



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

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

CITATION: 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 OF EVIDENCE: IA1a

RESEARCH OBJECTIVE/QUESTION

To determine whether color stimulation would produce gains for adolescents on a copying task, comparable to stimulant-produced gains observed for elementary-level children on attentional tasks

DESIGN

X	RCT		Single case		Case control
	Cohort		Before–after		Cross-sectional

RCT = randomized control trial

Participants were tested in pairs in a repeated-measures crossover design; for example, half of the pairs experienced high-stimulation handwriting tasks for the 30-min first session and the low-stimulation tasks 2 weeks later. The remaining pairs received level of stimulation in the reverse order.

SAMPLING PROCEDURE

	Random		Consecutive
X	Controlled		Convenience

Participants were 32 boys selected from a pool of 69 junior and senior high school students.

SAMPLE

N = 32	M range = 14–18 years	Male = 32	Ethnicity = NR	Female = 0
--------	-----------------------	-----------	----------------	------------

NR = Not reported

Sampling was performed on the basis of copying tasks and behavioral ratings (school teacher).

PARTICIPANT CHARACTERISTICS

Inclusion criteria: Not specified

- Attentional problems
- Poor handwriting

MEDICAL DIAGNOSIS/CLINICAL DISORDER

Not specified

OT TREATMENT DIAGNOSIS

Fine motor difficulties (handwriting), attention to tasks (classroom)

OUTCOMES

Performance and behavioral observations during graphomotor tasks

Measures	Reliability	Validity
Performance: Copying task and number of errors: omissions of whole and parts of letters, substitutions, spacing, erasures, failure to close or open specific letters, failure to use straight or rounded strokes, and unrecognizable letters	Y - intrarater agreement on performance $r = .85$	Y - attentional problems: concurrent and predictive validity
Behavior: movements while sitting (sliding and torso movements)	NR	NR

NR = not reported.

Outcome—OT terminology

Performance components

- Motor
- Psychological components

Outcome—ICIDH-2 terminology

Impairments

INTERVENTION

Low-stimulation (LS) and high-stimulation (HS) conditions

Description

Copying task included black letters on white paper booklet (LS) and color (red, blue, pink, green, purple, orange) added to the black letters on a page (HS).

Information was added to the LS and HS booklets by increasing the width of specific parts of letters in black for the LS condition or in color for the HS condition.

Who delivered

Not specified

Setting

Classroom-like setting

Frequency/Duration

2 sessions of 30 min each (1 week apart)

RESULTS

A mixed analysis of covariance was used to evaluate the between-subjects effects of information (emphasis added to difficult letter parts or to randomly selected whole letters) and of order (color first followed by black–white or the reverse order), and the repeated factors of (a) stimulation (black–white vs. colored letters), (b) group (matched pairs of adolescents with attention problems and comparison adolescents), and (c) time.

Handwriting performance:

- A) Errors: Adolescents with attention problems did not differ from the control adolescents in the number of copying errors [$F(1, 11) = 1.80, p > .05$]. The error rate for the attention-problem and control groups was differentially affected by color stimulation and time on task, as indicated by time interaction [$F(2, 24) = .63, p < .05$]
- B) Productivity: Insensitive measure)
- C) Activity: Follow-up analysis suggested that color added to relevant detail resulted in significantly less movement ($M = 3.4$) than when black emphasis was added to relevant detail.

CONCLUSIONS

- Added color stimulation has been found to improve the performance of hyperactive children but not control children during laboratory sustained-attention tasks, similar to the effects observed for hyperactive children from stimulant drugs.
- In summary, data do not support the use of emphasis on relevant detail in rote copying tasks.
- Support is given for the use of added color stimulation to reduce errors for adolescents with attention problems but not for control adolescents.
- Adolescents with attention problems performed better with HS task stimuli than with LS, relative to the opposite performance pattern of control children.

LIMITATIONS

There were IQ differences between the ADHD and control group. The sample size was small (16 per group).

- 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).

This work is based on the evidence-based literature review completed by Erna Imperatore Blanche, PhD, OTR/L, FAOTA, and Gustavo Reinoso, OTR/L. Contributions to the evidence brief were provided by Michele Youakim, PhD.

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.

Copyright 2004 American Occupational Therapy Association, Inc. All rights reserved. This material may be reproduced and distributed without prior written consent.