level were developed. Attention tests were focused on students who are following the same courses. Courses were grouped as theoretical and practical, and also the progress in the courses was mixed to achieve a better level of attention. Electrooculography (EOG) measurements were taken and eye movements were recorded. Bourdon's attention test was applied to the participants. Prelesson attention level of the participants was measured, between courses attention level also observed. It was seen that after the first 2 courses, attention level was increased, however after 4 courses attention level started to decrease and at the end of the 8 courses a high level of attention deficit was observed. Rest, classical music and the effects of stimulants such as coffee were studied to eliminate attention deficit.

Keywords: biomedical, biosignal, bourdon attention test, electrooculography.

1. Introduction

1.1. Attention

Attention can be defined as conscious or unconscious attention to the state of instant condensation with all emotions and power of thought, to make the events more vivid [1].

Caution is the process of selecting some of the stimuli from environmental data for subsequent cognitive processes. While reading an articles, there are countless other stimulations around you, however in all of this stimulations, you are just trying to get your attention on

these articles you read. Therefore, attention plays a central role in learning and remembering [2].

Factors affecting attention is;

- Size
- Density
- Innovation and extraordinariness
- Inconsistency
- Emotion
- Personal Severity

1.2. Bourdon attention test

An important feature of attention is selectivity. There are many stimulants that will always attract attention. Since it is impossible to focus on all of these stimulants, it must be possible to choose which ones are important. Selective attention is the detection of the obvious, the neglect of other stimuli, and attention to a specific stimulants. It is important to able to distinguish between the relevant stimulus and the unrelated stimulants and to react only to the relevant stimuli, but not to react to indifferent stimuli [4, 5].

Without the selectivity of attention, the organism would not be able to behave in a consistent way. Individuals

with a high level of selective attention are particularly interested in things that need attention, while individuals with low or distracting attention are more concerned with stimuli. Most of these stimulants are stimulants that they should not be interested in. There is a need for measurement tools that can evaluate these concepts in a valid and reliable way for researches that measure or develop selective attention. One of these tools is a bourdon attention test [6].

The most recently used form of the Bourdon attention test was developed by Benjamin Bourdon in 1955. There are two different forms of the Bourdon attention

^aCorresponding author: cagatay.tasdemirci@kocaeli.edu.tr

test. In the first, finding and marking certain letters within random text, the second one is finding and marking the figures which are given as random shapes [7].

The tests requires a continuous attention orientation. Ideally There should be 660 letters in the letter form of the bourdon test, within 3 or 5 minutes, participants must find certain letters. Figure form of the test is consists of one page and there are 450 small figures on this page. It is desired to find certain figures in page. There is no age limit for the figure form of the test however letter form of the test suitable for 6-22 years old people [8, 9].

At the evaluation of the test, number of correct answers,

1.3. Electrooculography

Electrooculography (EOG) is the term used by Marg in 1951 for the first time [13], indicating the potential for resting between the cornea and the posterior segment of the eye. The existence of this potential was first discovered by Emil Dubois Reymond in 1849 and was more positive in the cornea than in the posterior segment of the eye [14]. Swedish physiologist Alarik Frithiof Holmgren showed that the changes in the enlightenment of the retina in 1865 changed the amplitude of this potential. This potential difference ranges from 0.4 to 1mV. This potential difference is

mistakes (incorrect markings) or time can be considered. The practitioner may evaluate the number of correct answers of the participants within a certain time. How many correct figures marked by participants could be count and considered. Also missed and wrong marks could be observed and reason of the miss and wrong marks could be considered. There is no template created. The researchers can determine their own template [10, 11].

In this study, the letter form of the Bourdon attention test was used. Finding and marking "b, d, g and a" letters were requested from participants. In the evaluation of the test, number of letters, correct, missing and incorrect markings, eye movements and error ratio were taken into consideration.

attributed to the retina, even if it is wrong to say that it belongs to a tissue. The voltage and the stresses associated with the movement of the eye are also measured by a pair of periorbital surface electrodes. These signs are potentials arising from the movement of the eye and are known as electrocardiogram (EOG) and are also known as biomedical signals that allow even small movements of the eye to be measured [15]. The device used in EOG measurements can be seen in Figure 1 and Figure 2 (BIOPAC MP36).



Figure 1: BIOPAC device used in EOG measurements



Figure 2.:BIOPAC device used in EOG measurements

BIOPAC MP36 have 4 channel, it can record 4 different biosignals at the same time, however for EOG signal 2

channel must be used. One for horizontal, one for vertical eye movements record

2. Materials and methods

Bourdon Attention Test Letter Form was used for attention measurement in experiments. In the prepared tests, the letters a, b, d, g were arranged as 60 pieces (15 pieces each letter) and total number of 390 letters at each text were used. Letters were used from English Alphabet. Tests were repeated 3 times in a row, each session was given 2 minutes.

Participants were selected from the same class in order to minimize environmental factors and educational differences. Measurements were taken for the theoretical and practical stages of similar courses and it was aimed to make the best course plan to minimize attention deficit.

While participants was marking text, eye movements were recorded. With the help of the recorded eye movements (EOG), the steps and methods of solving the test were examined and the letters they missed and attend were observed. At each text, same number of

letters, font and size were used.

The records were taken at the beginning of the course, between the courses and at the end of the courses. After the 4 courses (8 lessons), their attention deficit and the methods to eliminating these attention deficits were examined. To eliminate attention deficit, factors such as rest (without physical activity) and classical music, different course plans (2+2 theoretical courses, 3 theoretical + 1 practical courses) were studied.

For recording EOG signals “BIOPAC MP36” was used. This device is can connect to PC by USB and record and analysis most of the biological signals such as electrooculography, electromyography, electrocardiography, electroencephalography. The positions of the electrodes are shown in Figure 3. Two different channels are used for vertical and horizontal movements of the eye.

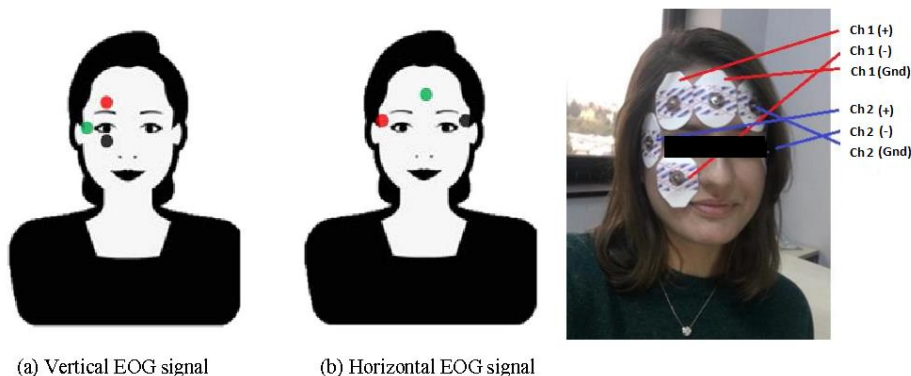


Figure 3: Position of electrodes in EOG measurements

3. Results

As a result of the measurements, students' attention test results were evaluated for 4 courses. In the evaluation, the average of the results of 20 students was taken and

the mistakes were evaluated in two headings as wrong marking and missing marking. Study results are given in Table 1.

Table 1: Attention test results at the end of 4 courses (8 lessons)

1 Day Results	Total Letters	Average Mark	False Average Miss Mark	Attention Point
Beginning	60	5,40	3,80	84,66
1Courses	60	3,10	2,50	90,66
2 Courses	60	5,20	4,60	83,66
4 Courses	60	7,10	4,80	80,16

The attention score was calculated over 100 point. 60 letters were used for 1 test and ever template had 15 a, b, d, g letters. To improve total score, 3 different methods were used. At the end of the 2 courses, participants rested without physical activity, consumed coffee or listened classical music separately in addition

courses were planned as 2 theoretical courses than a practical course and as a last course one more theoretical course (2-1-1). Attention score improvements results for new course plan is given at Table 2.

Table 2. Attention score improvements results

End-of-day score	Total Letters	Average Mark	False	Average Miss Mark	Attention Point
4 Theoretical Courses	60	7,10		4,80	80,16
2-1-1 Course Plan	60	5,75		4,10	83,58

Table 3. Attention score improvements results

End-of-day score	Total Letters	Average Mark	False	Average Miss Mark	Attention Point
Normal	60	7,10		4,80	80,16
1 Hour Rest	60	4,55		3,35	86,83
Classical Music	60	5,80		4,15	83,41
Coffee	60	6,10		4,30	82,66

Attention score improvements results for break time plan are given at Table 3. As a result of the measurements, it was observed that 1 hour rest without physical activity is the most effective factor to increasing the end-of-day score. It was observed that the

effects of coffee and classical music were minimal and did not increase the end-of-day score more than beginning score. 2-1-1 course and break time plan is the best alternative to improve attention deficit (mix plan). Attention score improvements results given at Table 4.

Table 4. Attention score improvements results

End-of-day score	Total Letters	Average Mark	False	Average Miss Mark	Attention Point
Normal	60	7,10		4,80	80,16
1 Hour Rest	60	4,55		3,35	86,83
2-1-1 Course Plan	60	5,75		4,10	83,58
Mix Plan	60	3,25		3,10	89,41

Mixed Plan (2-1-1 course plan and break without physical activity) was increased end of day attention

score approximately 12%.

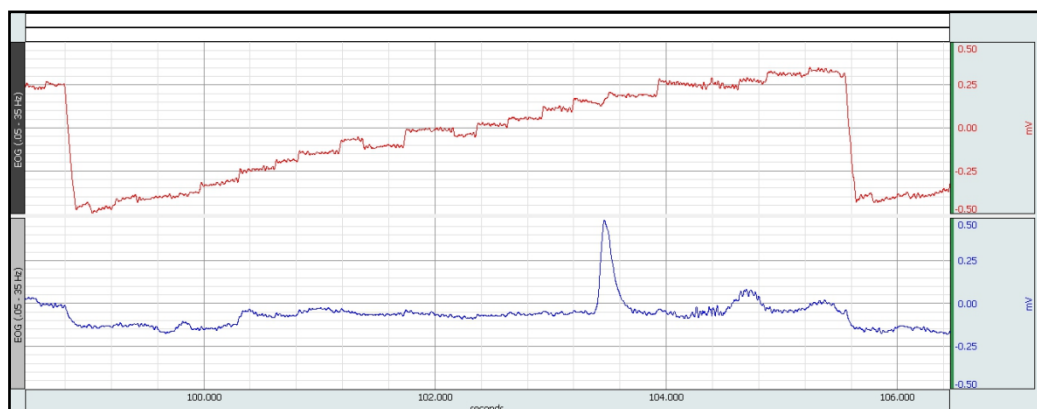


Figure 4: EOG Records sample for 1 line

EOG measurements showed that participants were particularly careful with the letter “c”, in addition, it was observed that the letter “p” caused hesitations about

marking and participants especially focused on “p” letter. Although the effect of coffee did not change the day-end score significantly however increased eye

movements and activities. Eye movements can be seen at Figure 4. From records it is easy to understand every line also every letter participants read. Potential increase at every letter, because of the eye movement which is happened every letter read. It can be seen as a level difference. From left to right it can be seen that participant read letter, and potential decreases showed that participants read letter before (back to previous

letter).

At the beginning of the measurements, the participants were informed of the search as a whole and the line observations. The compliance of this rule and the reliability of the data was also checked via EMG measurements.

4. Conclusion and discussion

In this study, it was observed that the students should give a break their education middle of the day for increase efficiency of education and the most active break method is resting without physical activity. However, although given a break, attention deficit was at considerable level. This study shows that planning content of the courses also effect attention deficit. Therefore to minimize attention deficit not only given a break but also planning content of the courses is must. At future studies numeric and social courses also can be considered. Different week days and different break time activities could be examined.

In order to expand the studies, more participants and different courses can be examine. It is known that the attention factor varies according to the numerical and social courses [8], to examine this differences numerical

and social courses can be evaluate separately. EOG measurements are using to determinate attention deficit in different ways. At most of the studies, EOG measurements used to compare healthy individuals and patients [15, 16], however in this study EOG measurements used on participants (healthy individuals) variant is the attention level differences. In this way, it is seen that EOG measurements are selective not only to compare healthy individuals ant patients but also gives great benefit in healthy individuals.

This study shows that EOG measurements have been great benefit in the evaluation of erroneous and incomplete markings in the data reliability and attention testing process. EOG signals are effective to observe reading speed effect on the font size and style. Letter size and style can be examine for bourdon test texts.

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