CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

S0497

Project Title

Cognitive Neuroscience: The Effects of Numeric and Language Auditory Stimuli on Arithmetic Responses of the Brain

Abstract

Objectives/Goals

This experiment is designed to analyze the effects of numeric and language audio on responses of the brain regarding arithmetic cognitive functions. Hypothesis: If students are exposed to audio (numeric/language) containing the same subject material as the test given, then students# test scores will be lower than if exposed to a dissimilar audio and test.

Methods/Materials

Students were given standardized arithmetic tests to assess their performance when simultaneously challenged with varying audio. We conducted 427 tests altogether, exposing a relatively equal number of students to no audio, arithmetic audio, and language audio. The arithmetic test consisted of ten problems, five that required calculations and five that required comparison. Students were given five minutes to complete the test.

Results

The control group had a mean of 8.51007 questions correct, the language group 8.0741, and the arithmetic group 7.84615. The means for the control group's calculation scores and comparison scores were 3.85906 and 4.65101 respectively, numeric 3.41258 and 4.42657, and language 3.74074 and 4.33000.

Conclusions/Discussion

After analyzing the data, we found that the students who were exposed to audio containing the same subject material as the test scored the lowest on average. In order to compare the mean scores, we ran a one-way ANOVA test, finding a p-value of .0000176. This caused us to reject the null hypothesis and conclude that the means were not equal. The differences in test performance for each audio can be attributed to the dissimilar regions of the brain that control the functions. While the parietal lobe and the corpus callosum are largely responsible for arithmetic functions, Geschwind's territory, Broca's area, and Wernicke's area are accredited with language abilities. We also found that students scored higher on the comparison problems than on the calculation problems across each auditory stimulus. This phenomenon can be explained by the dependence of calculations on the regions associated with language, while comparison tasks rely on nonverbal brain networks. Thus, the latter is not as affected by auditory distractions, yielding higher scores. Based on the results, our hypothesis correct.

Summary Statement

This experiment was designed to determine the effects of different audio (numeric, language, or silence) on arithmetic brain responses through the conduction of tests and statistical analysis.

Help Received

Mrs. Hampton helped guide us throughout the duration of the experiment and kept us on track.