



# AOTA Evidence Briefs

## Attention Deficit/Hyperactivity Disorder

*\*A product of the American Occupational Therapy Association's Evidence-Based Literature Review Project*

### A#12

#### **Adding color as a stimulant on a copying task improves the performance of adolescents with attention problems**

Zentall, S. S., Falkenberg, S. D., & Smith, L. B. (1985). Effects of color stimulation and information on the copying performance of attention-problem adolescents. *Journal of Abnormal Child Psychology*, *13*, 501–511.

**Level: IA1a**

Randomized control trial, 20 or more participants per group, high internal validity, high external validity

#### **Why research this topic?**

According to optimal stimulation theory, all organisms have a biological need to attain an optimal level of arousal. When they are not receiving adequate arousal, organisms may shift their attention or change their activity to obtain more stimulation. Children who are hyperactive are thought to be “less tolerant of situations involving minimal stimulation” (p. 502). If so, adding stimulation during repetitive or monotonous tasks should improve the performance of these children.

#### **What did the researchers do?**

Zentall, Falkenberg, and Smith (1985), of Purdue University (West Lafayette, Indiana), Eastern Kentucky University (Richmond), and Columbia State Community College (Tennessee), investigated whether added stimulation would improve the performance of hyperactive adolescents on a copying task. The participants in their study were 32 boys selected from a pool of 69 junior and senior high school boys. All 69 had taken a 20-minute story-copying test. Of the 32 selected, 16 had attention problems (as indicated by scores of 9 or above on the first 6 items of the 10-item Conners scale) and poor handwriting (as indicated by scores of 6 or below on the Test of Written Language). The other 16 had low scores on the Conners scale. They were matched to the other 16 on the basis of handwriting scores and age.

The participants were tested in pairs. For 30 minutes, eight pairs performed a handwriting task involving high stimulation, while the other eight pairs performed a handwriting task involving low stimulation. Two weeks later the groups performed the tasks in the reverse order of stimulation.

The task in all cases involved the boys copying word lists, city and state lists, and paragraph stories in two 17-page booklets, A and B. The booklets were alike in number of letters and content but were counterbalanced across the treatment order. That is, with one group, booklet A was used first, then booklet B; with the other group, booklet B was used first, then booklet A.

Some copies of each booklet were low stimulation, and some were high. Low-stimulation booklets contained black letters printed on white paper. Color was added to black letters to produce high-stimulation booklets (two colors per page, alternating by line).

Half the subjects also received added “information” in their high- and low-stimulation booklets. For these subjects, the width of specific parts of all 26 letters (e.g., the cross-bar on the *t* or the dot on the *i*) was increased. This was accomplished in the low-stimulation booklets by adding black to the black letters and in the high-stimulation booklets by adding color to the colored letters. In the “noninformation” group, color was added to randomly selected whole letters across both levels of stimulation.

Half the pairs experienced high stimulation for the first 30-minute treatment session; they experienced the low stimulation 2 weeks later. The reverse took place for the remaining pairs.

In each treatment order, half of the eight pairs were randomly assigned either to color added to relevant letter detail or to color added to randomly selected letters.

The outcome areas of interest to the researchers were *performance* (as measured by number of errors on the first page, the middle page, and the last page completed; and the number of pages completed); and *behavior* (as reflected in sliding movements of the buttocks and 45° torso movements forward or backward, both noted by observers).

### **What did the researchers find?**

The adolescents with attention problems made **significantly** (see *Glossary*) more errors on the first page with black letters than on the first page with color-added letters. They also made significantly more errors on the middle page with black letters than on the middle page with color-added letters.

Those in the attention problem group who worked with color-added letters during the first session and black letters during the second session made significantly more errors than those in the attention problem group who worked with black letters during the first session and color-added letters during the second session.

For both groups, color added to relevant detail resulted in significantly less movement than when black emphasis was added to relevant detail.

### **What do the findings mean?**

For therapists and other providers, the findings suggest that adding color to a copying task reduces errors among adolescents with attention problems.

### **What are the study’s limitations?**

The basic hypothesis upon which this study is based is that children who are hyperactive are less tolerant of low level of arousal, and so adding stimulation in monotonous tasks will increase arousal and thus performance. However, the subjects in this study are adolescents who have attention deficit problems but not hyperactivity. The authors added colors to letters to increase arousal, but there is no independent measure of arousal. A major limitation is that there were IQ differences between the ADHD and control group. The sample size was small (16 per group).

### **Glossary**

**significance (or significant)**—A statistical term, this refers to the probability that the results obtained in the study are not due to chance, but to some other factor (such as the treatment of interest). A significant result is likely to be generalizable to populations outside the study.

Significance should not be confused with clinical effect. A study can be statistically significant without having a very large clinical effect on the sample. For example, a study that examines the effect of a treatment on a client’s ability to walk may report that the participants in the treatment group were able to walk significantly longer distances than the control group. However, if you read the study you may find that the treatment group was able to walk, on average, 6 feet, whereas the control group was able to walk, on average, 5 feet. Although the outcome may be statistically significant, a clinician may not believe that a 1-foot increase will improve his or her client’s function.

■ Terminology used in this document is based on two systems of classification current at the time the evidence-based literature reviews were completed: *Uniform Terminology for Occupational Therapy Practice—Third Edition* (AOTA, 1994) and *International Classification of Functioning, Disability and Health (ICIDH-2)* (World Health Organization [WHO], 1999). More recently, the *Uniform Terminology* document was replaced by *Occupational Therapy Practice Framework: Domain and Process* (AOTA, 2002), and modifications to *ICIDH-2* were finalized in the *International Classification of Functioning, Disability and Health* (WHO, 2001).

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For more information about the Evidence-Based Literature Review Project, contact the Practice Department at the American Occupational Therapy Association, 301-652-6611, x 2040.



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