AOTA Evidence Briefs

Attention Deficit/Hyperactivity Disorder

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

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Reinforcement combined with medication improves the academic performance of children with ADD

Pelham, W. E., Milich, R., & Walker, J. L. (1986). Effects of continuous and partial reinforcement and methylphenidate on learning in children with attention deficit disorder. *Journal of Abnormal Psychology, 95,* 319–325.

Level: IA1a

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

Why research this topic?

A prominent researcher has theorized that partial reinforcement (versus continuous reinforcement) has negative effects on children with attention deficit disorder (ADD). Studies testing the theory have not been conclusive, however.

What did the researchers do?

Pelham, Milich, and Walker (1986), of Florida State University (Tallahassee), the University of Kentucky (Lexington), and the University of Georgia (Athens), respectively, designed a study to test the effects of partial reinforcement, at the same time addressing the limitations of previous studies. The participants in their study were 30 children who had been referred to a summer treatment program at Florida State University. All had a diagnosis of ADD, and 25 also met the criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed.) for attention-deficit/hyperactivity disorder (ADHD). Twenty-four of the children were boys, 6 were girls. Their average age was 8.6 years.

The researchers grouped the participants by sex, then rank-ordered them by age. They then randomly assigned each member of a group of three to one of three reinforcement conditions: none, partial, or continuous. The reinforcement condition involved awarding points for correct responses, verbal praise for correct responses, and encouragement for incorrect responses. The partial reinforcement condition involved awarding points about 50% of the time, verbal praise 100% of the time, and encouragement for incorrect responses. The no-reinforcement condition involved only verbal praise and encouragement.

Within each condition the children received three doses of medication per day: either 0.3 mg/kg of methylphenidate (Ritalin) (i.e., 0.3 milligrams per kilogram of body weight) or a placebo (a drug substitute, such as a sugar pill, that contains no active ingredients). The medication was administered across 2 days. Within each reinforcement condition, half the children received the placebo on the first day and the methylphenidate on the second. The other half received the medication in the reverse order.

The focus of each group during the study was to learn how to spell lists of 10 nonsense words. The researchers chose this task because of its similarity to the learning typically required of children in classrooms. They tested the children on 2 successive days. Before each test, the children practiced spelling the words they were to learn. They were then given 10 trials to spell the words correctly. The words were presented in random order on each trial.

The outcome area of interest to the researchers was *number of errors over 10 trials.*

What did the researchers find?

In all three reward conditions, the children receiving the methylphenidate made **significantly** (see *Glossary*) fewer errors than the children on the placebo.

The children in the two reinforced groups combined made significantly fewer errors than the children in the no-reinforcement condition, although there was no difference between the two different types of reinforcements (partial and continuous).

When they were receiving the methylphenidate, the children in the two reinforced groups combined made significantly fewer errors than the children in the no-reinforcement condition and fewer than the children in the no-reinforcement condition when they were receiving the placebo.

What do the findings mean?

For therapists and other providers, the findings suggest that partial reinforcement does not have negative effects on children with ADD. "Both reward conditions dramatically and equally improved performance relative to no reinforcement" (p. 622).

The findings also suggest that reinforcement alone improves the academic performance of children with ADD and that reinforcement combined with medication has an even greater beneficial effect on academic performance.

What are the study's limitations?

This study provides important information on the effects of two different schedules of reinforcement and medication treatment on learning in children with ADHD. One limitation of this study is that the task used to assess learning (spelling) is not directly related to the deficits seen with ADHD, and without a control (non-ADHD group) there is no way to determine whether partial reinforcement is more effective for children with ADHD vs. other children.

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.