

1999

## An Intervention Approach for Children with Teacher- and Parent-Identified Attentional Difficulties

Margaret Semrud-Clikeman

Kathleen H. Nielsen

Amanda Clinton

Leihua Sylvester

Nancy Parle

*See next page for additional authors*

Follow this and additional works at: [https://digitalcommons.georgefox.edu/gscp\\_fac](https://digitalcommons.georgefox.edu/gscp_fac)



Part of the [Psychology Commons](#)

---

---

## **Authors**

Margaret Semrud-Clikeman, Kathleen H. Nielsen, Amanda Clinton, Leihua Sylvester, Nancy Parle, and Robert T. Connor

# An Intervention Approach for Children with Teacher- and Parent-Identified Attentional Difficulties

Margaret Semrud-Clikeman, Kathleen H. Nielsen, Amanda Clinton, Leihua Sylvester, Nancy Parle, and Robert T. Connor

---

## Abstract

Using a multimodal and multi-informant method for diagnosis, we selected 33 children by teacher and parent nomination for attention and work completion problems that met *DSM-IV* criteria for attention-deficit/hyperactivity disorder (ADHD). Of the 33 children in this group, 21 participated in the initial intervention, and 12 were placed in an ADHD control group and received the intervention after pre- and posttesting. A similarly selected group of 21 children without difficulties in attention and work completion served as a control group. Each child was assessed on pre- and posttest measures of visual and auditory attention. After an 18-week intervention period that included attention and problem-solving training, all children in the intervention and control groups were retested on visual and auditory tasks. Children in both ADHD groups showed significantly poorer initial performance on the visual attention task. Whereas the ADHD intervention group showed commensurate performance to the nondisabled control group after training, the ADHD control group did not show significant improvement over the same period. Auditory attention was poorer compared to the control group for both ADHD groups initially and improved only for the ADHD intervention group. These findings are discussed as a possible intervention for children with difficulties in strategy selection in a classroom setting.

---

Children with attention-deficit/hyperactivity disorder (ADHD) exhibit problems with inattention, impulsivity/inhibition, and overactivity. The emerging experimental literature strongly supports the existence of clinically meaningful subtypes (Frick & Lahey, 1991; Lahey, Schaughency, Hynd, Carlson, & Nieves, 1987; Teeter, 1991). The *Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV)* (American Psychiatric Association, 1994), defines three subtypes of ADHD: predominantly inattentive, predominantly hyperactive-impulsive, and combined. The two subtypes of predominantly inattentive and combined show significant attentional difficulties. Children with these subtypes have traditionally been described as experiencing difficulty with completing assignments, achieving a

good quality of work, and maintaining on-task behaviors (Frick et al., 1991). Thus, children with ADHD are described as low achieving despite the absence of learning disabilities (Barkley, 1997; Cantwell & Satterfield, 1978; Hynd et al., 1991). In contrast, children with the hyperactivity-impulsivity subtype do not show significant attentional problems and have been primarily identified in the preschool population (Appelgate et al., 1997), whereas the predominantly inattentive and combined subtypes have been found in the school-age population (Barkley, 1997). Some investigators have found that the hyperactive-impulsive behavior pattern emerges initially in the preschool years, with symptoms of inattention emerging at later ages, thus qualifying the children for a diagnosis of predominantly in-

attentive or combined type of ADHD (Haenlein & Caul, 1987; Hart, Lahey, Loeber, Appelgate, & Frick, 1995; Loeber, Green, Lahey, Christ, & Frick, 1992).

## Disinhibition

A linkage between behavioral inhibition and task persistence/goal-directed action has been hypothesized by Barkley (1997). Recent studies have supported the hypothesis of a generalized self-regulatory deficit that affects information processing, inhibition of responses, arousal/alertness, planning, executive functions, metacognition, and self-monitoring ability and spans the various sensory modalities (Barkley, 1997; Haenlein & Caul, 1987; Schachar, Tannock, & Logan, 1993).

Children with ADHD have been found unable to use effective problem-solving strategies over an extended period of time (Douglas, Barr, O'Neill, & Britton, 1988; Sergeant, 1995; Torgesen, 1994).

Barkley (1997) recently advanced the theory that behavioral disinhibition constitutes the main underlying component of the ADHD combined and hyperactive-impulsive subtypes, but not of the predominantly inattentive subtype. Disinhibition is defined as the inability to control and direct attention to the demands of a task (Loge, Staton, & Beatty, 1990). Barkley (1996) defined attention as "functional relationships between some environmental event or stimulus and behavior" (p. 73). Deficits in children's attention are problems in facilitating, sustaining, or disengaging these relationships apart from the specific environmental event. Thus, attentional problems may be deficits in sustaining or disengaging the behaviors in relation to the environment (Barkley, 1994; Teeter, *in press*; Teeter & Semrud-Clikeman, 1997).

Teeter and Semrud-Clikeman (1997) suggested that difficulties with hyperactivity and with inattention can both be thought of in terms of inhibitory processes. Hyperactivity can be conceptualized as disinhibition of motor systems. Similarly, inattention can be theorized as involving interference sensitivity or difficulty in filtering out extraneous information. Thus, the most cogent conceptualization of attention-deficit disorder may be a transactional relationship between the environment and the child's behavior.

Brain structures that have been implicated in sustained attention to tasks have been hypothesized to be compromised in ADHD children (Drewe, 1975). Results from lesion studies in humans (Posner & Peterson, 1990; VerFaellie & Heilman, 1987) and animals (Olmstead & Villablanca, 1980) have implicated the frontal-striatal regions as involved in arousal-motor regulatory systems. These are the systems that are directly involved in the

ability to inhibit, focus, and shift attention.

## Intervention Models

Nonpharmacologic interventions that have been developed for children with ADHD generally involve behavioral management or cognitive-behavioral strategies (Barkley, 1990; Braswell & Bloomquist, 1989; Reid & Harris, 1993) and, more recently, the development of attention-training strategies (Sohlberg & Mateer, 1987; Thomson, 1994; Williams, 1987). The first intervention type involves the use of the classroom or the home to deliver treatment, whereas the other two involve direct training of the child in strategy generation and use.

Behaviorally based interventions used to improve on-task performance include the use of classroom-based contingency systems (Piffner & Barkley, 1990; Piffner & O'Leary, 1987; Rosen, O'Leary, Joyce, Conway, & Piffner, 1984), response cost (Atkins, Pelham, & White, 1990; Cocciarella, Wood, & Low, 1995; DuPaul, Guevremont, & Barkley, 1992; Evans, Ferre, Ford, & Green, 1995; Gordon, Thomson, Cooper, & Ivers, 1991; Rapport et al., 1987), home-school contingencies (Abramowitz & O'Leary, 1991; Kelley & Carper, 1988), and peer-mediated contingencies (Carden-Smith & Fowler, 1984; Gresham & Gresham, 1982; Lentz, 1988).

Cognitive-behavioral intervention programs involve teaching children to use problem-solving approaches and to observe their own behaviors (Abramowitz & O'Leary, 1991). These interventions have proven to be helpful when parent and teacher training is included in the program. Generalization of skills beyond the treatment condition has been an area of concern in both these types of interventions. Abikoff (1991), in a review of cognitive-behavioral treatments, concluded that the goal of these treatments to establish "internalized self-regulation skills [that] would facilitate

generalization and maintenance effects has not been realized" (p. 208).

Although it is intuitively attractive, little support has been found for cognitive-behavioral treatment beyond effects already obtained from medication and behavioral parent training (Abikoff et al., 1988; Braswell et al., 1997; Brown, Borden, Wynne, Schleser, & Clingerman, 1986; Brown, Wynne, & Medenis, 1985). Abikoff (1991) suggested that cognitive-behavioral treatment may be appropriate for use with nonclinical samples of children with attentional difficulties.

Another type of intervention, attention training, involves the direct tutoring of attention in children. Attention training has evolved from research on cognitive rehabilitation after head injury. It is based on Luria's (1980) concept that direct retraining can result in a reorganization of function. Attention Process Training (APT; Sohlberg & Mateer, 1986) involves the use of organized treatment tasks that emphasize sustained attention and are repeated until mastery is accomplished. This technique views attention as the ability to sustain focus over time and to adapt to differing environmental demands, similar to Barkley's (1996) definition. The use of specific attention-training strategies has been found to be successful with people with head injuries (Niemann, 1989; Ruff et al., 1994; Sohlberg & Mateer, 1987; Sohlberg, Mateer, & Stuss, 1993), children with learning disabilities and comorbid ADHD (Williams, 1987), and children with traumatic brain injury (Thomson, 1994) and for the late effects of treatment for childhood cancer (Butler & Name-row, 1988).

## Clinic Versus School-Based Samples

Currently, most studies using interventions in addition to medication have been conducted on children who were clinic selected (DuPaul et al., 1992; Hynd et al., 1991; Kolko, Loar, & Sturnick, 1990; Reader, Harris,

Schuerholz, & Denckla, 1994) rather than on children selected from the school population. One of the few studies that used teacher-selected "hyperactive" children found improvement in activity level and time on task following training in specific strategies and self-control (Reid & Borkowski, 1987). Braswell et al. (1997) used a group training program based on cognitive-behavioral strategies over a 2-year period for children with significant disruptive behaviors. Improvement was found immediately following the program. However, this improvement had not continued when these children were re-evaluated during a 1-year follow-up. Both of these studies used participants who evidenced significant difficulty with disruption and behavioral difficulty. It may be that cognitive-behavioral interventions are most efficacious for children without significant emotional, behavioral, or academic difficulties, as Abikoff (1991) suggested, but who evidence difficulty with attention and task persistence.

In summary, children with attentional difficulty appear to have a declining ability to persist on tasks that have little intrinsic appeal or minimal immediate consequence for completion. The child with disinhibition deficits can orient to specific stimuli but may be unable to disinhibit or resist responses to competing stimuli. These difficulties would appear to be consistent with the frequently reported difficulty of children with ADHD to complete work in the classroom. The children most frequently involved in published research generally come from medical centers or educational centers specifically involved with attention-deficit disorders (Biederman, Faraone, & Lapey, 1992; Fischer, Barkley, Edelbrock, & Smallish, 1993; Goodyear & Hynd, 1992; Shaywitz & Shaywitz, 1984). It is unknown whether children with attentional difficulties identified by teachers and parents can profit from interventions developed to assist with attention and task persistence.

The purpose of this study was to evaluate the effectiveness of an attention-training program, coupled with direct training in developing strategies for problem solving, in a teacher-selected school population. This study used a multiple informant, multimodal measure to select children with attentional problems following teacher nomination. The identification process used to diagnose a child with ADHD can inordinately influence the diagnosis. For instance, high inter-correlations between scales on behavior rating measures completed by the same informant suggest a halo effect (Schaughency & Rothlind, 1991). A diagnosis based solely on a clinical interview produces an overidentification of ADHD (Carlson, Lahey, & Neeper, 1986). However, when rating scales are used in conjunction with clinical interviews, diagnostic reliability improves (Hodges, McKnew, Burbach, & Roebuck, 1987). Therefore, these studies point to the need to use multiple methods for diagnosis of attention-deficit/hyperactivity disorder. We hypothesized that training in auditory-visual attention skills and task persistence would result in significant improvement on sustained visual and auditory attention tasks compared to the control groups.

## Method

### Participants

Students with attention and task persistence difficulties were identified by their teachers based on number of incomplete assignments and difficulty remaining attentive and on task in the classroom. Children who had been placed in programs for significant emotional disturbance or learning disability were not included in the study. This exclusion sufficiently limited the number of children who may have had comorbid disorders frequently associated with ADHD (i.e., oppositional defiant disorder and conduct disorder).

The teacher offered the child's parents the opportunity to participate in

the study. Parents who returned a form of intent to participate in the study were contacted by phone by the first author or by an advanced master's level school psychology graduate student to explain the study and to secure informed consent for their child's participation in the study. Once written consent was received, the parents and teachers completed the Child Behavior Checklist (CBCL; Achenbach, 1991) as well as the ADHD module from a structured clinical interview adapted from the Schedule for Affective Disorders and Schizophrenia-Children's Version (K-SADS; Orvaschel, 1985).

The structured clinical interview was used to document the presence of DSM-IV criteria for ADHD. The interview was conducted by trained master's and doctoral level students or by the first author. Interinterviewer agreement was excellent ( $\kappa = .89$ ). Screening for additional psychiatric difficulties (depression, anxiety) was conducted using the CBCL. No subject showed any elevations on CBCL scales beyond attention and activity.

There were four refusals to participate in the intervention portion of this study, due to concern that the sessions would conflict with after-school sports activities. However, all these children did complete the pre- and posttests for participation in the control group. Three children were not included in the study due to a previous diagnosis of learning disability or epilepsy. One child was not included in the study due to severe conduct problems. Three other children did not meet the criteria for ADHD based on teacher and parent interviews.

Thirty-three children who met the DSM-IV criteria for ADHD (American Psychiatric Association, 1994) and 21 controls who were free from attentional difficulties participated in the study. The children diagnosed with ADHD were divided into two groups: an ADHD intervention (ADHD/I) group of 21 children and an ADHD control (ADHD/C) group of 12 children. The ADHD control group con-

sisted of children who could not complete the intervention program due to conflicts with after-school activities or who had conflicts with the schedule for the first intervention period. All children were right-handed, had a normal developmental history, and were free from learning disabilities, any other *DSM-IV* diagnoses, and head injury. Because there were 11 comparisons to be made within the group, the significance level was calculated as  $.05/11 = .004$ .

Participants were selected from Grades 2 through 6 in three middle class school districts in suburban Seattle (see Table 1 for screening data). Ages ranged from 8 to 12, with a mean age of 10 for all groups. Following the screening process, all children completed the vocabulary and block design subtests of the Wechsler Intelligence Scale for Children—Third edition (WISC-III; Wechsler, 1991) with no participant scoring below a scaled score of 8. This shortened version, which provides an estimated IQ, is consistent with Sattler's (1992) recommendation.

The nondisabled control group consisted of 15 boys and 6 girls; 2 of these students were African American. All control children completed the same tests as the ADHD group. The ADHD intervention (ADHD/I) group consisted of 18 boys and 3 girls, 2 of whom were African American and 1 was Asian American. The ADHD/C group consisted of 10 boys and 2 girls, 1 of whom was African American. Pre- and posttests were completed for all participants within the same 1-month time frame.

Children were included in the ADHD groups if they obtained a *T* score of 67 or above on the attention problems subscale on either the parent- or the teacher-completed CBCL and met *DSM-IV* criteria with at least eight symptoms for ADHD by clinical interview. Symptoms had to be present before the age of 7 and had to constitute difficulty in at least two settings. Of the 21 children in the ADHD/I group, 10 had previously been diag-

nosed with ADHD and 2 were currently on medication by parental choice. Eight children were identified with ADHD combined type and 13 with ADHD predominantly inattentive type. No child was identified with ADHD hyperactive-impulsive type. We had hoped that there would be sufficient numbers of children in each subtype to compare the performance of subtypes on pre- and posttest measures. Although no difference was found between the two identified subtypes, this finding may be due to small numbers. There were no significant differences between the two subtypes on the teacher- and parent-completed CBCL. That no participants with the hyperactive-impulsive subtype were identified may in part be due to the fact that teachers were asked to identify children with attentional difficulties. Moreover, research has indicated that children with hyperactive-impulsive ADHD subtype are generally in the preschool-age group rather than the targeted school-age group (Appelgate et al., 1997; Hart et al., 1995).

The control group was identified by teacher selection in the same manner as the ADHD group. In order to be included in the control group, the child had to have a *T* score of 60 or below on all scales of the parent and teacher forms of the CBCL and to evidence fewer than 3 symptoms of ADHD based on a clinical interview of teacher and parent. Furthermore, these children had no assignments that were late and were reported to be attentive by their teachers.

There was no difference between the groups on the vocabulary subtest,  $F(2, 51) = 0.86$ ,  $p = 0.36$ , or the block design subtest  $F(2, 51) = 7.17$ ,  $p = .01$  (see Table 1). There were significant differences between the groups on all of the CBCL scales except the internalizing scale on the teacher and parent forms.

## Procedure

**Pre- and Posttests.** Each participant completed a test of visual and auditory attention. The visual attention task

**TABLE 1**  
Participant Demographics and Attention Results

Measure	ADHD <sup>a</sup>		Controls <sup>b</sup>		<i>F</i>	<i>p</i> <sup>c</sup>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Age	10.1	18.4	10.2	21.2	0.074	.79
Vocabulary	11.0	2.8	11.8	2.9	0.857	.36
Block design	11.1	2.7	13.4	2.8	7.167	.01
# of ADHD symptoms	11.7	2.9	0.5	0.8	283.5	< .0001
CBCL-T attn	65	7.4	50	0.5	83.5	< .0001
CBCL-P attn	65	9.8	51	2.3	40.5	< .0001
CBCL-T social	58	8.2	51	2.5	15.8	.0003
CBCL-P social	61	9.3	52	6.1	14.4	.0005
CBCL-T int	52	11.0	46	7.3	4.1	.05
CBCL-P int	54	10.8	46	8.6	7.9	.008
CBCL-T ext	59	9.6	43	6.4	36.2	< .0001
CBCL-P ext	57	11.7	41	7.3	27.3	< .0001

*Note.* All measures were performed before intervention. ADHD = attention-deficit/hyperactivity disorder; CBCL = Child Behavior Checklist (Achenbach, 1991); T = teacher; P = parent; attn = attention; int = internalizing; ext = externalizing.

<sup>a</sup>*n* = 33; 30 boys, 3 girls. <sup>b</sup>*n* = 21; 18 boys, 3 girls. <sup>c</sup>Significance level set at .0045 (.05/11).

was the d2 (Brickenkamp, 1981). The d2 requires the child to scan a row of *ds* with one to three marks around them. The child needs to select the *ds* with 2 marks. There are 14 rows, and the child is instructed to move down to the next row every 20 seconds. The score is the total correct minus errors. The internal consistency of this measure has been found to be above .80, with test-retest reliabilities ranging from .89 to .92 after a 12-month interval (Brickenkamp, 1975). Practice effects of approximately 25% have been found with controls, whereas studies with participants with brain damage have found no improvement (Sturm, Dahmen, Hartje, & Wilmes, 1983). In our study, no child showed a 25% practice effect—effects were below 8%. Lezak (1995) suggested that cancellation tasks assess the capacity for sustained attention as well as accurate visual scanning and inhibition of rapid responses.

The auditory attention task (Brief Test of Attention; Schretlen, 1989) required the child to listen to a series of random letters and numbers. After each presentation, the child is asked how many letters or numbers he or she has heard. The child must keep how many letters and how many numbers were said for each stimulus in mind at the same time. The test begins with 4 stimuli and ends with 12. This task has been hypothesized to be a measure of auditory divided attention as well as sustained attention. Schretlen, Bobholz, and Brandt (1996) found the reliabilities of the Brief Test of Attention (BTA) to be between .82 and .91. Practice effects were not found. These measures were repeated for all participants approximately 18 weeks after the initial testing. In order to control for developmental effects, the two control groups were also evaluated on pre- and posttest measures with approximately the same interval between tests. Five children in the original ADHD/C group of 17 participants did not complete the posttest and were dropped from the study.

**Training.** Each child with attention and work completion difficulties participated in a small group conducted by master's level school psychology students under the direct supervision of the first author. Groups consisted of four to five children grouped by age and had two to three leaders. The groups met for 60 minutes twice a week for 18 consecutive weeks, except for school holidays. The groups met before or after school and did not interfere with the child's school day. Each meeting began with the opportunity for children to inspect their progress charts. These charts plotted speed and accuracy of performance on tasks from preceding sessions. Each child set guided goals for his or her next performance on the tasks. The tasks were from the APT developed by Sohlberg and Mateer (1986) and consisted of visual and auditory attention tasks.

The visual attention tasks required the child to find a target among an array of distractors. The tasks started out relatively simple and became very complex. For example, the initial task required the child to find one type of figure among widely spaced figures that ranged from somewhat similar to completely dissimilar. The more advanced task required the child to find a selected number of figures from among many closely spaced figures as quickly as possible. There were a total of six tasks. Each child completed all the tasks to 100% accuracy on two consecutive occasions, with an increase in speed.

The auditory attention tasks required the child to count targets that were presented on a cassette tape. The initial three tasks required the child to find one letter from dissimilar letters, and the more difficult three tasks required the child to count words beginning with a specific sound.

During each session, guidance was offered to assist the child's selection of effective strategies and development of goals for improved performance. For example, the initial strategy used for many of the visual tasks was a

random selection strategy. Each group developed a method for solving the task that involved a strategy for efficient scanning. These strategies were developed for the visual and auditory portions of the training. Children would verbalize the strategy they had used and evaluate this strategy based on their performance.

Kirby and Grimley's (1986) taxonomy of problem-solving variables related to sustained attention was used to assist the children with learning how to solve problems effectively. These steps include understanding the task and setting goals before beginning, generating a plan or strategy for approaching the task, assessing the effectiveness of this plan, monitoring progress toward task solution, breaking down long-term goals into short-term steps, and assessing progress and changing strategies based on this assessment.

## Results

A 2 (Group)  $\times$  2 (Parent CBCL, Teacher CBCL) analysis of variance (ANOVA) with repeated measures on the second factor was performed for the attention problem subscale. The CBCL was only administered prior to the beginning of the intervention. There were no differences on this measure between the children with ADHD who did not participate in the intervention and those who did. For these analyses, all children with ADHD were combined as one group compared to nondisabled controls. Table 1 shows the means and standard deviations on these scales. A significant group effect score on the attention problems scale of the CBCL was found,  $F(1, 53) = 79.934, p = .0001$ . Post-hoc comparisons using the Bonferroni method ( $p = .001$ ) found that the children with ADHD scored significantly higher (i.e., poorer) on both the parent and teacher CBCL on this scale compared to the nondisabled control group.

A 3 (Group)  $\times$  2 (Pre- and Posttest) ANOVA with repeated measures on

the second factor was carried out for the visual and auditory tasks. For these analyses, the ADHD/C and ADHD/I groups were treated separately. Table 2 presents the means for each group on the visual and auditory measures.

### Visual Attention

There was a significant interaction effect between group and measure,  $F(2, 51) = 8.183, p = .0008$ , with the ADHD/I and ADHD/C groups showing significantly poorer performance on the pretest of sustained visual attention compared to the control group. This interaction was due to the finding that both the ADHD groups performed significantly more poorly than the control group on the pretest, whereas only the ADHD/C group performed significantly more poorly on the posttest compared to the ADHD/I and control groups. Figure 1 depicts this interaction.

### Auditory Attention

There was a significant interaction effect between group and measure,  $F(2, 51) = 5.179, p = .0090$ , with the ADHD/I and ADHD/C group showing poorer performance on the pretest compared to the controls and the ADHD/I showing performance commensurate to the control group on the posttest. This interaction effect accounts for the main effect also found between the groups on both the pre- and posttests. Figure 2 illustrates these results.

## Discussion

The main hypothesis of this study was confirmed: Children with attention and task persistence deficits performed better on visual and auditory attention tasks following training in sustained attention and problem-solving skills. Children with attention and work completion problems who did not receive the intervention did not show improvement on either measure. These results agree with the findings

of other investigators who used groups with neurological involvement to evaluate improvement in attention following intensive training (Butler & Namerow, 1988; Sohlberg et al., 1993; Williams, 1987).

The children with attention problems were identified by teacher selection based on criteria set forth by DSM-IV. These carefully diagnosed children did not show differences on

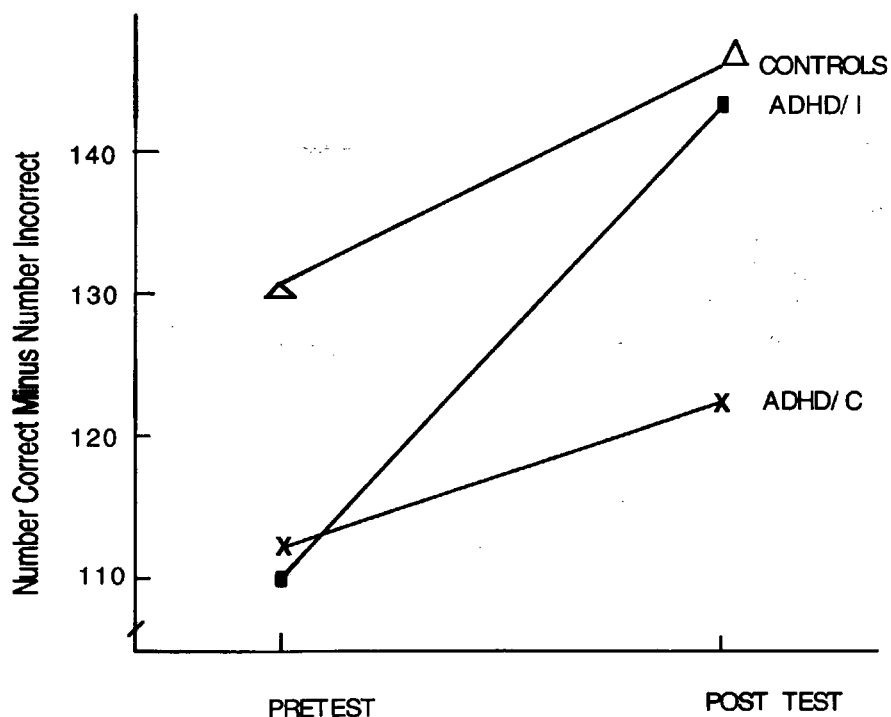
the pretest measures between those previously identified and those identified by teacher selection. Of the children who were teacher selected, three were later identified with ADHD and were prescribed medication. These children did not have comorbid diagnoses of other disorders. The median number of symptoms presented by these children was 13. Because at least 6 symptoms are required for a thresh-

**TABLE 2**  
Pretest and Posttest Measures of Sustained Visual and Auditory Attention

Measure	ADHD/C		ADHD/I		Controls	
	M	SD	M	SD	M	SD
Visual Pretest	112.75	25.4	110.95	24.4	131.43	24.3 <sup>a</sup>
Visual Posttest	120.75	25.4	143.57	28.3	146.19	31.3
Auditory Pretest	3.17	1.7	3.62	1.4	4.62	1.2 <sup>b</sup>
Auditory Posttest	3.75	1.7	5.67	1.5	4.86	1.5

Note. ADHD/C = attention-deficit/hyperactivity disorder, control group; ADHD/I = attention-deficit/hyperactivity disorder, intervention group.

<sup>a</sup> $F(2,51) = 8.7, p = 0.0005$ . <sup>b</sup> $F(2,51) = 5.2, p = 0.009$ .



**FIGURE 1.** Interaction between pre- and posttest measures of visual attention for three groups.



old diagnosis, these children were well above the minimum criteria for ADHD. No child showed less than 7 symptoms based on both teacher and parent reports. The median number of symptoms for children previously identified with ADHD was 13—the same as for the children identified at school. These children most likely represent a continuum of attention and activity/impulsivity problems and may describe the population of children with significant attention problems who are infrequently referred for an assessment beyond the pediatrician.

The ability of these children to improve their task persistence and completion on specific measures indicates that, for this sample at least, attention training may be beneficial in helping the child to cope with interference sensitivity. The children responded well to time-limited tasks that allowed them some control on performance as well as immediate feedback. A similar result has been reported

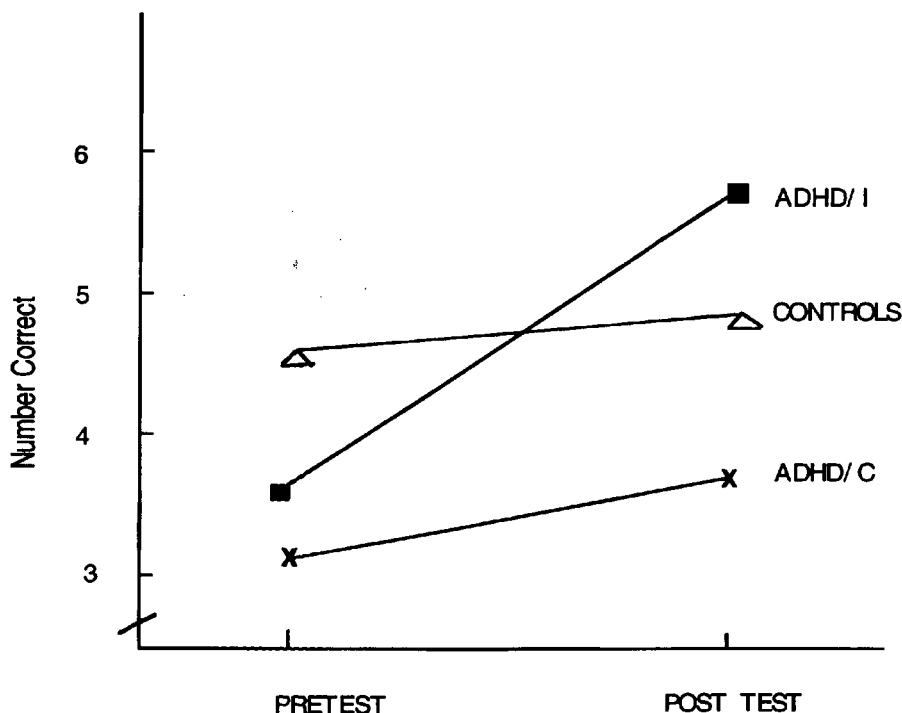
previously in behavioral intervention by Pelham, Milich, and Walker (1986). Possibly, the ability to inhibit attending to extraneous stimuli can be taught when materials are developed to assist with rule-governed behavior.

These findings give further credence to the hypothesis that children with milder forms of attentional deficits may be able to reorganize cognitive structures consistent with Luria's (1980) theory. Thus, assisting children with milder attentional problems to learn how to pay attention may be a promising technique. The study also indicates that the conceptualization of ADHD, based mostly on clinical samples who frequently have comorbid diagnoses (Barkley, 1990; Biederman et al., 1992), may not fully represent the expression of attentional problems in "typically developing" children with ADHD.

It may well be that children with attention and work completion problems without significant behavioral and learning problems frequently go

unaided in general education classrooms. Most of the research has focused on children who are referred to clinics for assessment (DuPaul et al., 1992; Hynd et al., 1991; Kolko et al., 1990; Reader et al., 1994). Lahey et al. (1987) have suggested that these children are more severely affected than children referred for assistance to their general pediatrician. More than half of the children in this study identified with attentional problems had previously been identified with ADHD; however, these children did not show comorbidity of other difficulties and thus were served in general education. Although these children had not qualified for special education services, they were experiencing such difficulties in the classroom that teachers identified them as at-risk children. These children may well have qualified for services under Section 504 of the Americans with Disabilities Act of 1990. This sample may also represent the children for whom Abikoff (1991) has suggested that cognitive-behavioral therapy may be most effective. This study certainly supports this possibility.

Although no children were failing their current grade placement, many of the children in this study were not working up to their ability and needed assistance in completing homework. The success of directly teaching problem-solving strategies within a classroom curriculum is unknown at present. The finding that the children with ADHD who participated in the intervention improved significantly compared to the ADHD control group children indicates that improvement can be promoted through direct training of strategies and immediate feedback about performance. A logical further step would be to bring the intervention into the classroom and provide feedback about the child's daily improvement in task completion. Using charts, as well as monitoring the child's approach to tasks, may prove to be helpful for task persistence and completion. Although this study was not designed to evaluate the use of



**FIGURE 2.** Interaction of pre- and posttest measures of auditory attention for three groups.

similar strategies in the classroom, future applications of such work would be helpful, particularly to shed light on the efficacy of such interventions with children with less severe attention problems.

There were limitations to the generalization of the findings of this study. One limitation was that there were so few children on stimulant medication that we were unable to assess whether those children performed differently from children not on medication. A study looking at the differential effects of medication on a child's performance using this training paradigm needs to be conducted. Although the children with predominantly inattentive type ADHD did not differ from those with the combined type, the numbers in this study were small, and differences may emerge with a larger sample. Moreover, the use of a control group of children without attention problems who also participate in the training paradigm should be considered to determine whether similar effects can be found with this group. Another limitation was that this study limited participation to those children without severe externalizing or disruptive behaviors. These children are most frequently served through special education, not through general education class placement. Thus, generalization of these findings to the more severe type of ADHD is not prudent.

#### ABOUT THE AUTHORS

**Margaret Semrud-Clikeman**, PhD, is an associate professor of educational psychology at the University of Texas at Austin. Her current interests include the neuroanatomical and neuropsychological underpinnings of attention-deficit/hyperactivity disorder (ADHD) and developmental disorders, interventions, and issues in the training of school psychologists. **Kathleen H. Nielsen**, MEd, is a doctoral student at the University of Georgia with interests in the neuropsychology of learning disabilities and ADHD. **Amanda Clinton**, MEd, is a doctoral student at the University of Georgia with interests in language, multicultural issues, and ADHD. **Leihua**

**Sylvester**, MEd, is a doctoral student at the University of Washington. Her current research interests are the development of prosocial behavior and aggression and the corresponding role of parents. **Nancy Parle**, MEd, is a school psychologist in Edmonds, Washington. She has experience as a general and special education teacher. Her areas of interest are working with children with attention difficulties. **Robert T. Connor**, PhD, is the school coordinator for the Children's Friendships and Families Project at the Center on Human Development and Disability located at the University of Washington. His current interests include the study of social competence in children with mild developmental delays and interventions to improve their social success with peers as well as the neuropsychological relationship between executive functioning and social competence.

#### AUTHORS' NOTE

The authors would like to acknowledge the assistance of Kendall Clements, Karen Cadigan, Sylvia Abbott, Melyssa Teague, Alison Foreman, Lisa Brown, Kathy Moffat, and Linda Armstrong.

#### REFERENCES

- Abikoff, H. (1991). Cognitive training in ADHD children: Less to it than meets the eye. *Journal of Learning Disabilities*, 24, 205-209.
- Abikoff, H., Caneles, G., Reiter, G., Blum, C., Foley, C., & Klein, R. G. (1988). Cognitive training in academically deficient ADHD boys receiving stimulant medication. *Journal of Abnormal Child Psychology*, 16, 411-432.
- Abramowitz, A. J., & O'Leary, S. G. (1991). Behavioral interventions for the classroom: Implications for students with ADHD. *School Psychology Review*, 20, 220-234.
- Achenbach, T. M. (1991). *Manual for the Child Behavior Checklist/4-18 and 1991 profile*. Burlington: University of Vermont, Department of Psychiatry.
- American Psychiatric Association. (1994). *Diagnostic and Statistical Manual of Mental Disorders* (4th edition). Washington, DC: Author.
- Americans with Disabilities Act of 1990, 42 U.S.C. § 12101 et seq.
- Appelgate, B., Lahey, B. B., Hart, E. L., Biederman, J., Hynd, G. W., Barkley, R. A., Ollendick, T., Frick, P. J., Greenhill, L., McBurnett, K., Newcorn, J. H., Kerdy, K. L., Garfinkel, B., Walman, I., & Shaffer, D. (1997). Validity of the age-of-onset criterion for ADHD: A report from the DSM-IV field trials. *Journal of the American Academy of Child and Adolescent Psychiatry*, 36, 1211-1221.
- Atkins, M. S., Pelham, W. E., & White, K. J. (1990). Hyperactivity and attention deficit disorders. In M. Hersen & V. Van Hasselt (Eds.), *Psychological aspects of developmental and physical disabilities: A casebook* (pp. 137-156). New York: Pergamon.
- Barkley, R. A. (1990). *Attention-deficit/hyperactivity disorder: A handbook for diagnosis and treatment* (pp. 36-93). New York: Guilford Press.
- Barkley, R. A. (1994). The assessment of attention in children. In G. R. Lyon (Ed.), *Frames of references for assessment of learning disabilities* (pp. 69-102). Baltimore: Brookes.
- Barkley, R. A. (1996). Critical issues in research on attention. In G. R. Lyon & N. A. Krasnegor (Eds.), *Attention, memory and executive function* (pp. 45-56). Baltimore: Brookes.
- Barkley, R. A. (1997). Behavioral inhibition, sustained attention and executive functions: Constructing a unifying theory of ADHD. *Psychological Bulletin*, 121, 65-94.
- Biederman, J., Faraone, S. V., & Lapey, K. (1992). Comorbidity of diagnosis in attention-deficit/hyperactivity disorder. In G. Weiss (Ed.), *Child and adolescent psychiatry clinics of North America: Attention deficit disorder* (pp. 335-360). Philadelphia: W. B. Saunders.
- Braswell, L., August, G., Bloomquist, M. L., Realmuto, G. M., Skare, S., & Crosby, R. (1997). School-based secondary prevention for children with disruptive behavior: Initial outcomes. *Journal of Abnormal Child Psychology*, 25, 197-208.
- Braswell, L., & Bloomquist, M. L. (1989). *Cognitive-behavioral therapy with ADHD children*. New York: Guilford Press.
- Brickenkamp, R. (1975). *Test d2*. Göttingen, Germany: Verlag Hogrefe.
- Brickenkamp, R. (1981). *Test d2: Concentration-Endurance Test: Manual* (7th ed.). Göttingen, Germany: Verlag Hogrefe.
- Brown, R. T., Borden, K. A., Wynne, M. E., Schleser, R., & Clingerman, S. R. (1986). Methylphenidate and cognitive therapy with ADD children: A methodological consideration. *Journal of Abnormal Child Psychology*, 14, 481-497.
- Brown, R. T., Wynne, M. E., & Medenis, R. (1985). Methylphenidate and cognitive

- therapy: A comparison of treatment approaches with hyperactive boys. *Journal of Abnormal Child Psychology*, 13, 69–87.
- Butler, R. W., & Namerow, N. S. (1988). Cognitive retraining in brain-injury rehabilitation: A critical review. *Journal of Neurological Rehabilitation*, 2, 97–101.
- Cantwell, D., & Satterfield, J. H. (1978). The prevalence of academic underachievement in hyperactive children. *Journal of Pediatric Psychology*, 3, 168–171.
- Carden-Smith, L. K., & Fowler, S. A. (1984). Positive peer pressure: The effects of peer monitoring on children's disruptive behavior. *Journal of Applied Behavior Analysis*, 17, 213–227.
- Carlson, C. L., Lahey, B. B., & Neeper, R. (1986). Direct assessment of the cognitive correlates of attention-deficit disorders with and without hyperactivity. *Journal of Behavioral Assessment and Psychopathology*, 8, 69–86.
- Cocciarella, A., Wood, R., & Low, K. G. (1995). Brief behavioral treatment for attention-deficit/hyperactivity disorder. *Perceptual and Motor Skills*, 81, 225–226.
- Douglas, V. I., Barr, R. G., O'Neill, M. E., & Britton, B. G. (1988). Dosage effects and individual responsivity to methylphenidate in attention-deficit disorder. *Journal of Child Psychology and Psychiatry*, 29, 453–475.
- Drewe, E. A. (1975). Go-no go learning after frontal lobe lesions in humans. *Cortex*, 11, 8–16.
- DuPaul, G. J., Guevremont, D. C., & Barkley, R. A. (1992). Behavioral treatment of attention-deficit/hyperactivity disorder in the classroom. *Behavior Modification*, 16, 204–225.
- Evans, J. H., Ferre, L., Ford, L. A., & Green, J. L. (1995). Decreasing attention-deficit/hyperactivity disorder symptoms utilizing an automated classroom reinforcement device. *Psychology in the Schools*, 32, 210–219.
- Fischer, M., Barkley, R. A., Edelbrock, C. S., & Smallish, L. (1993). The stability of dimensions of behavior in ADHD and normal children over an 8-year follow-up. *Journal of Abnormal Child Psychology*, 21, 315–337.
- Frick, P. J., Kamphaus, R. W., Lahey, B. B., Loeber, R., Christ, M. A. G., Hart, E. L., & Tannenbaum, L. E. (1991). Academic underachievement and the disruptive behavior disorders. *Journal of Consulting and Clinical Psychology*, 59, 289–294.
- Frick, P. J., & Lahey, B. B. (1991). Nature and characteristics of attention-deficit/hyperactivity disorder. *School Psychology Review*, 20, 163–173.
- Goodyear, P., & Hynd, G. W. (1992). Attention-deficit disorder with (ADD/H) and without (ADD/VO) hyperactivity: Behavioral and neuropsychological differentiation. *Journal of Clinical Child Psychology*, 21, 273–304.
- Gordon, M., Thomason, D., Cooper, S., & Ivers, C. L. (1991). Nonmedical treatment of ADHD/hyperactivity: The attention training system. *Journal of School Psychology*, 29, 151–159.
- Gresham, F., & Gresham, G. (1982). Interdependent, dependent, independent group contingencies for controlling disruptive behavior. *The Journal of Special Education*, 16, 101–110.
- Haenlein, M., & Caul, W. F. (1987). Attention-deficit disorder with hyperactivity: A specific hypothesis of reward dysfunction. *Journal of the American Academy of Child and Adolescent Psychiatry*, 26, 356–362.
- Hart, E. L., Lahey, B. B., Loeber, R., Applegate, B., & Frick, P. J. (1995). Developmental changes in attention-deficit/hyperactivity disorder in boys: A four-year longitudinal study. *Journal of Abnormal Child Psychology*, 23, 729–750.
- Hodges, K., McKnew, D., Burbach, D., & Roebuck, L. (1987). Diagnostic concordance between the Child Assessment Scale and the Schizophrenia in School-Age Children Scale in an outpatient sample using lay interviewers. *Journal of the American Academy of Child and Adolescent Psychiatry*, 26, 654–661.
- Hynd, G. W., Lorys, A. R., Semrud-Clikeman, M., Nieves, N., Huettner, M. I. S., & Lahey, B. B. (1991). Attention-deficit disorder without hyperactivity: A distinct behavioral and neurocognitive syndrome. *Journal of Child Neurology*, 6 (Suppl.), S37–S43.
- Kelley, M. L., & Carper, L. B. (1988). Home-based reinforcement procedures. In J. C. Witt, S. N. Elliott, & F. Gresham (Eds.), *Handbook of behavior therapy in education* (pp. 419–438). New York: Plenum Press.
- Kirby, E. A., & Grimley, L. K. (1986). *Understanding and treating attention-deficit disorder*. New York: Pergamon.
- Kolko, D. J., Loar, L. L., & Sturnick, D. (1990). Inpatient social-cognitive skills training groups with conduct disordered and attention-deficit disordered children. *Journal of Child Psychology and Psychiatry*, 31, 737–748.
- Lahey, B. B., Schaughency, E. A., Hynd, G. W., Carlson, C. L., & Nieves, N. (1987). Attention-deficit disorder with and without hyperactivity: Comparison of behavioral characteristics of clinic-referred children. *Journal of the American Academy of Child and Adolescent Psychiatry*, 26, 718–723.
- Lentz, F. E. (1988). Reductive procedures. In J. C. Witt, S. N. Elliott, & F. M. Gresham (Eds.), *Handbook of behavior therapy in education* (pp. 439–468). New York: Plenum Press.
- Lezak, M. D. (1995). *Neuropsychological assessment* (3rd ed.) New York: Oxford University Press.
- Loeber, R., Green, S. M., Lahey, B. B., Christ, M. A. G., & Frick, P. J. (1992). Developmental sequences in the age of onset of disruptive child behaviors. *Journal of Child and Family Studies*, 1, 21–41.
- Loge, D. V., Staton, R. D., & Beatty, W. W. (1990). Performance of children with ADHD on tests sensitive to frontal lobe dysfunction. *Journal of the American Academy of Child and Adolescent Psychiatry*, 29, 540–545.
- Luria, A. R. (1980). *Higher cortical functions in man*. New York: Basic Books.
- Niemann, H. (1989). *Retraining of attention in head injured individuals*. Unpublished doctoral dissertation, University of Victoria.
- Olmstead, C. E., & Villablanca, J. R. (1980). Effects of caudate or frontal cortex ablations in cats and kittens: Passive avoidance. *Experimental Neurology*, 68, 335–345.
- Orvaschel, H. (1985). Psychiatric interviews suitable for use in research with children and adolescents. *Psychopharmacological Bulletin*, 21, 737–745.
- 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.
- Pfiffner, L. J., & Barkley, R. A. (1990). Educational placement and classroom management. In R. A. Barkley (Ed.), *Attention-deficit/hyperactivity disorder: A handbook for diagnosis and treatment* (pp. 498–539). New York: Guilford Press.
- Pfiffner, L. J., & O'Leary, S. G. (1987). The efficacy of all-positive management as a function of the prior use of negative consequences. *Journal of Applied Behavior Analysis*, 20, 265–271.
- Posner, M. I., & Peterson, S. E. (1990). The attention system of the human brain.

- Annual Review of Neurosciences*, 13, 182–196.
- Rapport, M. D., Jones, J. T., DuPaul, G. J., Kelly, K. L., Stoner, G., & Birmingham, B. K. (1987). Attention-deficit disorder and methylphenidate: Group and single-subject analyses of dose effects on attention in clinic and classroom setting. *Journal of Clinical Child Psychology*, 16, 329–338.
- Reader, M. J., Harris, E. L., Schuerholz, L. J., & Denckla, M. B. (1994). Attention-deficit/hyperactivity disorder and executive dysfunction. *Developmental Neuropsychology*, 10, 493–512.
- Reid, M. K., & Borkowski, J. G. (1987). Causal attributions of hyperactive children: Implications for teaching strategies and self-control. *Journal of Educational Psychology*, 79, 296–307.
- Reid, R., & Harris, K. R. (1993). Self-monitoring of attention versus self-monitoring of performance: Effects on attention and academic performance. *Exceptional Children*, 59, 1–13.
- Rosen, L. A., O'Leary, S. G., Joyce, S. A., Conway, G., & Pfiffner, L. J. (1984). The importance of prudent negative consequences for maintaining the appropriate behavior of hyperactive students. *Journal of Abnormal Child Psychology*, 12, 581–604.
- Ruff, R. M., Mahaffety, R., Engel, J., Farrow, C. E., Cox, D., & Karzmark, P. (1994). Efficacy of THINKable in the attention and memory retraining of traumatically head-injured patients. *Brain Injury*, 8, 3–14.
- Sattler, J. (1992). *Assessment of children* (rev. 3rd ed.). San Diego: Author.
- Schachar, R. J., Tannock, R., & Logan, G. (1993). Inhibitory control, impulsiveness, and attention-deficit/hyperactivity disorder. *Clinical Psychology Review*, 13, 721–729.
- Schaughency, E. A. & Rothlind, J. (1991). Assessment and classification of attention-deficit/hyperactivity disorders. *School Psychology Review*, 20, 187–202.
- Schretlen, D. (1989). *The brief test of attention*. Baltimore: Author.
- Schretlen, D., Bobholz, J. H., & Brandt, J. (1996). Development and psychometric properties of the Brief Test of Attention. *The Clinical Neuropsychologist*, 10, 80–89.
- Sergeant, J. A. (1995). Hyperkinetic disorder revisited. In J. A. Sergeant (Ed.), *Eunethydis: European approaches to hyperkinetic disorder* (pp. 7–17). Amsterdam: Author.
- Shaywitz, S. E., & Shaywitz, B. A. (1984). Diagnosis and management of attention-deficit disorder: A pediatric perspective. *Pediatric Clinics of North America*, 31, 429–457.
- Sohlberg, M., & Mateer, C. A. (1986). *Attention process training*. Puyallup, WA: Center for Cognitive Rehabilitation.
- Sohlberg, M., & Mateer, C. A. (1987). Effectiveness of an attention-training program. *Journal of Clinical and Experimental Neuropsychology*, 9, 117–130.
- Sohlberg, M., Mateer, C. A., & Stuss, D. T. (1993). Contemporary approaches to the management of executive control dysfunction. *Journal of Head Trauma Rehabilitation*, 8, 45–58.
- Sturm, W., Dahmen, W., Hartje, W., & Wilmes, K. (1983). Results of a program for the training of perceptual speed and concentration in brain damaged patients. *Archiv für Psychiatrie und Nervenkrankheiten*, 233, 9–22.
- Teeter, P. A. (1991). Attention-deficit/hyperactivity disorder: A psychoeducational paradigm. *School Psychology Review*, 20, 266–280.
- Teeter, P. A. (1999). *Interventions for ADHD*. New York: Guilford Press.
- Teeter, P. A., & Semrud-Clikeman, M. (1997). *Child neuropsychology: Assessment and interventions for neurodevelopmental disorders*. Boston: Allyn & Bacon.
- Thomson, J. (1994, March). *Rehabilitation of high school-aged individuals with traumatic brain injury through utilization of an attention training program*. Presentation at the annual meeting of the International Neuropsychological Society, Cincinnati, Ohio.
- Torgesen, J. K. (1994). Issues in the assessment of executive function: An information-processing perspective. In G. R. Lyon (Ed.), *Frames of reference for the assessment of learning disabilities: New views on measurement issues* (pp. 143–162). Baltimore: Brookes.
- Verfaellie, M., & Heilman, K. M. (1987). Response preparation and response inhibition after lesions of the mesial frontal lobe. *Archives of Neurology*, 44, 265–271.
- Wechsler, D. (1991). *WISC III manual*. San Antonio, TX: Psychological Corp.
- Williams, D. J. (1987). *A process-specific training program in the treatment of attention deficits in children*. Unpublished doctoral dissertation, University of Washington.