

Effects of Game-Based Brain Training on Alertness, Vigilance, and Executive Control in Students with Hearing Loss: A Randomized Controlled Psycho-Physiological Study

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Abstract

Objectives: To improve the attention components: Alertness, Vigilance, and Executive control in students with hearing loss using a game-based brain training program. In additions, to determine the brain regions activation during performing attention tasks after the training program.

Participants: 22 male students with hearing loss (40-70 db) aged between (14-18 years; $m=16.8$, $SD=1.1$) agreed to participate in the psychological study. Only 5 students agreed to perform the Functional Magnetic Resonance Imaging (fMRI) study.

Measurements: **Attention Network Test (ANT):** a computerized test for measuring attention Components: Alertness, Vigilance, and Executive control. **A computerized brain training game** (Brain Challenge): includes: logic, math memory, visual and focus sub-tasks. **Functional Magnetic Resonance Imaging (fMRI):** to determine the activation of brain regions during performing attention test before and after training.

Results: There is a statistically significant difference in alertness, vigilance and executive control between pre and posttest on ANT for posttest ($p=0.005$). Brain regions related to alert, vigilance and executive control were more active during posttest rather than pretest. Brain regions (i.e.: superior temporal sulcus (STS) inferior frontal gyrus, premotor cortex, and inferior parietal lobule) activated more obviously on ANT posttest compared to pretest.

Conclusion: The more engagement on tasks depending on brain training, the better performance on cognitive aspects. The brain regions that are included on training tasks would be activated during performing the developed cognitive aspects.

Keywords

Brain training, Alertness, vigilance, Executive control, Attention Network Test, Hearing loss.