Chapter 16
Neuropsychological Intervention and Treatment Approaches for Childhood and Adolescent Disorders

Information about the child's neuropsychological, cognitive, academic, and psychosocial status forms the basis for designing integrated intervention and treatment plans for children and adolescents with brain-related disorders. Efforts to develop models of neuropsychological intervention have been expanding in recent years. In an effort to provide a framework for linking assessment to interventions, the Multistage Neuropsychological Assessment-Intervention Model is presented. Specific techniques for designing intervention programs addressing academic, psychosocial, and executive function (EF) deficits associated with various childhood and adolescent disorders are summarized.

Multistage Neuropsychological Model: Linking Assessment to Intervention

While the need for neuropsychological and neuroradiological evaluations may be obvious for conditions where traumatic brain injury or CNS disease is suspected, there also may be reasons to use these techniques for neurodevelopmental disorders, such as learning disabilities and attentional disorders. It is sometimes difficult to determine when to proceed with a comprehensive neuropsychological evaluation, particularly for school-related problems, and how to integrate neuropsychological evaluations into ongoing intervention plans. Teeter (1992) first described a multistage neuropsychological model as a guideline for linking neuropsychological assessment and intervention, and it serves as a foundation for the expanded model to be described (See Table 16.1). The multistage neuropsychological model begins with structured behavioral-observational assessment techniques, and proceeds to more extensive cognitive and psychosocial, neuropsychological and/or neuroradiological evaluations if problems are not effectively remediated at any given stage. This model recommends that systematic interventions be developed and implemented at each stage based on evaluation results.

The following multistage neuropsychological assessment-intervention model (MNM) should be considered when treating children and adolescents with neurodevelopmental and/or neuropsychiatric disorders. This paradigm assumes a linkage between assessment and intervention, where competent evaluation of a problem or disorder leads to effective intervention strategies or plans. It is possible that at early stages of this model effective interventions may eliminate the necessity for further, more in-depth evaluation of the child. However, ongoing treatment evaluation is needed to verify the efficacy of the problem identification-intervention link at all stages. For some childhood problems (e.g., traumatic brain injury, CNS diseases, seizure activity), the clinician is advised to immediately proceed to more advanced stages of the MNM model (i.e., neuropsychological evaluation and neurodiagnostic examination). The MNM paradigm comprises eight assessment-intervention stages. Stages 1 through 4 can reasonably be conducted by school-based professionals, including school psychologists and educational diagnosticians. Stages 5 and 6 should be conducted by trained clinical child neuropsychologists in private practice, university, or medical clinics.

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Table 16.1 Viodels for neuropsychological remediation and rehabilitation: Linking assessment to interventions

Models	Stages	Description
MNM[a]		
	Stage 1: Problem identification	Behavioral assessment
	Stage 2: Behavioral-based intervention	Self-management
		Contingency-management
		Learning strategies
		Peer tutoring
	Stage 3: Cognitive child study	Comprehensive congnitive, academic, psychosocial assessment
	Stage 4: Cognitive-based intervention	Pattern analysis
		Phonological awareness
		Activating schemata
		Organizational strategies
	Stage 5: Neuropsychological assessment	Comprehensive neurocognitive assessment
	Stage 6: Integrated neuropsychological intervention	Compensatory skills
		Psychopharmacology
	Stage 7: Neurological and neuroradiological assessment	Neurological, CT, MRI
	Stage 8: Medical-neurological rehabilitation	Rehabilitation and medical management
DNNR (Rourke, 1994)[b]	Step 1: Neuropsychological assets, deficits; academic and psychosiclal assessment	Neuropsychological profile
		Ecologically based evaluation
	Step 2: Demands of environment	Behavioral, academic, and psychosocial challenges within contextual framework
	Step 3: Short and long-term	Formulate short- and long-range predictions
		Which deficits will decrease?
		Specific treatment straegies
	Step 4: "Ideal" remedial plans	"Ideal" plans
		Monitoring and modification
	Step 5: Availability of resources	Therapeutic goals
		Prognosis
		Reduce redundant services
	Step 6: Realistic remedial plan	Compare differences between steps 4 and 5
	Step 7: Ongoing assessment and intervention	
REHABIT (Reitan & Wolfson, 1992)[c]	Tract A: Verbal-language	Materials to increase expressive-receptive skills
	Tract B: Abstraction and reasoning	Materials to increase analysis, organization
	Tract C: General reasoning	Materials for general reasoning
	Tract D: Visual-spatial	Visual-spatial manipulation
		Sequential skills
	Tract E: Visual-spatial and manipulation	

[a] Multistage Neuropsychological Model (developed by Teeter & Semrud-Clikeman).
[b] Developmental Neuropsychological Remediation/Rehabilitation Model (Rourke, 1994).
[c] Reitan Evaluation of Hemispheric Abilities and Brain Improvement Training (Reitan & Wolfson, 1992).

Stage 7 is reserved for physicians in hospitals or medical centers and Stage 8 most likely requires at least short-term hospitalization in a medical or rehabilitation center. At each stage of the MNM, accurate diagnosis or problem identification forms the basis for developing specific intervention strategies and for conducting ongoing monitoring and modification of intervention plans. One of the most common errors in implementing intervention programs occurs when treatment strategies are continued long after they are effective. This may occur when evaluations are scheduled years apart without systematic documentation of how the child is actually progressing (e.g., triennial evaluations conducted by schools when children are placed in special education classrooms). Therefore, ongoing assessment and modification of the intervention plan is essential.

Stage 1: Problem Identification

During Stage 1, children with mild neurodevelopmental disorders (i.e., mild academic delays or deficits) may undergo an initial evaluation using well established behavioral and curriculum-based assessment (CBA) approaches. There are excellent resources describing these procedures, including work by Shapiro (2004) and Shinn (1989). Shapiro (2004) provides a flowchart indicating the steps involved in CBA, including (1) a teacher interview; (2) classroom observation and examination of the child's class work; (3) CBA procedures (e.g., problem identification, problem analysis, problem verification, and remediation); (4) analysis of classroom resources, and (5) remedial decisions. Data gathered from these steps would then be used to develop Stage 2 intervention plans.

Stage 2: Behavioral-Based Intervention Plan

In Stage 2, educational professionals develop and implement an intervention plan based on data derived from the initial behavioral-observational assessment. CBA and ecobehavioral procedures can be helpful to determine a child's instructional, frustrational, and mastery levels for academic materials (Shapiro, 2004). Once specific strategies are selected (e.g., self-management or contingency management techniques), a task analysis of the skill to be taught is conducted. Specific learning strategies may also be the focus of instruction (e.g., summarizing and memory strategies), and other curricular procedures may be implemented (e.g., peer tutoring). Intervention monitoring, use of CBA and behavioral measures, and modification of the instructional plan would be ongoing during this phase. Curriculum-based procedures contribute a number of important factors to the assessment-intervention process, including a means for (1) identifying current levels of academic skills; (2) monitoring intervention strategies or plans; (3) assessing the instructional context, particularly related to ecobehavioral factors (e.g., rate of presentation, reinforcements, contingencies, prompting, cueing, and feedback mechanisms) that affect learning; (4) assessing mild to moderate reading/learning problems; (5) evaluating skills, particularly at the elementary level; (6) reducing time consuming and expensive evaluation, and (7) conducting data-based consultation for remediating academic difficulties in children (Shapiro, 2004). These contributions are important and may alleviate the need for more in-depth evaluations. In some cases, Stage 1 evaluation and Stage 2 intervention may not be sufficient, and learning problems may persist that require further clinical evaluation and intensive remediation.

Stage 3: Cognitive Child Study

Some conditions (e.g., reading disabilities resulting from phonological core deficits) may not respond to interventions developed from behavioral assessments and, thus, may require more in-depth evaluations. In these instances a comprehensive psychoeducational evaluation is warranted. Measures of intellectual, academic, and psychosocial functioning usually make up this phase of assessment. Evaluation at this stage would seek to identify underlying cognitive, perceptual, memory, and reasoning deficits associated with particular academic deficiencies. Word fluency, phonological awareness, prior knowledge (e.g., vocabulary knowledge), and listening comprehension skills are also of interest in this phase. The child's metacognitive strategies and approaches to learning tasks may be helpful for understanding the nature and extent of their learning difficulties. Intervention plans would incorporate information gleaned during this stage, and may include multiple targets (i.e., academic, cognitive, and psychosocial) for intervention.

Stage 4: Cognitive-Based Intervention Plan

Interventions developed at this stage would address patterns of the child's specific cognitive strengths and weaknesses as the basis for designing effective academic programming. Depending on the patterns

of strengths/weaknesses, efforts at this level may include training in phonological awareness for explicit decoding skills, strategic instruction in comprehension (e.g., use of context for gleaning meaning from text), and methods for developing and activating schemata for learning new information. Study skills and organizational strategies may also be targeted. Specific techniques for various academic deficits (e.g., reading) are discussed in subsequent sections of the chapter. Attention would also be paid to the child's psychosocial functioning, and attempts to increase the child's self-esteem, social interaction, and psychological well-being may be a focus. Although Stage 4 interventions would systematically address psychosocial factors, these could also be the focus of intervention in Stage 2. In cases where interventions are not initially effective, however, there is an increased probability that the child will develop secondary psychological problems, as a cycle of academic failure, social rejection, and low self-esteem often ensues with repeated or prolonged academic deficiencies. Intervention plans would be systematically monitored and modified based on the child's progress. There are instances in which traditional psychoeducational evaluations and interventions are not sufficient, and some children require more in-depth neuropsychological evaluations.

Stage 5: Neuropsychological Evaluation

Children with traumatic brain injury or CNS diseases typically require more in-depth neuropsychological evaluations, and would benefit from baseline information about how the brain is functioning and about changes in this baseline over time and after effective interventions. Neuropsychological testing may also be necessary for children sustaining birth complications (e.g., prematurity, hypoxia) or exposure to teratogenic agents. Children with severe speech-language, learning, and/or motor difficulties may also require neuropsychological evaluations in an effort to effectively assess the nature of their delays or deficits. In these instances clinical child neuropsychological assessment is warranted. The need for neuropsychological assessment is particularly crucial for children who do not respond to the interventions described in earlier stages in the MNM model, or for children who have neurological symptoms associated with their learning and/or psychosocial problems.

Stage 6: Integrated Neuropsychological Intervention Plan

Bergquist and Malec (2002) suggest that neuropsychological assessment serves as the foundation for treatment planning. Interventions developed from neuropsychological data typically address compensatory skills and long-term management. Psychopharmacology may also be needed by some children at this level. See discussions in later sections of the chapter for more details about neuropsychological interventions.

Stage 7: Neurological and/or Neuroradiological Evaluation

Finally, some children may need intensive medical and/or neuroradiological evaluations and interventions. Although only a small portion of children require this stage of evaluation, this stage is crucial for some childhood disorders. Oftentimes children with life threatening conditions (e.g., tumors, injury, and/ or intractable seizures) need ongoing Stage 7 evaluations and medical treatment (e.g., neurosurgery, chemotherapy, and/or CNS irradiation). However, evaluations and interventions described at other levels may also be incorporated into treatment plans for children with these conditions.

Stage 8: Medical-Neurological Rehabilitation

Medical-neurological rehabilitation efforts may be required for a small number of children with severe brain injuries or CNS diseases. These services may require placement in a rehabilitation center for short-term or long-term medical

management. In these cases, a medical team including physicians (e.g., pediatric neurologists, neurosurgeons, radiologists, and pediatricians), neuropsychologists, psychologists, speech-language and physical therapists, and social workers design interventions to help remediate or rehabilitate the child's problems. Programs are generally comprehensive in nature and include the child and his or her parent. In summary, the MNM describes a process for linking multiple stages of evaluation into intervention plans.

Neuropsychological Framework for Remediation

Interest in neuropsychological rehabilitation has grown significantly over the past 20 years, and there has been an increase in research in cognitive neuroscience and clinical rehabilitation (Ponsford, 2004). Eslinger and Oliveri (2002) suggest that clinicians should apply rigorous evidence-based analysis to design and evaluate neuropsychological interventions using multiple baseline assessment to determine treatment efficacy. Neuropsychological interventions generally focus on the restoration of functions to improve skill deficits, and/or compensatory training to adapt to behavioral and cognitive deficits (Eslinger & Oliveri, 2002). It is important to set both short-term and long-term goals for clinical interventions and to address the full spectrum of neurocognitive deficits. See Hirschberg, Chui and Frazier (2005) for an overview of emerging brain-based interventions for children and adolescents.

Specific Strategies for Improving Cognitive, Academic, Social-Emotional, and Executive Control Deficits

Various techniques should be carefully selected following a comprehensive, multimethod evaluation, a clear understanding of the child's neuropsychological assets and deficits, and an assessment of his or her developmental, cognitive, academic, and social-emotional needs.

Neurocognitive Deficits

Although neurocognitive deficits are commonly found in a number of pediatric disorders (e.g., TBI), not all deficits are associated with traumatic insult (e.g., learning disabilities, ADHD) (Butler, 2006). Common neurocognitive deficits include problems with attention, learning and memory, language, and self regulation. Specific interventions with proven efficacy are briefly reviewed.

Interventions to Improve Attention Difficulties

Interventions to improve attention difficulties adopt a componential approach that recognizes different forms of attention. Attention may well contain multiple aspects, which are arranged in hierarchical order and may interact with motor, cognitive, and social development (Sohlberg & Mateer, 1989, 2001). Thus, disruption of any component may compromise the efficiency of the total attention system. Moreover, disruption of a component will have a negative impact on aspects lower in the hierarchical chain of attention (e.g., ability to shift set may be disturbed and consequently affect responses to temporally presented information or vigilance). It is likely that a breakdown in processing of temporal information would have an impact on classroom learning which requires processing of sequential instructional language.

A system that combines training on the aspects of attention involving selective and sustained attention was developed by Sohlberg and Mateer (1989, 1996), and later revised by Sohlberg, Johnson, Paule, Raskin, and Mateer (2001)—The Attention Process Training–II (APT-II). The APT-II was designed to rehabilitate mild brain dysfunction (i.e., attention and concentration difficulties) resulting from hear injuries. The program contains five components of attention, including: focused attention, sustained attention, selective attention, alternating attention and divided attention.

- **Focused Attention**: is the ability to focus on specific sensory information including visual, auditory or tactile stimuli

- **Sustained Attention:** is the ability to maintain attention during continuous and repetitive activity; incorporates the concepts of vigilance, persistence and task consistency; includes the ability of *mental control* or *working memory* incorporating the notion of holding and manipulating information in one's head, such as doing mental math
- **Selective Attention:** is the ability to selectively process target information and inhibits responding to nontarget information; incorporates the notion of "freedom from distractibility"
- **Alternating Attention: is** the ability to shift one's focus of attention; includes the capacity for mental flexibility
- **Divided Attention:** is the ability to simultaneously respond to two or more events or stimuli; capacity that allows an individual to divide his or her attention between two or more ongoing events. Deficits in this ability are evident when an individual can only process one (adapted from Sohlberg et al., 2001)

Research on Attention Training

Although sparse, research on the efficacy of attention training has produced promising results for children with TBI, cancer survivors, developmental dyslexia, and ADHD. To date, most research has been case studies with few large scale efforts in progress.

The Amsterdam attention and memory training program is based on a modified version of the Sohlberg and Mateer (1996, 2001) model. The program contains elements that address: process training for attention and memory; metacognitive strategy training; social contact and support, and weekly therapeutic interventions at the hospital clinic. Sessions are 30 minutes per day, over a 20-week period. In a series of case studies, Hooft et al. (2003) found that, following treatment, children with TBI showed: marked improvement on neuropsychological measures of sustained and selective attention; modest improvement on memory tests, and improvement on teacher and parent reports of behaviors, learning and social-emotional factors. Although children commented that the training was hard to integrate into daily school activities (the sessions were too long and sometimes seemed too easy) they did indicate that it was easier to study for exams after the training. The authors recommended that the 20-week program be shortened, individualized and adapted to the child, and reinforcers should be incorporated into training.

In a review of research on attention training, Penkman (2004) indicated that there have been a few published accounts of rehabilitation for pediatric cancer survivors. Attention training did produce positive effects on arithmetic skills, scores on the Conners' Continuous Performance Test (CPT), and memory for sentences and digits for a young cancer survivor (Butler, 1998). In a larger study, following attention training, pediatric cancer survivors showed positive outcomes on measures of attention and concentration and CPT scores (Butler & Copeland, 2002). In an innovative study where teachers administered rehabilitation training on alertness, attention, concentration, perception and memory, and executive processes, teens with pediatric TBI also showed modest but significant improvements. Penkman conducted a small clinical study of a child who received cranial radiation treatment for acute lymphoblastic leukemia (ALL) with similar results. Modest gains were noted on a number of attention tasks, but attention problems did persist.

In a study investigating attention training for children with dyslexia, Chenault, Thomson, Abbott, and Berninger (2006) found that attention training facilitated composition skills and verbal fluency once composition training was introduced. The authors suggest that attention training can be helpful, but the sequencing of interventions is also important.

Several studies have explored the utility of attention training for children with ADHD. Kerns, Eso, and Thompson (1999) also reported that the Pay Attention! program was effective for 14 children (7–11 years of age) with ADHD. Children who received training improved on measures of attention and academic efficiency. While there were some signs of improvement in inattention-impulsivity, rating scales did not evidence positive changes post-treatment. However, Kerns et al. (1999) found that cognitive efficiency can be improved with direct training. Semrud et al. (1999) adapted tasks that were originally designed for adults with head injuries.

Children with teacher- and parent-identified attention difficulties received during 24 sessions, over a 12-week period. Each child worked in a group of five to six children, and charts were kept of the child's progress. The charts were reviewed at each session, and problem solving techniques were discussed to help the child consider the most efficient alternative, as well as to learn to self-monitor his or her progress. At the end of the 12-week period, teachers reported on the child's ability to complete assignments. In 20 of the 22 cases, improvement was seen in the number of completed assignments. Of the 22 children enrolled in the study, approximately 50 percent were on medication for ADHD. At the end of the study, there was no difference between the medicated and the non-medicated children in their performance on measures of selective and sustained attention. Moreover, there was a significant improvement in the auditory attention of children who participated in the groups. Such improvement on the auditory attention task was not found for children without attention problems or for the ADHD control children. Therefore, it would appear that children with attention and work completion problems can benefit from direct teaching in problem solving skills and practicing selective attention. Semrud et al. (1999), concluded that attention can improve when specific training is provided. Second, the extent to which improvement in attention persists over time needs to be carefully studied. Third, although stimulant medications reduce core ADHD symptoms, medication alone does not improve academic performance. Though preliminary, this research appears promising, and attention training (with problem solving techniques) may prove useful as an intervention strategy for children with attention deficits.

Tamm et al. (in press) are currently developing and examining the effect of a unique attention training program for preschool children with ADHD. This team has modified laboratory activities from a nonhuman primate study, and developed computer-based games that are highly motivating. The program targets attention, planning, and maintaining information over a delay time. Initial pilot study results suggest that AT training in preschool children can produce improvements after five sessions.

Despite these promising findings, Riccio and French (2004) caution that further research is needed to determine the efficacy of attention training programs. In a review of 83 studies, Riccio and French indicated that current research has not adequately measured outcomes at baseline and post-treatment. Further, attention training groups have not been contrasted to control groups or groups who receive alternative treatments. "The ultimate goal is to carry out large scale controlled clinical trails examining the effectiveness of specific interventions. However, these types of studies demand considerable resources from both a financial and time perspective. Single case studies can fill in the gaps in the knowledge base and help guide work that is taking place on a daily basis until there is more solid research" (Penkman, 2004, p. 120).

Interventions to Improve Working Memory and Learning Deficits

Interventions to improve working memory and learning have focused primarily on children with language and attentional difficulties. Children with specific language impairment (SLI) have a number of cognitive deficits, including lexical/morphological learning and sentence comprehension difficulties that may be related to working memory (WM) deficits (Montgomery, 2003). Montgomery reviews current theories of SLI that focus on problems in WM, including the Baddeley (1986) phonological loop model. Baddeley suggests that there is a "central executive" that regulates information within WM, retrieves information from other memory systems (i.e., short-term memory), and processes and stores phonological information. Phonological short-term memory (PWM) and verbal rehearsal is part of the phonological loop, where verbal information is stored for a limited time period and allows the listener to create long-term memory of information by rehearsing. The model suggests that PWM has a limited capacity. Children with SLI have been shown to have weak PWM, which interferes with vocabulary learning.

Daneman and Carpenter (1980) suggest a computational WM model where storage and processing functions share a limited amount of attentional energy during comprehension. This model has been referred to as functional working memory (FWM),

where verbal information is both processed (for lexical, morphological, and grammatical representations) and temporally stored/retained and processed [see (Montgomery, 2003) for a more detailed discussion]. Daneman and Carpenter assume there is a trade-off between storing and processing information; as the complexity of the task increases, previously stored information is forgotten. Poor FWM has been associated with difficulties in word recall.

In terms of intervention, Montgomery (2003) argues that "it is important to point out that intervention that does not address the bidirectional influences of memory and language will likely fall short in promoting language learning and processing" (p. 228). Activities to help develop and enhance WM in young children include naming letters and objects, and listening to rhymes and stories; while teaching verbal rehearsal, paraphrasing, and creating manageable chunks of information are helpful for older children and teens.

Klingberg et al. (2005) developed a computerized program to improve the working memory (WM) of children with ADHD. The computer program developed for this study (RoboMemo(R), Cogmed Cognitive Medical Systems AB, Stockholm, Sweden) includes visuospatial (remembering the position of objects) and verbal tasks (remembering phonemes, letters, or digits). The program is described in more detail in Olesen, Westerberg, and Klingberg (2004). The training was spread over 25 days, with 90 WM trials on each day of training (approximately 40 minutes in length). Post-intervention data were collected 5–6 weeks after the baseline data, and the follow-up assessment was completed three months after post-intervention data were gathered. Students were randomly assigned to treatment or a control group who received the same treatment, but had tasks of less difficulty that were not matched to the child's working memory span.

Students who received intensive WM training did show significant improvement on WM tasks compared to the control group. Treated students also showed improvement on measures of response inhibition (scores on the Stroop task), verbal WM (digit-span scores from the WISC-III), complex reasoning (scores on the Raven's Colored Progressive Matrices), and decreased parent ratings of ADHD symptoms. Although the study was conducted on a relatively small group of children (50 completed all phases of the study), it does seem promising. Future studies will investigate the combination of WM training with medication. The next series of studies also need to determine whether improvements in WM generalize to real-life situations that require executive functions and strong WM (e.g., academic tasks).

Interventions to Improve Speech and Language Deficits

Various models of language rehabilitation have been advanced and have received research and clinical attention (Hinckley, 2002). Select therapeutic models include neuropsychological, cognition and learning, linguistic, compensatory, social, and neurological approaches. Each approach emphasizes different goals and treatment procedures. For example, the cognitive neuropsychological model seeks to identify the processes underlying language problems, remediate the impaired component or develop compensatory strategies. Assessing the component deficits allows the clinician to arrange a hierarchy of specific tasks that will be taught during therapy. Treatment could include strategies such as naming, semantic cueing, phonological cueing, and constructing sentences, etc. Conversely the cognition and learning model seeks to understand the underlying cognitive and learning deficits, utilizes theories of learning and skills acquisition, and focuses treatment on developing specific language abilities. Treatment using this model would also address specific cognitive skills including attention, memory, and executive functions. The compensatory model incorporates strategies to enhance functional communication rather than specific component deficits, and may bypass speech-language modalities directly (e.g., gesturing, drawing, or a visual representation of language). Models of learning have dominated the special education and rehabilitation centers where skill acquisition during rehabilitation parallels normal language development. Hinckley argues that "cognitive/learning theories, in conjunction with neurological evidence, offer the best current step toward a theory of

therapy" (p. 213). See Hinckley for a more detailed description of various models.

Nadeau and Gonzalez (2004) offer another approach to explain language processing – the parallel distributed process model (PDP). PDP models are "neural-like in that they incorporate large arrays of simple units that are heavily interconnected with each other" (2004, p. 131). Further, Nadeau and Gonzalez explain that "in PDP models of language, memories of language units (e.g., stored knowledge of phonemes, joint phonemes, syllables, words, and sentence constituents) are represented in the same neural networks that support linguistic processing" (2004, p. 131). Nadeau and Gonzalez outline strategies for addressing impairments in phonological and lexical semantic (anomia and word finding difficulties), grammatical (organization of words and words within sentences), working memory, concept manipulation, and word-sequence knowledge.

Studies investigating interventions for speech and language impairments have focused primarily on children with development delays and those with deficits from traumatic events. Several studies are summarized.

In a study to address morphological and phonological processing deficits in preschool children with co-occurring speech and language impairment, Tyler, Lewis, Haskill, and Tolbert (2003) found that an approach that alternated strategies produced the best results. The study compared four conditions: phonological training for 12 weeks followed by 12 weeks of morphosyntax training; morphosyntax training first then phonological training; the alternating condition, one week of phonological training followed by one week of morphosyntax strategies, and, a simultaneous condition. All treatment groups received 24 weeks of training and were compared to a no-treatment control group. At the end of the study children who received the alternating condition (one week of phonological intervention, then one week of morphosyntax) showed the greatest improvement in morphosyntactic and phonological skills, and both the morphological fist condition and the alternating conditions were better than the no-treatment condition. The phonological strategy training did produce changes in phonological skills, but this did not produce a cross-domain effect on morphosyntax.

A large sample of children with language impairments (216, ages 6 and 9 years) were randomly assigned to the Fast ForWord Language (FFW-L) program, general academic enrichment, computer assisted language instruction, or individualized language therapy by a speech-language pathologist (Gillam et al., 2008). Components of the FFW-L training include five language targets: narratives, semantics, syntax (grammatical morphology), syntax (clause structure) and phonological awareness. The FFW-L program provides specific computer games to improve underlying auditory processing deficits, and target discrimination of tones, detection of phonemic changes, phonemic matching, word discrimination, recalling commands, and comprehension of complex sentences. The computer-assisted condition also provided various strategies targeting discrimination and memory, phoneme awareness, recall, and comprehension. The individualized language therapy condition targeted semantics, syntax, narration, and phonological awareness. The academic enrichment condition served as a comparison group, and tasks were similar to those in the FFW-L and computer-assisted conditions (computer games), but none of the computer games were designed to improve language or auditory processing skills. Children received six weeks of therapy, five days per week, for one hour and 40 minutes per week. See Gillam et al. (2008) for more details on the strategies used in each condition.

All treatment groups showed improvement on measures of global expressive and receptive language skills (Gillam, et al, 2008). Children assigned to the FFW-L and the computer assisted learning conditions had significantly better improvements on phonological awareness. In general, children in the FFW-L group did not have significantly better language outcomes than academic enrichment, or methods addressing specific language deficits (computer-assisted and individualized therapy). Gillam et al. concluded that "results of this study suggest that intensive language intervention experiences that require close attending and immediate responding to auditory and visual stimuli in combination with opportunities for socialization with same-ability peers and a great deal of positive attention from caring and interested adults should result in clinically relevant improvements in language and auditory processing skills with language impairments" (2008, p. 114).

Interventions to Improve Self Regulation and Self-control Deficits

Self-management techniques have grown in popularity in an effort to help children develop control over their own behavior. Self-control techniques generally include self-assessment (observing one's own behavior), self-evaluation (comparing one's behavior to a "standard"), self-recording, and self-reinforcement (DuPaul & Stoner, 2003). Although these techniques have been used for a variety of behaviors, attending to task has been a major thrust in the literature. Lloyd and Landrum (1990) surveyed 37 studies using self-recording techniques for children with learning, cognitive, and behavioral disorders from four years of age to adolescence. Self-recording was effective for the following variables: increasing attention to task, decreasing disruption, work productivity, work accuracy, task completion, and sustained schoolwork. Depending on the child's individual needs, self-recording can focus on academic accuracy, productivity, or attention to task, and all areas seem to improve regardless of which is targeted (Lloyd & Landrum, 1990; DuPaul & Stoner, 2003).

Typically, self-recording is most effective when cueing occurs (Heins, Lloyd, & Hallahan, 1986), and may take many forms (e.g., tape recorded beeps at one-, two-, or three-minute intervals, or kitchen timers that ring every five minutes). Fading of taped cues is often built into self-recording procedures, and maintenance appears quite good after the treatment has been discontinued (Lloyd & Landrum, 1990). See DuPaul and Stoner (2003) for a more in-depth treatment of self-management techniques for the classroom.

Treating Academic Deficits

There are number of intervention strategies with documented efficacy for reducing academic deficits in children and adolescents. Techniques for addressing reading, written language, and arithmetic disorders are reviewed, including strategies for improving executive control deficits, study, and organizational skills. Interventions for improving social skills are also discussed briefly. These techniques are offered as possible strategies based on the child's particular neuropsychological, cognitive, and psychosocial profile, and should not be automatically adopted for every child. An in-depth interview with the child's teacher and a record review is critical to determine remedial techniques that have been attempted in the past and have proved effective or ineffective.

Reading Disorders

McCandliss and Nobel (2003) outline a neurocognitive, developmental model for understanding and treating dyslexia. Further, they argue that methodologies and approaches from the neurosciences can be applied to better understand how early phonological processes influence visual processes for rapid recognition of written words.

Phonemic Awareness

Research suggests that "the phonological coding deficit is clearly established as the strongest predictor and correlate of reading disabilities" (Wise & Olson, 1991, p. 638). Remedial techniques that have proved most effective incorporate strategies for teaching children phonemic awareness skills and typically include segmenting, blending, and analyzing sounds (Fletcher, Lyon, Fuchs, & Barnes, 2007).

Lovett and colleagues have been studying the effects of intensive reading remediation for children with severe reading disabilities using a modification of the Reading Mastery, a Direct Instruction program (Fletcher et al. 2007). Two programs were developed, Phonological Analysis and Blending/Direct Instruction (PHAB/DI) and the Word Identification Strategy Training (WIST), which focus on metacognitive strategies (Lovett, Barron & Benson, 2003). Although both programs feature transfer of learning sessions, neither normalized reading after 35 hours of instruction for children in upper to middle elementary grades. Lovett et al. (2000) combined both programs and extended the training for younger children with better results. The combination of 35 hours of training with PHAB/DI and 35 hours of instruction with WIST was more effective than 70 hours of training with either program alone.

PHAST (phonological and strategy training) is a new reading program that combines the PHAB/DI and WIST programs (Fletcher et al. 2007). Initial findings of school-based training with PHAST have

proven to be effective for reading recognition and comprehension skills. The study also examined the effects of a training program emphasizing reading fluency. The RAVE-O (Retrieval, Automaticity, Vocabulary elaboration, and Enrichment with language Orthography) program was developed to increase reading fluency in decoding and comprehension, and to improve reading interest and engagement [see (Fletcher et al., 2007) for more details]. Multidimensional approaches have produced effective outcomes including children from lower socioeconomic backgrounds.

Preventive efforts have also effective, increasing phonemic awareness skills in preschool children (Byrne & Fielding-Barnsley, 1993; Lundberg, Frost, & Petersen, 1988; Torgesen, 2004). Phonological recoding skills are stressed, where the child is taught to translate letters and letter patterns into phonemes. Knowledge of the grapheme-phoneme correspondences are usually integrated within reading instruction, and are not taught in isolation. Phonograms, common sound elements in word families (e.g., "ight" in light and fight), may also be stressed in beginning stages to increase vowel generalizations (Iversen & Tunmer, 1993). While children are instructed to categorize words on the basis of their phonemic similarity (Bradley & Bryant, 1983), phonemic awareness is most effective when contextualized using words taken from regular reading lessons (Cunningham, 1989).

Peer-assisted Learning Strategies (PALS) has been systematically studied for the past 20 years, and shown to be effective for students with weak academic skills (Fuchs & Fuchs, 2005). McMaster, Fuchs, Fuchs, and Compton (2005) extended treatment for children who did not respond favorably to the PALS program. Children who received adult tutoring focusing on word recognition, storytelling practice, and self monitoring improved reading at higher rates than those who received no further adaptations (continued PALS program), or a classroom modification of the PALS.

Training programs in phonological awareness and phonological recoding often incorporate metacognitve strategies. Children are made aware of the visual and phonological similarities in words, and are taught how and when to use this knowledge (Iversen & Tunmer, 1993). Cunningham (1990) incorporated similar metacognitive techniques and found this instruction extremely beneficial.

Reading Comprehension

Strategies to improve reading comprehension have been effective, particularly when metacognitive techniques are used (Fletcher et al., 2007; Wise & Olson, 1991). Palincsar, Brown, and Martin (1987) used a "reciprocal teaching" method whereby teachers used predicting, questioning, and clarifying strategies to improve comprehension skills in slow readers. Comprehension skills were maintained two months after instruction and were generalized to other content areas [see (Wise & Olson, 1991) for a review]. Bos and Van Reusen (1991) describe several techniques that have effectively increased comprehension and vocabulary knowledge, including "interactive learning strategies." This model emphasizes cooperation between the student and the teacher, where the student helps to identify their prior knowledge about a topic and then proceeds to link that prior knowledge with new information. Students are then taught how to scan reading material, to develop "clue lists," "relationship maps," or charts, and to predict relationships across concepts (Bos & Van Reusen, 1991). The teacher's role begins as an instructor working together with the student through these stages, then moves to facilitator when students begin to work with each other. These techniques have been effective in bilingual LD classes for social studies and reading (Bos & Van Reusen, 1991), and for middle school children for science (Bos & Anders, 1990).

Melzer, Pollica, and Barzilla (2007) describe excellent strategies for increasing executive control of reading comprehension for elementary aged students. Planning, prioritizing, organizing, flexibility in shifting mental sets, and self-checking strategies are all important EF skills (see Meltzer, 2007). Many of the EF strategies teach students how to use efficient and effective self-assessment techniques to monitor comprehension during the reading process. "Seven principles for understanding the relationship between reading comprehension and executive control are: 1. Reading must make sense. 2. Understanding is the result of planning to understand. 3. Accessing background information helps organize new information. 5. Self-checking enhances goal achievement. 6. Having a flexible mindset provides opportunities for increased understanding. 7. Understanding is improved by self –assessing" (Gaskin, Satlow, & Pressley, 2007. p. 213). See Gaskin et al. for other metacognitive strategy methods.

Computer and Speech Feedback

Olson and Wise (2006) have conducted a number of studies investigating computer-based programs to increase word recognition and decoding skills. Olson, Foltz, and Wise (1986) developed a reading program for the microcomputer utilizing a speech synthesizer (i.e., DECtalk). Wise et al. (1989) found that below average readers (lowest 10% of readers from selected classrooms) improved in phonological coding and word recognition skills using a computer reading program. When children were unable to read a word, segmented feedback was available whereby the computer highlighted and simultaneously "spoke" the word with the child. Comprehension questions were also incorporated into the program, and corrective feedback was provided. These results are promising and efforts are underway to improve these computer-based technologies (Olson et al., 1994; Wise & Olson, 1991).

Lewandowski and his colleagues at the Syracuse Neuropsychology Laboratory have found that students with reading disabilities also recall more words when stimuli are presented in two modalities–computer screen and computer voice synthesizer–simultaneously. Montali and Lewandowski (1996) showed a memory advantage for students with reading disabilities who experience short-term memory weaknesses, when words were presented bimodally. The performance of the reading-disabled group approached that of normal readers. Further, this performance advantage was also shown for reading conditions. When text was highlighted on the computer screen and the computer also read (spoke) the words at the same time, spontaneous word recall and reading comprehension improved. Students with reading disabilities expressed a preference for this computer-based reading format. Steele, Lewandowski, and Rusling (1996) replicated these findings with a mixed (LD, ADHD, and emotionally disturbed) group of children with reading problems. Bimodal facilitation was found in almost every student when data were analyzed using single-subject methodology. In summary, Lewandowski and colleagues suggest that bimodal computer reading methods can be helpful for a variety of poor readers in grades three through 12. Future research needs to address the issue of long-term benefits for such methods and to identify which children specifically benefit the most from these procedures. At present, there are a number of commercial computer programs available that combine highlighted and/or bigger text with speak-aloud capacities for spelling, writing, and literacy activities for Macintosh or IBM computers. These commercial programs may prove useful when incorporated into remedial programs for poor readers, and certainly warrant further research.

More recently Wise, Ring, & Olson (2000) developed an intensive computer-based instructional program focusing on phonological awareness and decoding (50–60 ½-hour sessions). Students in grades 2–3 who received this intervention did show phonological improvement 1–2 years after completing the program, but gains for children in grades 4–5 were not as impressive. Older children benefited from computer sessions emphasizing accurate story reading. Even though phonological skills increased for the younger children, these did not transfer to other reading and spelling skills. Long-term transfer is apparently best when word recognition training is combined with reading comprehension strategies (i.e., reflective reading).

Whole Language Programs

Advocates of whole language programs stress the importance of teaching reading as a language activity, linking reading to writing, and incorporating children's literature as a source for reading activities. Wise and Olson (1991) describe whole language techniques as a "strength" approach and further suggest that word recognition and metacognitive techniques can be incorporated into this framework.

Written Language Disorders

Many techniques to improve written language skills use cognitive and metacognitive strategies (Graham, Harris, & Olinghouse, 2007). Strategy instruction usually involves teaching students how to plan, organize, write, edit, and revise their writing samples. Several structured curricular programs are available, including Cognitive Strategy Instruction

Writing (Englert, 1990) and self-regulated strategy development (SRSD) (Graham & Harris, 2003, 2005). The SRSD teaches students to apply writing strategies such as goal setting, self-monitoring, and self-regulation to improve writing (Graham & Harris, 2003, 2005). The SRSD has evolved over the years and includes two major strategies: the POW and the TREE. Strategies that plan (e.g., who are the characters, what is the setting, etc.), organize, and write more ideas (POW) have been combined with other strategies (TREE, Tell what you believe in a topic sentence; give reasons to support your beliefs; end or wrap up your story, and examine the story or edit). The SRSD program has improved performance in students with learning disabilities (Graham & Harris, 2003, 2005).

Mathematic Disorders

Mathematic problem solving difficulties have not been as well researched as reading deficits (Bos & Van Reusen, 1991). Reasoning, metacognitive processing, and reading delays have been associated with deficits in solving word problems (Bos & Van Reusen, 1991). Remedial techniques designed to address mathematical problem solving disorders often reflect cognitive and metacognitive approaches, where students are taught to understand the nature of the problem, plan a solution, carry out the solution, and assess the accuracy of the solution. Similar problem solving strategy instruction has been proven effective in a number of studies (Montague & Bos, 1986). Fleischner (1994) cautions that few studies with math learning disabilities have adequately addressed the neuropsychological characteristics of the subjects, or, when these data are available, the cognitive strategies employed by the subjects are not described. Fletcher et al. (2007) suggest that a number of cognitive difficulties interfere with the development of mathematics, including working memory, language, nonverbal problem solving, phonological decoding, attention, and reading sight words. In this regard, Fleischner (1994) suggests using the Test of Early Mathematics Ability (TEMA-2) or the Diagnostic Test of Arithmetic Strategies to gain information about which strategies are being employed.

In a review of studies on mathematics disabilities, Baker, Gersten and Lee (2002) report that several approaches can be helpful including: providing student progress to the teacher and the student; using peer tutoring; giving performance feedback to parents, and explicit teaching of math concepts and processes. Fuchs et al. (2003a, 2003b) successfully applied a cognitive framework for a classroom-based approach to improve the math problems, particularly when combined approaches were used (e.g., teacher instruction of math concepts, teaching students to solve word problems, word problem solving with specific strategies for transfer). See Fletcher et al. (2007) for a more detailed review of strategy instruction for mathematics disabilities.

Rourke (1989) provides an extensive description of the neuropsychological characteristics of children with specific deficits in the math area, with relative strengths in reading and spelling, and describes a comprehensive intervention program for this problem.

NLD Syndrome

Rourke (1989) and his colleagues (Rourke et al., 1983; Rourke, Del Dotto, Rourke, & Casey, 1990; Rourke & Fuerst, 1991) have described numerous remedial techniques that address the academic and psychosocial problems experienced by children with nonverbal learning disabilities (NLD). NLD children have the most difficulty in the academic areas of mathematics reasoning, calculation, and problem solving, with basic social-emotional problems (Rourke, 1989). These problems appear related to a pattern of right-hemisphere weaknesses (e.g., tactile and visual perception, concept formation, novelty, and complex psychomotor skills), with relative strengths in left-hemisphere activities (e.g., phonological skills, verbal abilities, reading, spelling, verbatim memory) (Rourke, 1994). Rourke (1989) suggests a remedial approach that acknowledges these assets and deficits and encompasses techniques for improving academic skills as well as social relationships. Strang and Rourke (1985) describe a series of teaching strategies to enhance mathematics calculation and reasoning, which involve verbal elaboration of the steps, written cue cards with the rules

for solving the problem, and concrete aids (e.g., graph paper and color-coded columns). Students are encouraged to use calculators to check for errors, and teachers use error pattern analysis to modify the remedial plan (Teeter, 1989). Lessons utilize relevant and practical problem solving situations (e.g., shopping). Further, Rourke (1989) describes techniques for increasing problem solving skills, generalization of strategies and concepts, appropriate nonverbal skills, accurate self-evaluation, and life skills that prepare for adulthood. Rourke (1989) stresses the need for social problem solving skills, social awareness, structured peer interactions, and parent involvement in the treatment plan because of the serious psychosocial limitations inherent in the NLD syndrome. Techniques are also developed to increase the child's exploratory behaviors and interactions with the environment. Rourke's (1989) methods emphasize the need for a step-by-step problem solving approach, in which feedback is provided in a supportive manner. Children are encouraged to "lead with their strong suit" and are also taught more appropriate ways to utilize their relative strengths (i.e., verbal language skills). Rourke (1994) has used single-subject investigations to validate his remedial techniques, finding support for treatment plans that are based on a model of identifying the interactions of neuropsychological assets and deficits on academic and psychosocial functioning. Rourke (1994) acknowledges the need for more systematic empirical study of remedial strategies based on neuropsychological findings, particularly to investigate whether interventions should be deficit-driven or compensatory in nature. Developmental considerations appear important in this decision, as Rourke (1994) suggests that when deficits result from early white matter disease or dysfunction, remediation might focus on attacking the deficit. If the diagnosis is made later or if the syndrome persists, compensatory strategies are most likely the best approach.

Interventions for Executive Control Deficits

Dawson and Guare (2004) have written a useful handbook that describes a number of promising interventions for increasing executive skills that focus on the environment and the individual. First, changes in the environment are made to adjust to the limitations of the child. These include: (1) changing the physical environment in the classroom which may include changing the child's seating, matching the child with a highly structured teacher, and/or reducing the number of children in the classroom and increasing the amount of supervision; (2) changing the nature of the task by making it shorter, making steps more explicit, making the task closed ended (e.g., fill-in-the-blank or true-false), building in choice, and providing scoring rubrics with each assignment; (3) changing the way in which cues are given by using verbal prompts and reminders, using visual cues, creating schedules, making lists, using audio taped cues for self-monitoring, and using pager systems for older youth, and (4) changing the way adults interact with the child by anticipating problems and modifying the environment, by intervening early before the problem gets too big, by reminding and prompting the child, and by designing interventions that address the child's individual weaknesses.

Interventions that promote executive control skills that focus on the child teach planning, organization, and follow specified directions (see Dawson & Guare, 2004). Initially these steps are followed under the direction of parents (or teachers); then supervision is faded. For example, specific steps include: describing the problem behavior; setting a goal; establishing steps to meet the goal; supervising the child to meet goals; evaluating the strategies and making changes if needed, and fading the supervision. These steps move the child to self-directed or self-monitored problem solving. An incentive system (i.e., behavioral contracts) is built into the steps to increase saliency of the strategies that are being taught. Other strategies include targeting skills for response inhibition, working memory, self-regulation of emotions, sustained attention, initiating tasks, planning goals, organization, time management, and goal-directed persistence. The techniques that are described utilize a number of behavioral and cognitive-behavioral strategies that may prove to be helpful in assisting children with ADHD. Other coaching techniques are suggested, including ways to integrate these into educational plans.

Study and Organizational Skills

Systematic strategy instruction for high school students has been the focus of a program—the Strategies Intervention Model—developed by the University of Kansas Institute for Research on Learning Disabilities (Ellis & Lenz, 1991). This program was developed to teach learning strategies that enable students to acquire and store knowledge, and demonstrate this knowledge (Ellis & Friend, 1991). For strategies to be effective, they must be useful, efficient, and memorable. Ellis and Friend (1991) describe several effective strategies, including setting priorities; reflecting upon how a task can be attacked and accomplished, and analyzing the task, setting goals, monitoring, and checking to see if goals were accomplished. Archer and Gleason (1989) also developed Skills for Success (Grades 3–6), a structured curriculum to teach students study and organization skills. This program features lessons on reading, organizing and summarizing information, test-taking, anticipating test content, how to study, and responding to various test formats (DuPaul & Stoner, 2003). DuPaul and Stoner (2003) also describe a program for organizing school materials, making an assignment calendar, and organizing and completing a paper for children with ADHD. Although these study and organizational skills have not been thoroughly researched, initial evidence suggests that they are promising procedures that can be employed for learning disabled youth (Ellis & Friend, 1991), and warrant further investigation for children with ADHD (DuPaul & Stoner, 2003).

Social Skills Training

Interest in the remediation of social skills deficits has increased over the years, due to the growing awareness that social skill development is linked to learning disabilities (Semrud-Clikeman & Hynd, 1991); school dropout rates, delinquency, and emotional disturbance (Barclay, 1966), and attention-deficit disorders (Carlson, Lahey, Frame, Walker, & Hynd, 1987). Specifically, it has been shown that peer rejection as a result of aggression is predictive of criminal behavior later in adulthood (Parker & Asher, 1987). Recently, proposed definitions suggest including social problems as characteristics of learning disabilities (Lerner, 1993). Advocates of this proposal assert that to focus solely on academic gains in reading and math, while ignoring social interaction skills, will limit the usefulness of our remediation efforts for children with learning disabilities (Rourke, 1994). Social skills problems appear related to a number of factors including self-efficacy, self-esteem, locus of control, social cognition, comprehension of nonverbal cues, moral development, comprehension of social rules, problem solving skills, communication disorders, and classroom behaviors (Bryan, 1991). Semrud-Clikeman and Hynd (1991) further describe several neuropsychological syndromes resulting from involvement of either the right or the left hemisphere. Right-hemisphere dysfunction was postulated in learning-disabled children with a variety of deficits, including math, visual-spatial, and social perception, and left-sided motor weaknesses, with verbal reasoning, social gesturing, and social linguistic problems (Denckla, 1978, 1983). Voeller (1986) also described a group of children with abnormal right-hemisphere signs based on CT scans, EEGs, and neuropsychological measures. These children were unable to interpret others' emotions and had trouble displaying appropriate emotions. Further, there was an increased rate of attentional and hypermotoric behaviors as well in children with right-hemisphere involvement.

There are a number of social skills training programs, including the ACCEPTS program for elementary children (Walker, McConnell, Todis, Walker, & Golden, 1988), and the ACCESS program for adolescents (Walker, Holmes, Todis, & Horton, 1988), to name a few. These programs are highly structured, and have proven efficacy for children with mild to moderate handicaps.

Interventions designed to address social skills deficits in children with various learning and social interaction problems have met with mixed if not disappointing results (Vaughn, McIntosh, & Hogan, 1990). When positive behavioral changes have been noted in children with social skills problems, peers and teachers do not readily acknowledge or perceive these gains (Northcutt, 1987). Another concern that is often raised by researchers is that children "trained" in social skills often

display appropriate social skills in controlled, therapeutic settings, but fail to interact appropriately in natural settings.

A couple of therapy caveats illustrate this point. One of the authors conducted a 15-week social skills training program with four monthly booster sessions for children with ADHD. At the end of the 15-week sessions, one 12-year-old girl threw her "graduation" gift on the floor. When confronted about her inappropriate behavior, she commented, "Well, you told me I should be honest. Did you want me to lie when I didn't like my present?" Despite weeks of modeling, role-playing, corrective feedback, videotaping, and behavioral reinforcement on expressing feelings appropriately, when disappointed in a "real-life" situation, she was unable to apply the skills she had demonstrated on numerous occasions during group sessions. When processing the incident, she could generate alternative behaviors, but in the heat of her emotions she was unable to exercise control over her disappointment. On another occasion, a 13-year-old ADHD male pushed one of his peers and kicked his books across the parking lot on his way out of the hospital. This situation followed an evening when alternatives to anger were the focus of the group session. This adolescent wasn't even an aggressive child, but when he was teased about something that was particularly painful for him, he reacted inappropriately. Not to be overlooked was the other 12-year-old who was baiting his peer. He, too, was part of the group and obviously was acting inappropriately. Even though both boys were progressing nicely in therapy, in a more natural, less structured situation both were unable to generalize skills that had been the focus of numerous sessions.

In a critical review of 20 studies conducted between 1982 and 1989, Vaughn et al. (1990) did indicate that programs for students with LD were most effective when the following conditions were in place:

1. Students with LD received part-time versus full-time LD services.
2. Students with LD were in either elementary or high school; middle school students showed fewer gains.
3. Regular class students were included in the intervention program.
4. Programs were individualized to the student's needs.
5. Children were selected for social skills training based on deficits rather than LD placement alone.
6. Training programs were long-term (average nine weeks, 23.3 hours) and included follow-up sessions.
7. Instruction is conducted in small groups or one-to-one.
8. Programs included coaching, modeling, corrective feedback, rehearsal, and strategy instruction.

La Greca (1993) indicates the need for training programs that address the broader social milieu of the child. Rather than focusing solely on the social skills deficits of the "problem child," programs should also include high status or non-problem peers. La Greca (1993) recommends the following: (1) changing peer acceptance through multisystemic intervention models; (2) employing prevention models at the school level; (3) utilizing peer pairing or cooperative activities with children of mixed social status; (4) changing the way teachers select groups in the classroom to avoid cliques and child-picked teams; (5) on-going teacher monitoring of social skills interventions in the classroom, and (6) involving parents in intervention efforts. La Greca (1993) also suggests that one or two close friends might buffer a child who does not enjoy peer acceptance with the larger group. Helping the child develop supportive friendships might be worthwhile to reduce anxiety, stress, depression, and low self-esteem.

Stein and Krishnan (2007) provided an overview of strategies to improve the social success of students with NLD. Improvement depends upon interventions that focus on classroom, individual, and small group instruction. It is critical to design classrooms and schools that promote, teach, and reinforce positive social interactions. School environments should provide structure in the classroom and the playground, organize cooperative play, teach social problem solving skills, and implement anti-bullying programs.

In summary, social skills training can be effective when it involves broader goals than increasing skill deficits in the targeted child. By expanding treatment

goals to include peers, teachers, parents, and the school environment, social skills intervention can be helpful for many children with learning problems.

Classroom and Behavior Management

Behavior management has long been used as an effective remediation strategy for a variety of learning and behavioral problems in the classroom. The literature base demonstrating the positive effects of behavior management are too extensive to review here. The reader is referred to DuPaul and Stoner (2003) for a detailed review of research on token economies, contingency contracting, cost response, and time-out from positive reinforcement. This section reviews selected strategies that have proved helpful for classroom management and instructional techniques, including self-management, attention training, home-based contingencies, and peer tutoring.

Home-Based Contingencies

Home-based contingencies are frequently used as a supplement to school-based token systems (DuPaul & Stoner, 2003). Generally, these procedures employ daily or weekly rating forms that are filled out by the teacher. Several classroom or academic behaviors can be targeted, including attention to task, work completion, homework completion, compliance, and social interactions. The teacher rates the child by class periods or subject areas, using a point scale (e.g., 5 = excellent, 1 = terrible), and provides written comments. The child is responsible for taking the rating form to the parent, and the parent then discusses the child's performance with the child and provides reinforcement based on the points earned at school. DuPaul and Stoner (2003) indicate that delay of reinforcement can be a problem for children with ADHD, particularly with younger children. However, home-based contingencies have proved effective for increasing school performance, particularly when used with classroom behavior management techniques.

Peer Tutoring

Peer tutoring techniques have been developed for reading, spelling, and math activities, and participants have demonstrated significant gains (Greenwood, Maheady, & Carta, 1991). DuPaul and Stoner (2003) indicate that peer tutoring is an attractive technique because it is time- and cost-efficient. In peer tutoring the class is divided into dyads, and tutor-pairs work together during learning activities (Shapiro, 2004). The Class Wide Peer Tutoring (CWPT) program provides systematic and detailed training guidelines for implementing this intervention technique (Greenwood, Delquardi, & Carta, 1988).

Shapiro (2004) indicates that these procedures have produced positive academic and behavioral gains for children with a variety of disorders, including slow learners, learning disabled children, and behaviorally disordered children. DuPaul and Henningson (1993) also reported positive gains for a young child with ADHD when a class-wide peer tutoring program was initiated. The second-grade child with ADHD showed less hyperactivity and improved on-task behavior and academic performance in math.

These techniques offer a number of viable strategies to improve the academic, behavioral, and social functioning of children and adolescents with various disorders. Individual educational planning is necessary to decide which of these techniques are most appropriate. These interventions are usually used in combination, and careful monitoring is essential to determine their effectiveness. See DuPaul and Stoner (2003) and Shapiro (1989) for detailed information on intervention monitoring.

Other studies have shown that the following behavioral treatments are highly effective for youth with ADHD.

(1) Contingency Management includes the application of positive (token or point systems) and negative consequences (time-out and response cost) in highly structured environments. Pelham and associates developed a summer treatment program that incorporates these principles with other psychosocial and academic interventions (Pelham, Wheeler, & Chronis, 1998). To be effective, behavioral strategies must be used consistently.
(2) Behavioral therapy has been shown to be effective in both the home and school environments

(DuPaul & Stoner, 2003; Teeter, 1998). Parent training programs and teacher consultation to reduce disruptive behaviors generally include the use of token systems with rewards for targeted behaviors. When necessary punishment can be effective when it is nonphysical and consistently applied to a reward-rich environment. Homeschool contingency plans also utilize these behavioral techniques with success.

(3) Social skills training has produced mixed results, but when applied more systematically, positive results have been more robust [see (Pfiffner & McBurnett, 1997; Pfiffner, Barkley, & DuPaul, 2006)].
(4) Peer tutoring of children with ADHD is an effective intervention in the classroom (DuPaul, Ervin, Hook, & McGoey, 1998).
(5) Self-management, self-instruction and self-reinforcement techniques are also promising (DuPaul & Stoner, 2003).

While we do not have an extensive research base to determine efficacy to date, there are some promising interventions that appear effective for promoting self-control and other executive skills in children. Strayhorn (2002) reviewed the empirical evidence of a number of systematic strategies for children with self-control difficulties. In general, the methods incorporate goal setting, determining and arranging task difficulty, changing attributional style, modeling desired behaviors, practicing skills (rehearsal), reinforcement and punishment to foster delay gratification, and self-instruction.

Summary

This chapter provided a brief overview of interventions for various cognitive, academic, social-emotional and executive control difficulties that occur in childhood. Although the strategies cross various paradigms, we suggest that a comprehensive neuropsychological model would advance the science of understanding and treating childhood disorders. It will be important for future research to better determine the extent to which interventions impact brain functions. "While it is possible that some intervention approaches may reverse the core deficits in abnormal patterns of functional activity, others may achieve their effects by recruiting compensatory mechanisms or have no measurable effect on the underlying brain mechanism" (McCandliss & Noble, 2003, p. 202).

In their elegant review of dyslexia, McCandliss & Noble (2003) concluded, "We believe, however, that a more complete theoretical treatment of the neurobiological basis of reading ability and disorder will require an account of the mechanisms by which the functional properties of these brain areas change with learning, development and intervention" (p. 203). We believe that this statement could easily apply to other cognitive and academic problems.

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