CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

J0701

Project Title

The Effect of Deep Breathing vs. Exercise on Stress Reduction and Test Performance

Abstract

Objectives/Goals

The objective of this study was to determine which technique: deep breathing or exercise lowers stress related to taking tests and improves performance on tests.

Methods/Materials

Heart rate variability (EMwave) ear sensor, HeartMath/EMwave Software on Laptop, Mental Math Test on iPad, Stopwatch, 4th and 5th grade student volunteers, Incentives (candy or stationary), Feathers to monitor deep breathing, Stress Questionnaire (Depression, Anxiety, Stress Scale).

Results

Over a two week period, 41 volunteers from 4th and 5th grade classes, were randomized into three different groups: control group, meditation/deep-breathing group, and exercise group. I had the 41 students complete a 21 question survey on their level of stress. I then measured all the students' heart rate variability using a ear sensor and EMwave software. I calculated the baseline level of reported stress on the questionnaire and physiologic stress using the ear sensor and heart rate variability software for each student. I then taught the 4-7-8 deep breathing technique to the meditation group. Then, every day for two weeks, I had the meditation group do deep breathing with me for 5 minutes, the exercise group ran with me for 5 minutes, and there was a control group, which had a regular school day during this time. Upon completion of the experiment, I measured heart rate variability while the students took a mental math test again. After two weeks of daily intervention, the group that did deep breathing every day, lowered their stress levels as measured by a significant improvement of 5.5% in heart rate variability ($p=.003$) and also increased their mental math test scores by a significant 12% ($p=.03$). The other two study groups had their stress levels stay the same or worsen during the same time period.

Conclusions/Discussion

No prior study has shown that just five minutes of simple deep breathing can result in statistically significant improvement of 12% in test performance. This improvement in test scores was correlated with statistically significant physiologic stress reduction measured by improvement in heart rate variability. The impact of these findings is that schools could teach a simple, but powerful breathing technique to help students improve test performance. Just five minutes of deep breathing before a stressful activity can result in big changes in test taking and other stressful situations.

Summary Statement

I showed that training students in deep breathing can improve their physiological stress and significantly improve their test scores.

Help Received

I designed and did all parts of the experiment myself, including teaching students deep breathing daily for two weeks as well as doing all subject testing. My teachers and the 4th and 5th grade teachers at my school gave me class time to perform the interventions. My mom helped me with the statistics.