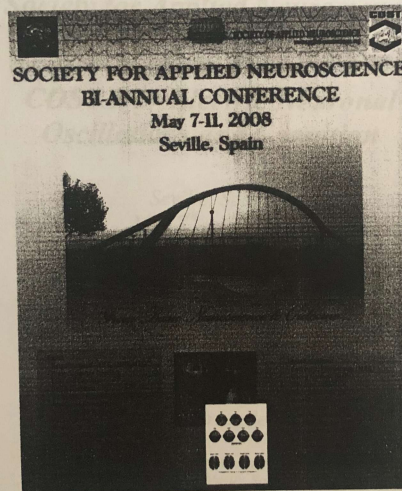

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Biofeedback modalities for better achievement in high school students

Nada Pop-Jordanova, Irena Cakalaroska & Tatjana Zorcec

Faculty of Medicine, University of Skopje

The aim of this study was to compare three biofeedback methods for enhancement of cognitive abilities (concentration and attention) in high school students. The sample comprises 80 students, aged 16-18 years, 94% girls, 6% boys; 81% were Macedonian and 19% Albanian. Four groups are established: (I)- 30 students trained with Peak Achievement Trainer; (II)- 10 trained with EDR; (III)-10 trained with HRV and (IV)- 30 students as control group. Used equipment was: Peak Achievement Trainer (NeuroTek, USA); Heart Rate Variability (Freeze Framer, Boulder Creek, California, USA) and Electrodermal resistance (The Inner Tunner Expert System, Ultramind International, Ltd, UK version 2.10). The Peak Achievement Trainer is supposed to activate the executive attention network – the part of the brain that has been recently identified as area which is most important for doing tasks and for new learning. HRV and EDR were supposed to influence indirectly, through the stabilization of autonomous nervous system. As psychometric tests we used: Trail Making Test-form A (TMT-A) and form B (TMT-B) and Numbering (forward and backward), applied prior and after the experiment. The difference of the duration of concentration between the first and last session on PAT is significant ($t = 3.44$, $p = 0.0017$; % time total $t = 3.00$ $p < 0.0005$). Concerning HRV we obtained significant improvement of the heart rate control ($t = 4.34$, $p = 0.0018$), and coherence ($t = 4.34$, $p = 0.0013$). EDR training also reduced stress level measured by skin resistance in $k\Omega$ ($t = 3.26$, $p = 0.0098$). Psychometric results confirmed the influence of PAT on concentration and learning (for TMT-A $t = 8.302$; for TMT-B $t = 5.137$, for numbering forward $t = 3.521$ and backward $t = 2.168$). For other two modalities only HRV showed improvement for numbering forward. The results suggest that PAT can be successfully used for improving concentration and attention and to a less extent the short term memory span. The HRV showed improvement only for numbers, and EDR group did not show significant improvement in the concentration, attention and the short term memory span. However, all the three methods are highly cost-benefit and very comfortable for application and can be used for stabilization of the homeostasis.

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