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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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Children with ADHD benefit in arithmetic performance from background music of their own choice

Abikoff, H., Courtney, M. E., Szeibel, P. J., & Koplewicz, H. S. (1996). The effects of auditory stimulation on the arithmetic performance of children with ADHD and nondisabled children. *Journal of Learning Disabilities, 29,* 238–246.

Level: IIA1a

Nonrandomized control trial, 2 groups, 20 or more participants per condition, high internal validity, high external validity.

Why research this topic?

Research findings regarding the effects of real-life distractions on the academic performance of children with attention-deficit/hyperactivity disorder (ADHD) are not clear-cut. There is empirical evidence to support the premise that external stimuli facilitate academic performance under certain conditions, but more research is needed about characteristics of the distracting stimuli, as well as which tasks are affected.

What did the researchers do?

Abikoff and his colleagues (1996), variously affiliated with Albert Einstein College of Medicine (Bronx, New York) and Long Island Jewish Medical Center (New Hyde Park, New York) or in private practice, designed a study to evaluate the effects of external auditory stimulation on the academic performance of children with ADHD.

The participants in the study were 40 boys in grades two through six, of whom 20 had ADHD and 20 did not. Their average age was 9.9 years. All the children with ADHD met the criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed. rev.) for ADHD and had a score of at least 1.5 out of 3.0 on the Hyperactivity factor of the Conners Teacher Rating Scale. Further, all the children had scored at least 8 on the Vocabulary subtest of the Wechsler Intelligence Scale for Children–Revised (WISC–R). Children were excluded if their score was 85 or less on the Arithmetic subtest of the Wide Range Achievement Test–Revised (WRAT–R) and if that score was 15 points or more below their estimated intellectual ability, or if their functional score on the Arithmetic Screening Test was lower than second grade.

The 20 boys with ADHD were outpatients at a clinic. The 20 boys without ADHD were students in local school districts.

The experimental procedure took place over 2 days. On the first day, all the children took the Vocabulary subtest of the WISC–R, the Arithmetic subtest of the WRAT–R, and the Arithmetic Screening Test. The latter consists of five levels, which correspond to grades two through six. Each child first took the Arithmetic Screening Test that was one grade level below his grade-level arithmetic score on the WRAT–R. If he scored 80% or higher, he took the next-higher test; if he scored below 80%, he took the next-lower test. The testing continued, on higher- or lower-level tests, to determine the highest level at which a score of 80% was obtained.

Also on the first day, the children provided the titles of their favorite songs and the names of the artists who performed them. The researchers then prepared 10-minute audiotapes of each child's favorite music.

On the second day of the experimental procedure, all the children took three arithmetic exams at the grade level indicated by their performance the previous day on the Arithmetic Screening Test. The researchers administered the exams under three conditions: (1) 10 minutes of background music (the child's favorite), (2) 10 minutes of background speech (a nightly business report on local television), and (3) 10 minutes of silence. They assigned the children with ADHD to one of six groups, each of which experienced a different sequence of the three conditions: music-speech-silence, music-silence-speech, speech-music-silence, speech-silence- music, silence-music-speech, silence-speech-music. Each child without ADHD was paired with a child with ADHD by grade and followed the same sequence as his partner.

The outcome areas of interest were *number of problems attempted*, *number of correct answers*, and *accuracy*.

What did the researchers find?

The children with ADHD had significantly (see *Glossary*) more correct answers under the music condition than under the speech or silence condition.

Further, the children with ADHD who experienced music as the first condition attempted significantly more problems and had significantly more correct answers than the children with ADHD who experienced music second or third. They also attempted significantly more problems than the children without ADHD who experienced music first or second, and they had significantly more correct answers than those children, regardless of sequence.

What do the findings mean?

For therapists and other providers, the findings suggest that children with ADHD benefit in arithmetic performance from background music of their own choice. "The benefits . . . appear to be related to the facilitative effects of appealing, highly salient stimulation" (p. 243). Further, the effects depend on when the music is presented.

What are the study's limitations?

This study provides potentially important data on the effects of extra task stimulation (auditory) on the academic (arithmetic) performance of children with ADHD. However, it has limited generalizability with respect to other types of stimulation and academic tasks. Although the authors claim to find an effect on "arithmetic performance" (more problems completed), there was no difference in accuracy (i.e., percent correct). Studies using larger sample sizes are needed; the significant order effect reported is based on three to four subjects, and music had an effect only in the first 10 minutes.

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.