Effects of Prior Attention Training and a Composition Curriculum with Attention Bridges for Students with Dyslexia and/or Dysgraphia

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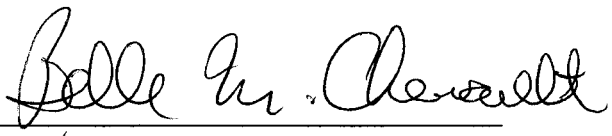
Signature 

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University of Washington

Abstract

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Research attention has been directed to relationships between dyslexia and attention/executive function. After reviewing research on dyslexia as manifest in both reading and writing, this dissertation discusses executive function and the frequent overlap between attentional problems and dyslexia. Dyslexia and Attention-Deficit/Hyperactivity Disorder (ADHD) are distinct disabilities, but both occur along a continuum and frequently display overlapping characteristics.

Just as literacy processes can be improved in children with dyslexia through systematic instruction, attentional processes in children with ADHD can be improved with attention process training, originally conceived as cognitive rehabilitation for persons with head injury. Attention process training with the *Pay Attention!* materials has also shown positive effects on academic skills. This dissertation research investigated the proposition that attention process training, coupled with attention bridging activities in a literacy context, would enable dyslexic writers in grades 4–6 to make significant progress in subsequent writing composition instruction compared to a

peer control group that received reading fluency training with the *Read Naturally* program.

Twenty students in grades 4-6 identified as low functioning in reading or writing were randomly assigned to an intervention containing either the reading fluency or attention process training component. In addition, both groups received writing composition instruction with attention bridge activities in a literacy context. The first phase of instruction consisted of ten half-hour individual sessions twice a week, and the composition phase consisted of ten hour-long group sessions twice a week.

As predicted, students who received attention process training prior to composition lessons demonstrated significantly improved scores in composition compared to their peers who received prior reading fluency training. In an unexpected finding, the attention group also demonstrated significant growth in oral verbal fluency. Results were interpreted as showing that prior attention training enhanced attentional management, enabling students to improve their planning and revising abilities in writing. In addition, attention training helped students improve their efficiency of retrieving information from memory stores for oral verbal fluency. This study is significant because it demonstrates that attention process training can enhance later academic instruction by improving cognitive efficiency.

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DEDICATION

To my mother, Belle Richardson Montgomery Chenault, who always did too much, but did it gracefully and with love, and did it well.

To my father, John Murphy Chenault, M.D., who was pleased and surprised that I was going for my Ph.D.

To my grandfather, Jack Percival Montgomery, Ph.D., Professor of Organic Chemistry at the University of Alabama in Tuscaloosa, who tolerated mandatory retirement in 1947 at the age of 70 by starting to write poetry and joining an amateur theatre group.

Introduction

Dyslexia is an inability to read and spell effortlessly and accurately that cannot be explained by intellectual, emotional, environmental, or sensory factors. The person with dyslexia usually experiences great difficulty initially learning the names and sounds of letters, and then has significant problems learning to decode words. As literacy skills develop, problems with spelling typically emerge. As Berninger and Amtmann discuss (Berninger & Amtmann, 2001), the student with dyslexia may also have dysgraphia, a problem with automaticity in handwriting of letters, as well. Spelling and handwriting problems often interfere with higher order written language composition skills. Thus, the person with dyslexia typically experiences an evolving panoply of literacy problems over the course of the school years.

In addition to their problems with literacy development, many people with dyslexia have problems with attention, memory, and "executive function," the ability to plan and execute goal-directed behavior (Moores & Andrade, 2000). Indeed, it is a common clinical observation that dyslexia and attentional disorders frequently occur in the same individual, even when either the attention problem or the reading problem is not severe enough to be diagnosed separately. Attention problems of varying degrees may interfere with ability to coordinate the word codes involved in reading (Corina et al., 2001). In other words, reading requires the ability to integrate the contributions of the auditory, visual, and motor systems, an effort that may depend upon executive function.

This dissertation is organized as follows: Chapter I discusses dyslexia, moving from initial difficulty with reading decoding to later writing problems. Chapter II discusses attention and executive function and the confusion among definitions of these constructs and the construct of working memory. Chapter III considers the possible role of attention and executive function in dyslexia and dysgraphia. Chapter IV describes a study investigating the effect of attention training on dyslexia. Chapter V discusses the

methods used in the study, Chapter VI reports the results, and Chapter VII discusses the results and significance of the findings.

Chapter I: Dyslexia

Reading Problems

As Paulesu and colleagues reported (Paulesu et al., 1996), between 2 and 10% of the population in English-speaking countries have great difficulty learning to read in spite of adequate educational resources, normal cognitive development, and no obvious sensory or oral language defects. Researchers and educators generally agree that difficulties with phonological processing, short-term memory, rapid automatic naming skills, and orthographic processing are the root causes of early reading problems.

Pennington (Pennington, 1991) argues that the root deficit in reading disability is a subtle language processing problem that gives rise to difficulty with analysis, synthesis, memory, and/or rapid recall of the sounds of the language. Children who are most at risk for developing reading difficulties lack skills in 1) phonological awareness, including phoneme analysis, segmentation, and blending in spoken words; 2) the ability to say the names of known objects, colors, letters, or numbers rapidly (Rapid Automatized Naming or RAN); and 3) short-term auditory/verbal memory (Blachman, 1994; Felton & Pepper, 1995; Torgesen, 1991; Torgesen & Davis, 1996; Torgesen, Wagner, & Rashotte, 1994; Vellutino et al., 1996).

Phonological awareness is a precursor to understanding of the alphabetic principle that phonemes correspond to one or two letters in a spelling unit. Rapid naming is related to the ability to associate names automatically with orthographic symbols, a skill that is needed to acquire automatic word recognition. Wolf and Segal (Wolf & Segal, 1992) have found that the naming system offers powerful, early, differential prediction of reading problems, and that speed and accuracy of word-finding differentiate average from dyslexic readers at all ages.

Many researchers have also reported that low scores on memory span tasks in persons with reading disabilities seem to be a marker for poor response to remediation

(Morris et al., 1998; Torgesen, 1991; Vellutino et al., 1996). Torgesen reported that persons with reading disabilities tend to do worse consistently on memory span tests than on any other single type of task commonly found on intelligence tests. Waring et al. (1996) found that digits backward, a working memory task that requires the student to repeat digits presented aloud in reverse order, was important in distinguishing between poor readers who recovered by sixth grade and those who did not.

Phonological awareness, rapid naming, and phonological memory deficits as markers for dyslexia come from the theoretical perspective that reading disabilities are the result of problems with a core phonological processing deficit. Other research points to the contributions of orthographic skills to reading and reading disabilities. For example, Berninger and colleagues (Berninger, 1998; Berninger, Abbott, Zook, Ogier, & Lemos, 1999) and Badian (Badian, 1997) found that pretreatment orthographic skills were also significant in predicting response to reading remediation. Growth in reading was predicted by Verbal IQ, orthographic, phonological, and RAN skills. Another Berninger et al. study (Berninger, Abbott, Thomson, & Raskind, 2001) found that an orthographic factor, based on short-term coding and long-term memory for orthographic word forms, was one of the strongest predictors of reading and writing disability in children and adults. The work of several researchers (Badian, 1997; Morris et al., 1998; Vellutino et al., 1996) supports the idea that the more cognitive trait deficiencies the learner is experiencing, the more severe the reading deficits are.

Researchers agree that students with reading problems must be explicitly taught sound-symbol correspondences to acquire phonological decoding skills. The methodical teaching of phonological analysis and synthesis skills is necessary to remediate dyslexia (Felton & Pepper, 1995; Torgesen, 1991; Torgesen & Davis, 1996).

Writing Problems

Initial problems with learning sound-symbol correspondence commonly give rise to spelling problems, with resulting writing failure and avoidance of writing activities.

Berninger and Amtmann (Berninger & Amtmann, 2001) quoted studies showing that diagnosis of written expression problems increases sharply about grade four, just when the complexity and length of writing assignments in the curriculum increase. Large numbers of middle school students report writing difficulty, and writing is the most common problem of high school students with learning disabilities (Mayes, Calhoun, & Crowell, 2000).

As is the case with reading, disabilities in writing often involve the short-circuiting of foundational skills. Without the necessary foundational skills, fluency in composition is elusive. Writing problems typically range from lower order mechanical problems, such as difficulty with handwriting and spelling, to higher order cognitive and metacognitive/executive functioning problems involving planning, goal-setting, clarity, organization, and genre concerns.

According to Hayes and Flower (Hayes & Flower, 1980), skilled writing consists of three main processes: planning, translating, and reviewing. Students with writing problems frequently have trouble with all three of these processes. Hayes and Flower proposed a recursive view of writing, positing that the three processes of planning, translating, and revision interact during the act of written composition. Berninger and Swanson (1994) modified Hayes and Flower's model of writing to explain developing writing that has not yet reached the skilled stage. They break the *translating* process into two components: *transcription*, the physical act of writing and spelling; and *text generation,* translating ideas into language.

Developmentally, the three processes proposed by Hayes and Flower (1980) do not appear at the same time. Transcription emerges in primary grade children, before the child has the cognitive development to do much, if any, global planning or revising. In the writing efforts of young children, successful translation of ideas into written words depends on coordination of the linguistic ability of text generation with the skills of orthographic coding (letter recognition), finger maneuvers, and orthographic-motor integration. As the child gets older, transcription processes need to become automatic if the person is to become a skilled writer. If the processes of transcription are not

automatic by the intermediate grades, the young writer's ability to generate text at a developmentally appropriate level will be constrained by the demands of the transcription process. The student will have to devote precious mental energy to transcription, rather than being able to concentrate on what to say and how to say it. (Berninger & Swanson, 1994)

Students with writing disabilities often show fine motor, orthographic, and/or orthographic-motor integration problems (Berninger & Hooper, 1993). These difficulties affect their handwriting fluency, and poorly automatized handwriting skills, along with poor spelling, impair compositional fluency. Thus, it takes these children longer both to generate ideas for writing and to physically write text. These researchers argue that poor handwriting is generally not the result primarily of poor motor skills, but of poor letter representation in memory. The compromised letter knowledge of children with poor handwriting, then, contributes to their difficulty with producing written text fluently. The quality of phonological and orthographic representations of letters in memory may influence the spelling acquisition process.

Berninger et al. (1997), in a surprising finding, reported that their sample of children receiving training in handwriting fluency and composition improved in word recognition in reading, a skill that was not directly taught. It would appear, then, that handwriting may be a tool for developing orthographic awareness, which, along with phonological awareness, is essential for decoding. Explicit instruction in handwriting may transfer to both word recognition in reading and to text generation in written composition. These authors suggest that, since writing is a multi-component process, training in one process may have had unanticipated beneficial effects on other literacy processes.

As children develop, they need to use higher-level cognitive skills of memory and executive function for writing. For intermediate grade children, the verbal working memory system, that function by which we hold ideas in mind long enough to use them, becomes more important. It contributes to writing both through its role in active

construction of sentences and through passive recall of information from memory during text generation.

Metacognition about writing, the ability to analyze steps in the writing process, begins to be related to writing quality in junior high school. The processes of translating, global planning, and global revision become more available developmentally for the early adolescent student (Berninger & Swanson, 1994). Junior high writers have difficulty with advance planning and global revision (Berninger, Whitaker, Feng, Swanson, & Abbott, 1996). Verbal working memory, metacognition, planning, and revision are aspects of writing that depend on executive functioning.

The "process writing" format can facilitate acquisition of cognitive and metacognitive skills in writing (Englert et al., 1995). When the audience (one's own classmates) for a written composition is physically present and able to ask questions, students rapidly improve their ability to communicate clearly. Process approaches have become extremely popular, and many studies provide evidence for student growth in such a setting (Englert et al., 1995; MacArthur et al., 1995). Process approaches provide for regular writing on meaningful subjects, frequent response from teachers and peers, and routines that support the view of writing as a process involving planning, drafting, revising, and publishing.

Feedback from peers and teachers allows the student to develop strategies for detecting and repairing communication problems with a real audience (Wong, Wong, & Blenkinsop, 1989). The social and contextual supports of the process writing instructional approach give a forum for applying the strategies being taught, as well as experience on how, why, and when to use each strategy. MacArthur et al. (1995) report success with instruction combining a process approach with explicit strategy instruction, teacher modeling, and teacher scaffolding. However, they caution that instruction in basic writing skills, such as spelling, is still needed to supplement this model.

In summary, children with dyslexia have deficiencies in a core group of phonological skills involving phonological awareness, rapid serial naming, short-term memory, and orthographic skills. These initial deficits cause early problems with letter

identification and sound-symbol correspondence. Those letter identification and sound-symbol correspondence difficulties lead to later-emerging problems with spelling, handwriting, and written language composition. Just as children with reading problems must be taught explicit sound/symbol connections, children with writing problems need explicit instruction in mechanical writing skills of letter formation and spelling (Berninger & Rutberg, 1992); Berninger et al., 1997; MacArthur et al., 1995). Students with dyslexia do not generally become proficient in these areas without specific instruction. Lack of automaticity in skills like letter recognition, spelling, and handwriting interferes with emergence of later metacognitive skills like reading comprehension and writing composition.

Chapter II: Attention and Executive Function

The connection between reading and writing, two literacy skills, is very close. It is not surprising that those who experience initial difficulty with reading are likely to have trouble later on with writing, as well. There seem to be some less obvious connections, however, between literacy skills, attention, and executive function. The frequent co-occurrence of dyslexia and attention problems in the same individuals leads to the question of whether or not some underlying cognitive process deficits give rise to both attention problems and literacy problems.

In addition, many literacy skills rely on executive functioning processes of various sorts, such as the automaticity of memory retrieval necessary for literacy, the dependence on short-term memory for decoding, the need for smooth code-switching between auditory, visual, and motoric aspects of reading and writing, and the constant planning and revising required in the framing of written communication. Indeed, Hooper et al. (Hooper, Swartz, Wakely, de Kruif, & Montgomery, 2002) point out that models of written expression have conceptualized writing as a problem-solving process where "writers attempt to produce visible, understandable, and legible language reflecting their declarative knowledge." (Page 58) Attentional and executive functioning processes are essential in reading and writing.

The idea of a "central executive" in the brain, like a "black box" within the "black box" of the brain (Barkley, 1997), is key to concepts of attentional focus, planning, short-term memory, and working memory. Baddeley (Baddeley, 1982) in his work on memory, discussed a "central executive" with two "slave systems" of the visuospatial sketchpad and the articulatory loop; that is, specialized modality systems for visual and auditory short-term memory. These two systems can operate independently from the "central executive" system, but they are limited in how much information they can process. Central resources can be mobilized to aid either of these specialized storage/processing systems when task demands become too great, and the three processes

compete for resources. In Baddeley's model, the central executive plays several roles. In addition to being a back-up extra energy system, the central executive is also responsible for tasks demanding sustained effort, like problem solving and reasoning. It also plays a regulatory role, selecting the appropriate motor schemas for task response, inhibiting some and activating others whenever competing behaviors are simultaneously elicited by environmental demands.

More recently, Goldman-Rakic (Goldman-Rakic, 2000) has questioned the idea of a central panmodal executive processor. Rather, she argued for the existence of multiple special purpose systems organized in parallel, with each segregated information processing module having its own sensory, mnemonic, motivational, and motor control features. Regardless of the specific model endorsed, short-term memory and working memory have traditionally been understood as a central part of executive functioning, and short-term and working memory facility is essential in literacy skills like decoding words and in the operation of higher-level executive functioning in planning and revising operations.

Likewise, attention and executive functioning are closely related. Psychologists have been studying attention since psychology began in the late 1800s. The selection of targets from competing inputs is considered a traditional role of attention, as Posner and Dehaene (Posner & Dehaene, 2000) explain. Gazzaniga (Gazzaniga, 2000) stated the problem succinctly: "We deal with the constant barrage of incoming sensory information by ignoring most of it." (page 155) Sohlberg and Mateer (Sohlberg & Mateer, 1989), in their work with the cognitive rehabilitation of brain injured adults, proposed that the overall concept of attention subsumes several components. Further, they conceptualized attentional processes as hierarchical, with higher order subprocesses of attention depending on underlying attentional skills.

Most basic in their hierarchy (Sohlberg & Mateer, 1989), focused attention is described as the ability to direct one's attention to a specific stimulus. Patients emerging from a coma often have difficulty even with this level of attentional functioning. Next, sustained attention comprises the vigilance and persistence necessary for maintaining

concentration during continuous, repetitive activity. Third, selective attention involves attending to target stimuli and blocking out responses to non-target stimuli. Persons who have trouble at this level are easily distracted from the appointed task by other stimuli. Fourth, alternating attention is the switching of concentration from one stimulus to another; for example, in switching rapidly from one task to another. At the top of the hierarchy is divided attention, the performance of two or more tasks at once; as when one listens to a lecture and takes notes at the same time, or holds thoughts in mind while remembering and writing letter forms and recalling spellings.

Attention is closely allied with executive function, defined by Denkla (Denkla, 1996) as the control processes that undergird the ability to orient, plan, program responses, and verify and modify one's performance. This and other more recent definitions of executive functioning take the concept far beyond Baddeley's conceptualization. Certainly, orienting is traditionally understood as the central factor in attention, while the rest of Denkla's list (plan, program responses, verify and modify performance) belongs squarely with executive function. Thomson et al. (Thomson, Kerns, Seidenstrang, Sohlberg, & Mateer, 2001) agreed that executive function and attention overlap as factors in human cognition. The higher order aspects of attention, namely alternating attention or divided attention, depend on such executive function abilities as disengaging attention and inhibiting responses, while lower-level attentional processes are not seen as being part of executive function.

The study of attention and executive function is complicated by definitional confusion. As Stuss et al. (Stuss, Shallice, Alexander, & Picton, 1996) pointed out, it has been difficult for researchers to achieve a common understanding of the executive processing idea, because the language used to describe it has been non-specific and frequently geared more to the layman's view of the concept. Further, those who have done research in the area have had difficulty designing tasks that were responsive to executive functioning without tapping many other types of cognitive skills. Barkley (Barkley, 1996) laments that others have equated executive function with metacognition, another concept that is ill-defined. "A greased pig by any other name is still a greased

pig" (page 310), he says, and understanding of the concept is just as elusive whether it is called metacognition or executive function.

In a unique perspective that places attention in a position tantamount to stimulus-response learning, Barkley (Barkley, 1996) defined attention not as a cognitive operation, but as the relationship between an organism's behavior and events in its environment. According to Barkley, attention is the relationship between the environmental event and the person's response to it. It involves relationships that occur within the immediate temporal context; there is no delay in the response. The behavioral response generates an environmental consequence for the person. Attention involves behavior directed at the moment.

Barkley (Barkley, 1996) goes on to say that executive function is a special case of attention. Executive function involves the inhibition and delay of the otherwise prepotent response (an already conditioned idea or process, or a response to a stimulus that is very compelling) of the individual to the environmental event. Thus, behavior is organized and desires are regulated in the service of a future goal through executive function. Barkley discussed Fuster's view of three components of executive function: a) working memory, a function that is retrospective in time; b) anticipatory set, which is prospective in time; and c) interference control that inhibits the disruption of progress toward a chosen goal. In Barkley's view of attention-deficit/hyperactivity disorder (Barkley, 1997), it is these three executive function operations that are disrupted, not attention itself.

Barkley (1997) argued that there are two forms of sustained attention: 1) context-dependent, contingency-shaped, externally controlled attention; and 2) rule-governed, goal-directed, and internally guided and motivated attention (elsewhere defined by him as executive function). It is the second type of behavior that is impaired by ADHD. This is why the apparent attention level of those with ADHD fluctuates so much as a function of the task. So long as the environment provides the ongoing reinforcement needed to sustain responding, those with ADHD will have no trouble. When minimal or no reinforcement is available and when behavior must be created, organized, and self-

sustained toward a future goal, those with ADHD will be found to be impersistent or "inattentive." In particular, persons with attention-deficit/hyperactivity disorder will have trouble resisting what Barkley calls a prepotent stimulus. Thus, executive function is a special case of attention: It is a response to the environment that requires planning for the future and inhibition of responses.

Stuss and colleagues (Stuss et al., 1996), in contrast to Barkley's characterization, described executive function as including the control of attention, instead of describing attention as including executive function. Executive functioning, in their view, involves sustaining, concentrating, sharing, suppressing, switching, preparing and setting attention. Stuss et al. (1996) also discuss an earlier model of executive function that is quite comparable to Barkley's views, the Supervisory Attentional System (SAS) model of Norman and Shallice. In the SAS model, executive functioning comes into play for non-routine activities. Routine processes are controlled by automatic schemata that are responsible for the control of overlearned skills. A "contention scheduling" function of inhibitory mechanisms that control competition between schemata can also operate in routine situations. But when the behavior required is not routine, as when there is no known solution, when specific selection among schemata is necessary, or when inappropriate schemata must be inhibited, then the Supervisory Attention System must come into play. The idea of automatic schemata may have a bearing on dyslexia, since difficulty with automaticity in naming and in letter formation is a consistent accompaniment to dyslexic problems.

In summary, there is tremendous overlap among attention, memory, and executive functioning. Morris (Morris, 1996) even questions whether the three are actually different constructs, or whether they are three labels for the same cognitive phenomenon. Regardless of definitions and differences among models, memory, attentional, and executive processes are important in dyslexia and dysgraphia, as they are in all learning. In dyslexia and dysgraphia specifically, lower-level executive processes of automatic word and name recall, automaticity of written letter forms, and short-term memory storage capacity for sound analysis are some of the underlying cognitive processes that

affect literacy. At the other extreme, recursive planning in writing and integration of meaning for reading comprehension represent higher-level executive functioning activities that are also crucial for literacy. A wide range of executive function skills are necessary for proficient reading and writing.

Remediation for Attention Processes

While instructional methods for remediation of reading and writing problems abound, only a few researchers have attempted to offer direct remediation for attention or executive function problems. School and home programs have usually focused on behavioral reward systems and cognitive behavioral methods for children with ADHD, with variable success (Semrud-Clikeman et al., 1999). However, people with traumatic brain injuries have been shown to benefit from cognitive rehabilitation of attention, memory, and other executive functioning processes (Sohlberg & Mateer, 1989).

A few researchers have reported success in using adult cognitive rehabilitation training methods for the brain injured with children who have ADHD (Semrud-Clikeman et al., 1999). Thomson et al. (Kerns, Eso, & Thomson, 1999; Thomson et al., 2001), adapted adult attention process training materials for children in the *Pay Attention!* training program. Following these lessons offering guided practice in response to auditory directions and visual vigilance, ADHD children demonstrated increased auditory and visual attention skills. They also showed an improvement in efficiency when doing math calculation worksheets. The success of this research in improving math calculation in children with ADHD raises the question of whether literacy skills might also improve if children's auditory and visual attention processes could be improved.

Similarly, a line of research based on the Planning, Attention, Simultaneous, and Sequential processing model of cognition (Carlson & Das, 1997; Naglieri & Gottling, 1997; Naglieri & Johnson, 2000) has shown that children who are low in planning skills benefit from interventions designed to help them develop better planning skills. This improvement in planning was reflected in improved mathematics and reading achievement among the study participants.

Carlson and Das (Carlson & Das, 1997) reported success in raising reading scores in Chapter One students who used their attention training program. In their attempt to train attention processes in the context of literacy, they offered what they called "bridge" activities alternating with "global" attention tasks. For example, if the global task was to look at parts of an animal and then explain what the animal was and how they knew, the bridge task might be to look at word parts and fit them together to make a word.

Findings from these attention training studies are provocative, and the impact of various types of attention training on academic skills is a promising area for further study. For this study, we examined one type of attention training and its impact on writing skills.

Chapter III: Dyslexia and Dysgraphia, Attention, and Executive Function

ADHD, as explained above, is commonly described as being an executive function deficiency. Literacy skills, also, are rooted in part in executive functioning processes, in addition to their phonological and orthographic bases. Coordination of attention and other executive processes is an essential factor in literacy. Frequently, children are diagnosed with both dyslexia and ADHD; thus, many researchers have wondered how attention/executive function disorders and literacy disorders are related. Children with ADHD, which is among the most common of behavior disorders (Goodyear & Hynd, 1992; Semrud Clikeman et al., 1999), exhibit problems with inattention, impulsivity/inhibition, and over-activity, in various combinations, as a result of their problems with executive control. According to Moores and Andrade (Moores & Andrade, 2000), around 15 per cent of children with dyslexia are estimated to have concomitant attention deficit hyperactivity disorder (ADHD), and around 36 per cent of children with ADHD are estimated to have dyslexia.

As Semrud-Clikeman's group and others found (Mayes et al., 2000; Semrud Clikeman et al., 1999), even those children who have ADHD without dyslexia or any other diagnosable learning disorder frequently have trouble with work production in school. Thus, they often have school functioning problems, even if they do not have an intrinsic learning disability. Similarly, Moores and Andrade and the Mayes group (Mayes et al., 2000; Moores & Andrade, 2000) found that children with dyslexia generally have some degree of problems with attention, even if they do not have attention problems severe enough to be diagnosed as ADHD. These co-occurrences raise the question of whether attention problems and dyslexia may have some common roots.

In contrast to the idea that dyslexia and attention problems may overlap, Pennington and colleagues (Pennington, Groisser, & Welsh, 1993), did find specific group cognitive differences when they investigated the relationship between ADHD and reading disability. Children with ADHD but not reading disability showed normal

phonological skills (measured by reading nonsense words and by a "Pig-Latin" test), but were significantly worse than controls on executive functioning tasks (involving planning, rule following, flexibility in switching tasks, and sustained visual vigilance). Students with reading disability but not ADHD displayed the opposite pattern. A comorbid group that met criteria for both reading disability (RD) and ADHD was found to have the same cognitive skill pattern as the RD-only group. The researchers concluded that for this sample, the presence of greater environmental stress factors for the RD + ADHD group indicated that their ADHD symptoms were not caused by internal executive functioning problems. Rather, their difficult behaviors seemed to be a response to the stress of early learning problems and other environmental factors. Therefore, reading problems were judged to arise from phonological problems, and the executive problems underlying ADHD were judged to represent a separate phenomenon.

Narhi and Ahonen (Narhi & Ahonen, 1995) attempted to replicate the Pennington et al. study using criteria that did not depend on reading skill or oral language. They used tests of Rapid Automatized Naming (RAN) and Rapid Alternating Stimulus (RAS) naming (Wolf, 1986) as their measures of underlying cognitive deficits in children with reading problems, rather than non-word reading and Pig-Latin. Such rapid serial naming tasks are thought to reflect inadequacies in the precise timing mechanisms necessary for the development of orthographic codes and for their integration with phonological codes (Bowers, Steffy, & Tate, 1988). Narhi and Ahonen hypothesized that deficient RAN performance would not be associated with attentional difficulties, but with reading disorder; and that deficiencies in executive function would be found in the ADHD group, but not the RD group. Results supported the connection between averaged RAN/RAS scores and reading disability, but in a confusing finding, no connection was found between ADHD and measures of executive functioning.

Narhi and Ahonen (1995) used different measures of executive functioning than the Pennington group (1993) had. In addition, they defended the lack of support for their executive functioning hypothesis by arguing that since ADHD is a self-regulatory deficit, children's responses will be variable depending on the demands of each test setting and

the reinforcement contingencies offered. Alternatively, ADHD may be a heterogeneous disorder caused by executive function problems as well as other factors. They lamented the difficulty of testing executive functions: "Executive functions are controlling functions, testing of which requires the use of material also sensitive to more basic functions (e.g., linguistic or visuospatial abilities)." (Page 346) Undaunted by the mixed results they obtained, they concluded that problems in reading acquisition faced by children with comorbid ADHD and reading disability are not the result of attentional problems but of reading disorder. They seemed to rely on the weight of other studies in making that conclusion, rather than on their own results.

In a more recent carefully grounded study, Roodenrys et al. (Roodenrys, Koloski, & Grainger, 2001) investigated the nature of executive processing in working memory as a core deficit in ADHD, as distinct from deficits associated with reading disability. They referred back to Baddeley's conception of the central executive (Baddeley, 1982) and to the Norman and Shallice Supervisory Attentional System (Bayliss & Roodenrys, 2000) in order to clarify their view of executive function. They hypothesized that children with comorbid reading disability and ADHD would demonstrate deficits in functioning of both the central executive and of the phonological short-term memory system. Children with reading disability only, on the other hand, were expected to show problems with phonological short-term memory, but not with executive function tests.

As expected, children with reading disability and children with ADHD + RD performed worse than controls on phonological memory tasks (auditory memory for digits and for long and short words). Children with ADHD + RD performed worse than RD-only children and controls on tasks involving a combination of phonological loop and central executive functioning. (For example, the student hears a series of numbers and is to give the sum of the last two numbers each time a new number is given. The child must hold the old and new numbers in mind and perform mental arithmetic on them.) The ADHD + RD group also did worse on a random number generation task, thought to involve supervisory executive function alone without phonological loop involvement.

Thus, the work of Roodenrys et al. (Roodenrys et al., 2001) helps to clarify the specific types of deficits involved in reading disability and ADHD. Like Pennington et al. (Pennington et al., 1993) and Narhi & Ahonen (Narhi & Ahonen, 1995), the Roodenrys group agreed that in spite of frequent comorbidity, reading disability and ADHD represent independent disorders. Reading disability arises from a disorder in phonological processes, and ADHD results from difficulty with executive functioning. The Roodenrys et al. study made operational definitions of phonological loop functioning and central executive functioning very clear. Unlike Pennington et al., Roodenrys and colleagues found a comorbid ADHD + RD group that did include the presence of both disorders, independent of environmental considerations. Other researchers have also found true comorbid groups.

Mayes et al. (Mayes et al., 2000), for example, found groups that had both learning disability and attention-deficit/hyperactivity disorder in their analysis of data from children referred to a university diagnostic clinic. In contrast to findings quoted above, these researchers found that children with both ADHD and learning disabilities (they included math and writing disabilities in their study as well as reading disabilities) scored worse on academic tests compared to IQ scores than did students with learning disabilities alone. Children with both ADHD and LD had the worst academic skills, followed by children with LD but no ADHD. Children with ADHD but no LD came next in the order, demonstrating worse academic skills than children with neither ADHD nor LD. In an unusual and important finding, children with ADHD + LD also did worst on measures of attention. The ADHD + LD group did worst on the Wechsler Freedom from Distractibility index and on the Gordon Diagnostic System, a continuous performance task system designed to measure attention. The ADHD-only group was next worst, then the LD group, then children with neither disorder.

Mayes et al. (2000) concluded that attention and learning problems each occur on a continuum, and that they frequently occur together. It is important to note here the presence of an ADHD + LD group that has more significant impairments than groups with either disorder alone on both learning and attention, when attention was measured

by continuous vigilance, rapid clerical operations, mental arithmetic, and short-term auditory memory. Further, groups with ADHD alone and LD alone still each showed some subclinical impairment in the undiagnosed area of functioning: LD students had some attentional problems, and ADHD students had some academic skill problems.

Much confusion, then, remains about the connection between literacy and attention. Moores and Andrade (Moores & Andrade, 2000) attempted to study attentional problems in children with dyslexia but without ADHD. In an inventive set of experiments, they concluded they had actually tapped a deficit in automatic symbol recognition in dyslexia rather than a deficit in sustained attention. Initially, they asked normal control participants and teenagers with dyslexia to perform the Sustained Attention to Response Task, making a motor response to each numeral presented visually except for a target numeral, to which they were to make no response. As expected, students with dyslexia did worse than typical controls. When the task was repeated with novel visual stimuli, "squiggles," there was no significant difference between controls and dyslexic participants, however. Researchers concluded that the advantage shown by the control group was a function of their more rapid automatic recognition of the overlearned visual symbols. Dyslexic groups were slower and less accurate not because of a sustained attention problem, but because of a deficit in automatic visual symbol recognition.

The role of attention in dyslexia and dysgraphia, then, remains unclear, in spite of provocative findings. Many researchers (Mayes et al., 2000; Roodenrys et al., 2001) and clinicians have found groups of children that truly have attention-deficit/hyperactivity disorder along with dyslexia, although some have not (Pennington et al., 1993). Some research has indicated that those with both disorders do worse academically than groups with only one of the disorders. In addition, attention problems have been found for students with learning disabilities, and learning difficulties have been found in those with ADHD (Mayes et al., 2000; Semrud-Clikeman et al., 1999). Further, it has been difficult to separate the study of attention problems from other factors in literacy, such as poor automatization of visual symbol recognition in persons with dyslexia (Moores &

Andrade, 2000). On the other hand, it may be that attention is a factor in automatization, a crucial literacy skill. The relationships between the two cognitive functions of attention and automatization remain unexplored, as well.

Attempts to investigate the role of attention in dyslexia have been plagued with definitional and semantic problems and with lack of clear theoretical understanding of the attention, memory, and executive function constructs involved. Definitions of executive function are various: Executive function has been described as an overall coordinating device that is responsible for planning and response inhibition, and for allocation of attention and mental resources (Denkla, 1996; Stuss et al., 1996). In Barkley's view (Barkley, 1996), executive function involves ordering responses in time. Roodenrys et al. (Roodenrys et al., 2001) agreed with Barkley's view of the central executive as the great inhibitor. That is, in order for working memory skills to develop in the first place, prepotent responses must be inhibited. In Baddeley's scheme (Baddeley, 1982), executive function consists mainly of working memory, with the central executive and its two modality slave systems. In Bayliss and Roodenrys' discussion (Bayliss & Roodenrys, 2000) of the Supervisory Attention System, the central executive comes into play when processes are not automatic or when novel decision-making is required. When information becomes automatic, central executive capacity is not needed to guide it.

In the case of writing, it is clearer that executive function processes, in spite of their various definitions, are a key part of the recursive on-line and global revisions that are an essential part of composition. The coordination of motor, visual, memory, and automaticity processes in physically writing letters and spelling words, plus the processes of generating text to convey a meaning, evaluating what one has written in terms of the audience, integration of information one wishes to present, clarity, and a host of other factors is very clearly reliant on executive function (Wong et al., 1989), and executive function is commonly viewed as overlapping with attention and memory (Barkley, 1996; Kerns et al., 1999).

Chapter IV: Rationale for Dissertation

What is the effect of improved attention on literacy? Processes of attention, memory, and mental integration of previously known information are essential in reading and writing. The *Pay Attention!* materials (Thomson et al., 2001), as well as the PASS Remedial Program training materials (Carlson & Das, 1997; Naglieri & Gottling, 1997; Naglieri & Johnson, 2000) mentioned earlier, have been demonstrated not only to improve performance on tasks designed to measure attention, but also on math calculation efficiency (Kerns et al., 1999; Naglieri & Gottling, 1997; Naglieri & Johnson, 2000) and reading (Carlson & Das, 1997). Effects of the Thomson et al. *Pay Attention!* training seemed to generalize to non-trained attention tasks as well as to the math efficiency measure. Likewise, research by Das, Naglieri, Carlson, and their colleagues with the PASS Remedial Program found that students who received tutoring designed to raise their planfulness also improved their reading and math scores.

Thomson et al. (Thomson, Chenault, Abbott, Raskind, & Berninger, 2004), in a structural equation modeling study, found significant direct paths from attention to orthographic and rapid naming factors. The path from attention to the phonological factor was not significant. These findings suggested that orthographic awareness places greater demands on the attentional system than does phonological awareness. Thus, the auditory aspects of language may be less vulnerable to disruption from attentional problems than are visual language aspects, at least for dyslexics. Writing, with its demand for production of visual language symbols, may place particularly heavy reliance on the attentional system.

The hypothesis tested in this study was, therefore, that children who received attention process training (*Pay Attention!* training), followed by remedial written language instruction with attention bridges, would show more positive gains on the subsequent writing composition instruction than children in the control treatment that did not train attention (Control Group – *Read Naturally* reading fluency program). During

the second phase of the study, when writing instruction was introduced, the attention-trained group was expected to improve more than the control group students on relevant processes of writing. Following the attention training or reading fluency training, both groups received identical remedial writing instruction that had attention "bridging" activities to direct attention to written words and phonology. The prior attention training was expected to have added value over and beyond the attention cues embedded in the writing curriculum, causing the attention treatment group to make greater gains in written language skill.

The production, planning, reviewing, and revising processes of writing involve executive function. Since attention and executive function are so closely allied, an intervention that improves attention could be expected to facilitate the executive function-dependent aspects of the writing process, as well. Other researchers (Carlson & Das, 1997; Kerns et al., 1999; Naglieri & Gottling, 1997; Naglieri & Johnson, 2000) have found that training in cognitive processes of attention and planning assisted learning efficiency for academic tasks. Thus, it was reasonable to propose that specific training with the *Pay Attention!* materials would give the attention training group an advantage in writing composition skills beyond the control group, which received reading fluency training.

To summarize, it was anticipated that students receiving the attention process training would make significantly more progress in writing skills than their reading fluency control group counterparts, because the attention process training would improve their executive function skills, making them better able to plan, review, and revise their written compositions, as well as paying better attention to word forms. Likewise, it was anticipated that students in the *Pay Attention!* group would show reliable improvement on tests of attentional skills.

Students in the Control Group, which used the *Read Naturally* materials, were expected to show significantly more improvement in their reading fluency than students using the *Pay Attention!* materials. The *Read Naturally* program is designed to develop reading fluency by repetitive reading of written text, initially while reading along with a

teacher so that the student has a model of fluent reading. Such fluency training was expected to increase reading fluency, but it would be unlikely to have a positive effect on attention or to transfer to writing.

A related question was at what point students who had attention process training would demonstrate increased writing skill. Would attention process training alone bring improvement in writing skills, or would specific writing instruction be needed? The hypothesis guiding this study was that attention process training would act as a bridge to better writing skills, but that attention process training alone would not improve writing. Attention process training was expected to facilitate improvement in writing skills following specific written language instruction for those who had previously had attention process training.

Chapter V: Method

Subjects

Participants were 20 monolingual, English-speaking children with reading or writing disabilities who attended grades 4, 5, and 6 at a parochial school that offers programs for the remediation of learning disabilities. Inclusion criteria included performance at least one standard deviation below WISC-III Verbal Comprehension Index scores in one or more of the following: text reading accuracy or reading rate (Gray Oral Reading Test), spelling (Wide Range Achievement Test-3 or Wechsler Individual Achievement Test, Second Edition), handwriting (UW Alphabet Writing Task), or writing composition (Wechsler Individual Achievement Test-2, Written Expression subtest). An exception was made in one case: A student was included whose WISC-III Verbal Comprehension Index was ten points lower than her Written Expression score, and whose GORT reading and accuracy scores were more than one standard deviation below her Written Expression score. Children with diagnosed neurological or psychiatric disorders or Verbal Comprehension Indices below 88 were excluded, but children with comorbid attention-deficit/hyperactivity disorder were included.

The sample consisted of four sixth-graders (one girl), six fifth-graders (three girls), and ten fourth-graders (four girls). The 12 boys and eight girls had a mean age of 128 months (S.D. 10.5) and a mean WISC-III Verbal Comprehension Index of 106.67 (S.D. 11.51, range 88 - 127).

The 20 participants were randomly assigned to one of two groups, with ten in the attention process training experimental group (Attention Group) and ten in the reading fluency control group (Reading Fluency Group). Groups were balanced as to grade and gender. Groups did not differ significantly on any of the academic or intellectual measures given to determine inclusion in the study, or on any of the other measures administered at pre-test.

This instructional study was conducted as part of a broader research program that qualifies as exempt for purposes of Human Subjects Review. Nevertheless, informed consent from parents and assent from children was obtained.

Experimental Design

This study had two phases. In the first phase, participants completed ten 25-minute individual training sessions in either attention process training or reading fluency training, according to their random group assignments. In the second phase, participants completed ten 55-minute group writing instruction sessions. The group writing activities were designed to draw students' attention to the planning, reviewing, and revising processes of writing. Attention bridge activities were intended to draw their attention to phonemes, orthographic units, and morphemes in words; and to sustain their attentional focus while they listened to group instruction and then produced written compositions. Both individual and group instructional sessions were held at the school during the regular school day. Most students participated during the portion of the school day that would ordinarily have been devoted to literacy instruction.

During the first phase (individual instruction in reading fluency or attention processes), participants were instructed individually by one of three trained masters-level graduate student teaching assistants or by the author. Each trainer taught an equal number of students from both treatment groups, so that any differential effect from individual trainers was evenly distributed across both treatments. Treatment fidelity was monitored in two ways: (1) At the end of each session, trainers completed a 10-point treatment checklist that monitored compliance with treatment procedures, and (2) on a biweekly basis, a supervisor observed training sessions and completed the same ten point checklist for each trainer. Trainers and observers rated compliance with the checklist at 94.71% and 96.04%, respectively.

During the second phase, group writing composition instruction with attention bridges, the author began each lesson by instructing the group as a whole, explaining the nature of the day's writing assignment. The same trainers who had worked with the

students individually in phase one continued to coach the students within the context of the group writing instruction, providing a one-to-four adult-student ratio. Coaching consisted of monitoring and reinforcing students' participation during the "attention to words" attention bridge activities and while they worked on their compositions. Tutors helped students to monitor themselves and reinforced them for good attention. They then monitored and consulted with students throughout the writing processes of drafting and revising.

Attention, reading, and written expression skills were evaluated at pretest, midtest (following attention or reading fluency training), and posttest (following composition training). Some skills were measured at pretest and posttest only, because of time constraints. The following chart outlines the structure of the testing and instructional portions of the study.

<table>
<tr><th></th><th colspan="2">Phase 1</th><th></th><th colspan="2">Phase 2</th><th></th></tr>
<tr><td rowspan="2">Pretest</td><td>Attention Training Group: ten 25-minute individual training sessions</td><td rowspan="2">Midtest</td><td rowspan="2">Attention Training Group and Reading Fluency Control Group combined for ten 55-minute group composition lessons with attention bridges, plus coaching support</td><td rowspan="2">Posttest</td></tr>
<tr><td>Reading Fluency Control Group: ten 25-minute individual training sessions</td></tr>
</table>

Figure 1

Training Procedures: Phase One—Individual Attention or Reading Training

The experimental group was instructed with the *Pay Attention!* program for attention process training, and the control group received instruction on the *Read Naturally* program for reading fluency. Both are published educational programs that are

widely available. Both the *Pay Attention!* and the *Read Naturally* training programs provide for students to chart their progress as they move through the programs, and both set proficiency criteria that students must meet before they move on to the next level of the program. Data sheets were maintained and charted with the children in both groups as a motivational and progress tracking strategy. For both programs, task difficulty increased when the child reached a criterion level for specific tasks. For example, for a task in the *Pay Attention* program, the child moved to a more difficult level of attention activities following a 20% gain in speed while maintaining 90% accuracy. Likewise, the *Read Naturally* program moved to a higher level of reading difficulty as the student attained a reading speed criterion.

Pay Attention! Program: The ten children in the experimental treatment group participated in attention process training with the *Pay Attention!* program (Thomson et al., 2001). This set of materials was "designed to remediate difficulties with sustained, selective, alternating, and divided auditory and visual attention skills" (manual, page 1). It was originally developed to remediate cognitive skills impaired through head injury. The activities are modeled on similar cognitive rehabilitation activities for adults as developed by Sohlberg and Mateer (Sohlberg & Mateer, 1989). The premise of this type of training goes back to Luria's theory (Luria, 1980) that direct retraining of cognitive functions can result in reorganization of impaired function.

Through the *Pay Attention!* program, the children practiced attentional/executive functions using the following cognitive operations: understanding and retention of auditory information, understanding and retention of auditory instructions, speed of response, categorization of visual and auditory materials by verbal labels, visual search, motor response to visual and auditory targets, evaluating more than one category at once, switching tasks flexibly, and maintaining focus on target stimuli in spite of auditory and visual distracters. They received corrective feedback for errors, and they charted their progress to track growth in accuracy and speed.

Pay Attention! activities, which involve responding to stimulus features and relations among stimuli, become progressively more difficult as the children advance through the materials. The visually based materials use sets of cards with drawings of people, and plasticized two-dimensional "houses" for the people on the cards to be sorted into families. The auditory materials are spoken words presented on tape, and taped recordings of distracting sounds. After the children reach basic mastery of a task, they are asked to respond faster. Background noise or distracting visual overlays are imposed on the tasks in order to train selective attention. To train alternating attention, the children start on one sort of task, then switch to another type of response on the trainer's cue. For divided attention, they do two of the tasks at once.

For example, initially for sustained attention activities, children are asked to sort the picture cards according to what family the pictured person is a member of, as designated by the background color of the cards. Individuals pictured on the cards are differentiated by age, gender, and other characteristics like hair color or wearing apparel. Each family also has a large plasticized two-dimensional "house" showing the layout of rooms with various objects pictured there. The house serves as a location to sort the cards or as a source of visual details to be searched for. More difficult sustained attention tasks include more than one thing to look for: "As quickly as you can, sort the cards into stacks of boys versus girls, and put the cards with someone wearing a hat upside down." For auditory tasks, the student is initially instructed to press a buzzer when a single target word is heard. More difficult tasks involve instructions like "Buzz when you hear the name of something you might see in the sky," or "Buzz when you hear the word 'red' followed by something that is red."

The *Pay Attention* program is based on the idea that sustained, selective, alternating, and divided attention skills are hierarchical, and that lower-level attention skills must be mastered as the foundation for the more difficult types of attention. It is recommended that each lesson include several activities, but that those activities be drawn from only one or two types of attention. The following outline lists the sorts of tasks that teach the different types of attention:

I. Sustained Attention

A. Visual

1. Card sort—child sorts cards into categories

2. House search—child finds and marks designated objects pictured in houses

3. Cards and buzzer--Examiner shows student the cards one by one, and the student buzzes when he/she sees the target card

B. Auditory

CD with auditory stimuli and buzzer—child buzzes when certain words or word patterns are heard

II. Selective Attention

A. Visual I

House search with distracting transparencies laid over the house

B. Visual II

House search with auditory distraction played on the CD while the student performs the house search

C. Auditory

CD with similar tasks as before, but with background noise recorded along with the stimuli

III. Alternating Attention

A. Visual I

House search, with the child initially searching for some category of objects, then switching to searching for another category of objects on the examiner's signal.

B. Visual II

Card sort, initially by one criterion, then switching criteria on the examiner's signal

C. Auditory

CD and buzzer, initially buzzing for one stimulus type, then changing to buzzing for another stimulus on the examiner's signal

IV. Divided Attention

A. Visual

Card sort looking for two things at once

B. Auditory/Visual

Search the house for something while listening to the CD and buzzing when the target stimulus is heard

For each type of task listed above, there are about 15 different items to choose from in planning lessons. In addition, after each item is mastered, the student can be asked to perform the same task faster. Lesson plans alternate between visual and auditory activities in order to preserve interest in the tasks. A sample lesson plan for the first lesson follows:

Lesson 1—Sustained Attention

- Introduce the visual materials
- Four card sorts—by family membership, hair color, whether the character is wearing a hat, and gender
- Introduce the CD and buzzer
- Auditory track 1—Buzz when you hear the word "red," slow, then fast
- Auditory track 2—Buzz when you hear the word "dog," slow, then fast
- Card sorts—put family members on the house belonging to their family
- Auditory track 3—Buzz when you hear either "red" or "yellow," slow, then fast
- Auditory track 4—Buzz when you hear either "dog" or "horse," slow, then fast
- Card sort—sort the cards into stacks of people with dark hair who wear glasses, and everyone else
- Card sort—sort the cards into stacks of people who are blond or have a hat, and everyone else

Read Naturally Program (1997): Children assigned to the control group received individual reading fluency instruction with the *Read Naturally* program. *Read Naturally* uses teacher modeling, repeated reading, and progress monitoring to increase fluency in reading. The student chooses a story from booklets of high interest stories that are at an appropriate skill level for that student. Booklets are available at graded levels of difficulty. The student tells the teacher what the topic or story title suggests and discusses any prior knowledge he or she has about the subject. Next, the student reads the selected story aloud, while the teacher underlines missed or unknown words. Students mark a graph showing how many words they read in one minute on this first "cold" reading. Student and teacher then read the passage aloud together. Through this choral reading, the teacher is able to model fluent reading for the student and encourage the student to read at a faster rate with better expression. Students then practice individually and time themselves on reading the story aloud, building up speed until the target goal is met. They read for the teacher again and chart their improved time for the "hot" reading. In order to progress to another story, students must reach an individually set goal for the number of words per minute, read with good expression, and make fewer than three errors. If the goal is not met, the student and teacher can read together again, and the student can do additional individual practice. Students graph the number of words they read correctly per minute when the target goal was met, and compare that to the number of words they read correctly per minute the first time they tried the story, noting their progress.

Teachers monitor progress and adjust time goals so that students need to read the stories several times in order to reach the criterion. After a student completes 12 stories in a level, the teacher and the student decide together whether the student should continue in the same reading difficulty level with the same time goal, adjust the reading rate goal, or move to more difficult reading material.

Through their work on the *Read Naturally* program, students practiced reading with speed and expression appropriate for their reading skill level. They did not practice

the categorization, search, switch activity, and response operations trained by the *Pay Attention!* program. Both programs aimed to develop speed of responding and used graphs to chart progress.

Phase Two—Writing Lessons with Attention "Bridges"

Following the completion of the ten individual attention training or reading fluency lessons, all 20 participants were combined into larger groups to participate in eight written composition lessons, spread over ten sessions. Writing composition activities were taken from a process writing intervention developed by Berninger (for overview, see Berninger & Hidi, in press) for students in grades 4 to 9, and parts of which are available in lesson plans for teachers (Berninger & Abbott, 2003). The composition activities included planning and revising strategies, as well as the opportunity for feedback and discussion from peers and tutors. In addition to the writing composition lessons, each class session incorporated attention "bridge" activities designed to train attention processes in the context of written and spoken language.

As an initial introduction and motivational set, students were told that writing involves many different types of skills; therefore, it requires attention to many different things at once. Thus, they would be learning ways to pay attention to words and to writing that they might not have thought of before. Attention bridging activities ("Word Detectives" and "Careful Listening") were designed for this study and used for the first time. Progress monitoring charts were introduced to show students the types of attention bridging activities they could get credit for within each lesson. These attention bridges and the following types of instructional methods were included in each lesson:

Word Detectives: Each lesson began with warm-up "Word Detective" games that directed the students' attention to orthographic, phonological, or morphological features of single words. Students listened for target sounds, putting out a plastic chip when they heard a word that met the target phonological or morphological criteria; sorted word cards into piles of words that met and did not meet phonological, orthographic, or morphologic criteria; or scanned a sheet of words and circled the ones that met

phonological, orthographic, or morphological criteria. These attention "detective" activities trained sustained attention in a word/subword analysis context. More complex activities that required the presence of two letters, sounds, or morphemes with different meanings in a word trained both alternating and sustained attention. (See specific examples of activities in Appendix B)

For example, for phonology Word Detective activities, students completed listening, card sort, and text scan activities over the course of the ten lessons. In one such listening activity, students were asked to listen for words starting with the phoneme /b/ as the teacher read a list of words. When they heard a word starting with /b/, they would slide a plastic chip forward and keep track of the number of words they heard that met criteria (beautiful=Yes, purple=No). In one card sort phoneme activity, students sorted word cards, looking for words with the phoneme /j/ anywhere in the word (danger=yes, jeep=yes, goat=no). In one phoneme word scan, students were given a page with words written on it and circled the words with the sound /oy/ anywhere in the word (boil=yes, bowl=no). Students did similar types of card sort or word scan activities for orthographic criteria. For example, they sorted cards or circled words that ended with "rd" (card=yes, cared=no). Morphological Word Detective activities were listening, card sort, and word scan. For example, one morphological listening activity had the students slide a plastic chip forward when they heard a word with "ed" pronounced /t/ (hopped=yes, rat=no). Morphological card sorts and word scans targeted prefixes and suffixes. For example, cards were sorted into three stacks, one with suffix "er" meaning a person who does something, "er" used as a comparison, or "er" present but not a suffix (1=renter, 2=bigger, 3=under).

Careful Listening: Following the Word Detective warm-up, attention activities were geared to keeping students focused during writing. First, the teacher giving the day's group instruction would slip in an "Instruction for Careful Listeners," like "touch your nose," "pat the top of your head," "scratch your knee," and similar statements. Those who heard and performed the activity quickly could give themselves a point on their personal point sheet. Since the activities were overt physical movements, students

who reacted first helped to draw their classmates' attention back to the words being said, as well as getting a point on their point sheets. This activity trained sustained, selective, divided, and alternating attention, and was an entertaining way to build rapport and make lessons enjoyable.

Maintaining on-task writing behavior: During the writing time, a timer was set to go off, and students were to rate themselves as to whether or not they were focused on writing when the bell rang. This metacognitive self-rating activity also trained selective, divided, and alternating attention. In addition, teacher helpers offered reinforcement to train sustained attention to focused writing by walking around the room and putting stars on students' point sheets for those who were actively engaged in writing.

Social Context: With the high adult/student ratio of one to four provided, there was ample opportunity for discussion of students' writing. In a "process writing" structure, students generated ideas for what to write in their compositions through discussions with peers and teachers. They read their compositions to each other and to teachers for feedback as to clarity of communication and ideas for what to add. This social interaction around writing also helped to focus and sustain attention to writing.

Interactive Instruction: Following the initial large-group instructions, tutors worked individually with the students assigned to them. They modeled and scaffolded planning processes, providing feedback to students as they drafted, reviewed, and revised their written compositions. Students and tutors thus participated in an interpersonal dialogue about writing. In addition, tutors extended the interpersonal dialogue among the students, working with them in pairs or small groups and providing an opportunity for supportive comments and questions about each other's work. Typically, after a student read his or her work aloud, listeners were asked to tell one thing they liked about what they had heard, and suggest one thing that would make it better.

Instructional Tools: Use of "graphic organizers" with visual reminders to structure compositions helped students focus on writing goals and organize their ideas. Use of personal attention point sheets in each student's folder helped them keep the idea

of paying attention paramount. After they had drafted their compositions, students had an opportunity to revise and edit with computers for word processing.

Organization of Lessons: A typical lesson was organized as follows: After ten minutes of attention/writing "word detective" bridge activities (usually two activities), for the next 20 minutes students were introduced to the topic for the composition lesson, engaged in planning activities, and wrote a rough draft. During the last 20 minutes of the session, they used computers to type and revise their composition from the previous lesson or continued to revise the current composition at their desk. At the end of each lesson, students were encouraged to share their writing with a partner or with a small group. Students gave each other feedback by first telling one thing they liked about the writing sample, then one thing that could be changed to make it better.

Students wrote on the following eight topics (see appendix for more complete lesson plans):

Lesson 1 "Which is Better, a Computer or a Pencil?" Students used a compare and contrast graphic organizer, and description and difference statements were incorporated in their explanations.

Lesson 2 "Should Children be Able to Watch TV Whenever They Want and Choose the Shows They Watch?" This invites a persuasive essay. Students used a "taking sides/boxing match" graphic organizer.

Lesson 3 "If I Ran the School" Students learned the "Plan, Write, Review, and Revise" strategy.

Lessons 4 and 5 Polish and catch up.

Lessons 6, 7, and 8 Autobiography—During lesson 6, students were asked to write about their lives from before they started school up until the present. For lesson 7, they predicted their future. For lesson 8, they integrated the two, revising and polishing, and had a chance to share their compositions with each other. Students used autobiography organizer sheets to develop and organize ideas.

Lessons 9 and 10 Students chose their best composition to share with the group, then revised and polished it. On the tenth meeting, students celebrated their work together with refreshments, a small gift, and reading aloud of student compositions.

Assessments given at Pretest, Midtest, and Posttest

Tests of handwriting accuracy and speed, writing composition skill, speed of sentence composition, spelling, reading speed and accuracy, attention and executive functioning, and oral verbal fluency were given at three points in the study: before the study began, at the midpoint following training in reading fluency or attention processes, and at the conclusion of the study, following instruction in written language skills. (Due to time limitations, some measures were administered at pretest and posttest only.) This testing/instruction/testing/instruction/testing format allowed for an examination of whether attention training would transfer directly to writing achievement, or whether writing instruction would be needed for writing improvement to occur. Monitoring skills before the study began, after reading fluency or attention process training, and after written language instruction occurred, helped to show whether attention training caused a direct skill effect alone (at midtest), or whether attention training acted as a bridge to better writing once writing instruction was added (at posttest).

Assessments given at pretest, midtest, and posttest:

Process Assessment of the Learner (PAL), (Berninger, 2001)

Alphabet Writing Task: The student writes the entire alphabet as quickly as possible and is scored on the number of letters written correctly in 15 seconds.

Wechsler Individual Achievement Test, Second Edition (WIAT-2) (Wechsler, 2001)

Written Expression Subtest: The student is asked to generate words sharing a common meaning (a written verbal fluency task), is asked to combine short sentences into longer sentences, and is given a topic to write about for ten minutes. Compositions are scored on several different parameters including organization, content, and mechanics of writing.

Gray Oral Reading Test—Third Edition (GORT-3) (Wiederholt & Bryant, 1992)

Oral Reading portion—Measures fluency and accuracy in reading connected text, with time norms for oral reading of graded passages.

Delis-Kaplan Executive Function System (D-KEFS) (Delis, Kaplan, & Kramer, 2001)

Letter Fluency Subtest: This subtest measures executive functions in language by asking the student to name all the words he or she can in 60 seconds that begin with certain letters.

Inhibition/Switching Subtest (section of Color Word Interference Subtest): The Color Word Interference Subtest uses a Stroop-like (Golden, 1978) task to measure inhibition and response to interfering information by asking the student to read names of colors printed in the wrong color of ink. The Inhibition/Switching subtest then takes inhibition and executive function to a higher degree of difficulty than the traditional Stroop task by asking the student to switch back and forth between naming the color of ink the words are written in, and reading the words.

Cognitive Assessment System (CAS) (Naglieri & Das, 1997)

Receptive Attention Subtest: The student must sustain attention and make rapid judgments by scanning a page of letter pairs and underlining those that are two of the same letter, rather than two different letters.

Wechsler Intelligence Scale for Children-III (Wechsler, 1991)

Digit Span Subtest: The student is asked to listen and repeat, in forwards order and then in reverse order, ever-lengthening strings of numbers the examiner has just said.

Assessments given at pretest and posttest only:

Process Assessment of the Learner (PAL), (Berninger, 2001)

Copy Task A: The student copies a sentence including all letters of the alphabet as quickly and accurately as possible.

Copy Task B: The student copies a short paragraph. Scoring for the two copy tasks is based on the number of letters copied correctly within a specified period of time.

Woodcock-Johnson Third Edition (WJ III), Tests of Achievement (Woodcock, McGrew, & Mather, 2001)

Writing Fluency Subtest: For each item, the student is given three words and asked to construct a short sentence with them as quickly as possible.

Wide Range Achievement Test-3 (Wilkenson, 1993)

Spelling Subtest: The examiner reads each word aloud and uses it in a sentence, and then the student writes the word.

Wechsler Individual Achievement Test, Second Edition (WIAT-2)(Wechsler, 2001)

Spelling Subtest: The examiner reads each word aloud and uses it in a sentence, and then the student writes the word.

NEPSY Developmental Neuropsychological Assessment (Korkman, Kirk, & Kemp, 1997)

Tower Subtest: The student must move colored balls on pegs one at a time to create a criterion design. This subtest assesses planning and ability to apply rules.

Auditory Attention and Response Set: The student is asked to listen to a taped voice saying words at the rate of one per minute. When the student hears a target color word, he/she is to put a block of that color into a box. On the second part of the test, the student again listens to the taped voice, but this time the student must put in a different color block than the target word

calls for. This subtest assesses ability to process auditory information, hold auditory directions in mind, and inhibit automatic responses.

Chapter VI: Results

The main hypothesis of this study and the three secondary hypotheses concerned differential progress expected to be made by the treatment (attention) group versus the control (reading fluency) group. In addition to these hypotheses about the relative growth of each group, it was expected that all students would make progress overall in the literacy skills taught in the writing lessons.

1) The central hypothesis of this study was that students in the attention training group would make greater progress in writing composition skills (as measured by the Wechsler Individual Achievement Test-2 Written Expression subtest) than would the students in the reading fluency group.

2) Students in the attention training group were not expected to show progress in written composition until after they received specific training in written composition, that is, at posttest, but not midtest. The attention process training was not expected to have an immediate effect on written composition, but was expected to serve as a bridge to improved written language following appropriate instruction in writing composition.

3) It was anticipated that students in the attention training group would make greater progress on tests of attention/executive function (Delis-Kaplan Executive Function System Color-Word Inhibition/Switching subtest, Cognitive Assessment System Receptive Attention subtest, NEPSY Tower subtest, and NEPSY Auditory Attention and Response Set subtest) than would the students in the reading fluency group.

4) Students in the reading fluency group were expected to make greater progress on tests of reading rate and accuracy (Gray Oral Reading Test--Rate and Accuracy) than the students in the attention group.

For each dependent measure, analysis focused on two questions: 1) Whether skill growth occurred over time, and 2) whether the two treatment groups showed different amounts of growth over time. Repeated measures analysis of variance (ANOVA) was used to examine effects over time for the Attention and Control groups from pretest to midtest (effects of only pretraining in attention or fluency), then from midtest to posttest (effects of introducing writing instruction in the context of prior attention or fluency training), on all the measures given at pretest, midtest, and posttest. Some assessments were not repeated at midtest because of time limitations. Their results can be interpreted only in reference to the combined pretraining (fluency or attention training) and composition instruction.

Table 1 shows means and standard deviations for each treatment at each time point for each outcome that was measured at pretest, midtest, and posttest. Table 2 shows means and standard deviations for each treatment at each time point for each outcome that was measured at pretest and posttest. Table 3 shows the results of the repeated measures analysis of variance for each outcome that was measured at pretest, midtest, and posttest. Table 4 shows the results of the repeated measures analysis of variance for each outcome that was measured at pretest and posttest.

Table 1

Means and Standard Deviations (SD)

for Each Treatment on Each Outcome Measured at Three Time Points

	Attention Treatment Group			Reading Fluency Controls		
	Pretest Mean (SD)	Midtest Mean (SD)	Posttest Mean (SD)	Pretest Mean (SD)	Midtest Mean (SD)	Posttest Mean (SD)
Writing						
Alphabet 15 Seconds	-.95 (.56)	-.91 (.79)	-.50 (.82)	-.93 (.85)	-.24 (.70)	-.15 (.78)
WIAT-2 Written Expression	93.40 (7.83)	89.40 (9.10)	96.50 (7.84)	94.10 (8.71)	93.30 (9.14)	90.20 (11.49)
Reading						
GORT Rate	7.9 (3.36)	8.1 (3.84)	8.5 (3.34)	7.6 (2.88)	7.4 (3.31)	8.3 (3.33)
GORT Accuracy	6.0 (2.45)	7.4 (2.95)	7.6 (2.76)	8.6 (2.55)	9.3 (3.13)	9.2 (3.08)
Attention/Executive Function						
DK-EFS Letter Fluency	9.30 (2.06)	9.50 (1.72)	11.40 (2.68)	8.90 (2.33)	10.70 (1.16)	10.30 (2.16)
DK-EFS Inhibition/ Switching	10.5 (2.51)	11.0 (2.11)	11.8 (0.63)	9.5 (1.78)	10.4 (3.34)	11.6 (2.27)
CAS Receptive Attention	9.0 (2.11)	10.6 (2.63)	10.8 (2.04)	9.0 (2.05)	11.1 (1.79)	9.5 (1.96)
WISC-III Digit Span	7.67 (1.5)	6.33/7.10 (2.06)3.11	8.0 (2.05)	7.9 (2.38)	6.0 (2.94)	8.40 (2.37)

Table 2

Means and Standard Deviations (SD)

for Each Treatment on Each Outcome Measured at Two Time Points

	Attention Treatment Group		Reading Fluency Controls	
	Pretest Mean (SD)	Posttest Mean (SD)	Pretest Mean (SD)	Posttest Mean (SD)
Writing				
PAL Copy A	-.08 (.66)	.31 (.78)	.05 (.94)	.43 (1.15)
PAL Copy B	-.62 (.45)	-.21 (.70)	-.39 (.86)	-.02 (.90)
WJ-R Writing Fluency	88.40 (6.79)	91.60 (11.21)	91.67 (8.03)	99.89 (15.78)
WRAT-3 Spelling	88.20 (6.97)	90.00 (9.02)	90.10 (5.80)	91.00 (5.31)
WIAT-2 Spelling	84.30 (9.79)	88.90 (11.72)	87.30 (5.25)	92.30 (10.31)
Attention/Executive Function				
NEPSY Tower	10.30 (1.64)	11.2 (2.10)	9.10 (1.37)	10.60 (1.17)
NEPSY Auditory Attention and Response Set	10.20 (1.40)	11.70 (1.06)	10.00 (91.63)	11.40 (1.35)

Table 3

Analysis of Variance Results

(F Values, Significance Level, and Mean Square Error)

for Measures Given at Pretest, Midtest, and Posttest

Time 1 = Pretest to Midtest
Time 2 = Midtest to Posttest

Tests	Contrasts	F (df)	p	MSE
Writing				
Alphabet 15 sec	Time 1 Effect	3.37 (1, 16)	.09	
	Time 1 x Trt.	2.64 (1, 16)	.12	
	Time 1 MSE			.36
	Time 2 Effect	4.01 (1, 17)	.06	
	Time 2 x Trt.	.07 (1, 17)	.79	
	Time 2 MSE			.30
WIAT-2 Written Expression	Time 1 Effect	1.78 (1, 18)	.20	
	Time 1 x Trt.	.79 (1, 18)	.39	
	Time 1 MSE			32.43
	Time 2 Effect	.97 (1, 18)	.34	
	Time 2 x Trt.	*6.32 (1, 18)	.02	
	Time 2 MSE			41.16
Reading				
GORT Rate	Time 1 Effect	.00 (1, 18)	1.0	
	Time 1 x Trt.	.49 (1, 18)	.49	
	Time 1 MSE			.81
	Time 2 Effect	*4.86 (1, 18)	.04	
	Time 2 x Trt.	.72 (1, 18)	.41	
	Time 2 MSE			.87
GORT Accuracy	Time 1 Effect	*5.97 (1, 18)	.03	
	Time 1 x Trt.	.66 (1, 18)	.43	
	Time 1 MSE			1.85
	Time 2 Effect	.01 (1, 18)	.91	
	Time 2 x Trt.	.12 (1, 18)	.74	
	Time 2 MSE			1.96
Attention/Executive Function				
DK-EFS Letter Fluency	Time 1 Effect	*5.36 (1, 18)	.03	
	Time 1 x Trt.	3.43 (1, 18)	.08	
	Time 1 MSE			1.87
	Time 2 Effect	3.01 (1, 18)	.10	
	Time 2 x Trt.	*7.07 (1, 18)	.02	
	Time 2 MSE			1.87

Table 3 Continued

DK-EFS Inhibition/ Switching	Time 1 Effect	2.40 (1, 18)	.14	
	Time 1 x Trt.	.20 (1, 18)	.66	
	Time 1 MSE			2.04
	Time 2 Effect	*6.08 (1, 18)	.02	
	Time 2 x Trt.	.24 (1, 18)	.63	
	Time 2 MSE			1.37
CAS Receptive Attention	Time 1 Effect	**24.99 (1, 18)	.00	
	Time 1 x Trt.	.46 (1, 18)	.51	
	Time 1 MSE			8.04
	Time 2 Effect	2.01 (1, 18)	.17	
	Time 2 x Trt.	3.31 (1, 18)	.09	
	Time 2 MSE			2.44
WISC-III Digit Span	Time 1 Effect	**11.55 (1, 17)	.00	
	Time 1 x Trt.	.36 (1, 17)	.56	
	Time 1 MSE			2.14
	Time 2 Effect	**17.11 (1, 18)	.00	
	Time 2 x Trt.	3.53	.08	
	Time 2 MSE			1.59

Table 4

Analysis of Variance Results

(F Values, Significance Level, and Mean Square Error)

for Measures Given at Pretest and Posttest

Tests	Contrasts	F (df)	p	MSE
Writing				
PAL Copy A	Time Effect	*4.83 (1, 18)	.04	
	Time x Trt.	.00 (1, 18)	.98	
	MSE			.30
PAL Copy B	Time Effect	**11.02 (1, 18)	.00	
	Time x Trt.	.02 (1, 18)	.90	
	MSE			.14
WJ-R Writing Fluency	Time Effect	*6.43 (1, 17)	.02	
	Time x Trt.	1.24 (1, 17)	.28	
	MSE			48.09
WRAT-3 Spelling	Time Effect	2.27 (1, 18)	.15	
	Time x Trt.	.25 (1, 18)	.62	
	MSE			8.01
WIAT-2 Spelling	Time Effect	**14.91 (1, 18)	.00	
	Time x Trt.	.03 (1, 18)	.87	
	MSE			15.46
Attention/Executive Function				
NEPSY Tower	Time Effect	**9.36 (1, 18)	.00	
	Time x Trt.	.59 (1, 18)	.45	
	MSE			1.54
NEPSY Auditory Attention and Response Set	Time Effect	**16.86 (1, 18)	.00	
	Time x Trt.	.02 (1, 18)	.89	
	MSE			1.25

Treatment-Specific Effects at Time 1 (Pretest to Midtest): There were no significant time by treatment interactions at time one, following individual training in reading fluency or attention processes. Contrary to expectations, the attention training group did not show greater improvement on measures of attention than did the reading fluency group. Likewise, the reading fluency group did not demonstrate greater progress on the GORT Reading Rate or Reading Accuracy than did the attention group at time one. Rather, both groups showed similar levels of progress in both attention measures and reading tests.

Treatment-Specific Effects at Time 2 (Midtest to Posttest): There were two significant time by treatment interactions at time two, following group instruction in writing composition with attention bridges. First, in a confirmation of the central hypothesis, the attention process training group demonstrated significantly more progress in writing than the reading fluency group, as measured by scores on the WIAT-2 Written Expression subtest (F=6.32, df 1, 18, p=.02). Mean WIAT-2 Written Expression scores for the reading fluency group fell slightly at both time points after the pretest. Scores for the attention training group fell from pretest to midtest, but rose above pretest levels at the time of the post-test, following the writing composition lessons. Thus, as predicted, the attention training enabled the students in the attention group to take better advantage of the subsequent writing composition with attention bridges training.

Second, in an unexpected finding, the attention process training group also demonstrated significantly more progress than the reading fluency group in oral verbal fluency from midtest to posttest, as measured by their scores on the DK-EFS Letter Fluency subtest (F=6.08, df 1, 18, p=.02). The sample as a whole made significant growth from pretest to midtest (at the conclusion of the individual reading fluency or attention process training), but the attention group showed significantly more progress than the reading fluency group from midtest to posttest (following group writing instruction with attention bridges).

Treatment-Specific Effects for Measures Administered Only at Pretest and Posttest: There were no significant time by treatment interaction effects for measures administered at pretest and posttest only (following individual instruction in reading fluency or attention processes and subsequent group writing instruction).

Improvement Over Time Regardless of Treatment at Time 1 (Pretest to Midtest): Following individual training in reading fluency or attention processes, the sample as a whole showed progress in handwriting automaticity when writing letters from memory, as measured by midtest scores on the Alphabet 15 Second task. The sample as a whole showed significant progress on GORT Accuracy (F=5.97, df=1, 18, p=.03). The sample as a whole showed progress on oral verbal fluency as measured by DK-EFS Letter Fluency (F=5.36, df=1, 18, p=.03), on sustained attention as measured by CAS Receptive Attention (F=24.99, df=1, 18, p=.00), and on short-term/working memory as measured by WISC-III Digit Span (F=11.55, df 1, 17, p=.00).

Improvement Over Time Regardless of Treatment at Time 2 (Midtest to Posttest): Following either attention or reading fluency training plus group writing instruction, the sample as a whole demonstrated significant progress in reading speed as measured by GORT Rate (F=4.86, df 1, 18, p=.04), in inhibiting automatic responses and switching attention as measured by DK-EFS Inhibition/Switching (F=6.08, df 1, 18, p=.02), and in short-term/working memory as measured by WISC-III Digit Span (F=17.11, df 1, 18, p=.00).

Improvement Over Time Regardless of Treatment for Measures Administered only at Pretest and Posttest: The sample as a whole showed significant progress from pretest to posttest in handwriting speed and accuracy when copying text on PAL Copy A (F=4.83, df 1, 18, p=.04) and Copy B (F=11.02, df=1, 18, p=.00). The sample as a whole also made significant progress in compositional fluency as measured by the WJ-III Writing Fluency subtest (F=6.43, df=1, 17, p=.02). In spelling, there were significant gains overall on the WIAT-2 Spelling subtest (F=14.91, df 1, 18, p=.00), but not on the WRAT-3 Spelling. The sample as a whole showed significant improvement from pretest

to posttest in NEPSY Tower (F=9.36, df 1, 18, p=.00), and in NEPSY Auditory Attention (F=16.86, df= 1, 18, p=.00).

In summary, of the four hypotheses, discussed at the beginning of Chapter VI, the central first hypothesis and the related second one were confirmed, while the two secondary hypotheses were not. That is, following instruction in writing composition with attention bridges, students in the attention process training group made significantly greater progress in written composition than their peers who received prior reading fluency training. Further, the progress in written composition did not occur as an immediate result of attention process training. Rather, the progress occurred following subsequent writing composition training with attention bridges. The prior attention process training apparently made students in the attention group better able to profit from the subsequent composition instruction with attention bridges.

The third and fourth hypotheses were not confirmed. Contrary to expectation, progress in reading and attention/executive function was not group-specific, with the exception of the Time 2 results on the DK-EFS Letter Fluency subtest. The attention process training group did not show greater progress on tests of attention/executive function (DK-EFS Inhibition/Switching, CAS Receptive Attention, WISC-III Digit Span, NEPSY Tower, NEPSY Auditory Attention and Response Set) at Time 1, Time 2, or Pretest to Posttest than did the reading fluency group, and the reading fluency group did not demonstrate greater skill development in reading speed or accuracy (GORT Rate, GORT Accuracy) than did the attention group, at any of the testing time points. Rather, both groups showed progress in most skills at both time points. At time one, both groups showed progress in measures of reading accuracy, oral verbal fluency, sustained attention, and working memory. At time two, both groups showed progress in reading speed, inhibition of automatic responses, and response switching. For measures given only at pretest and posttest, both groups showed progress at posttest, compared to pretest, in handwriting, writing fluency, spelling, and auditory attention and executive function skills.

In a fifth finding that was unanticipated, the attention group made significantly greater progress from midtest to posttest than the reading fluency group on one measure of attention/executive functioning, oral verbal fluency (Delis-Kaplan Letter Fluency). While the sample as a whole demonstrated improvement in oral verbal fluency from pretest to midtest (following attention or reading fluency training), only the attention group continued to improve through the course of the study, outdistancing the reading fluency group at time two.

The sample as a whole made significant progress in many areas tested, but only the progress shown on the WIAT-2 Written Expression subtest from midtest to posttest and the progress shown on the DK-EFS Letter Fluency from midtest to posttest were significantly different—depending on the training received in phase one prior to the phase two writing instruction.

Chapter VII: Discussion

Overview

This study investigated the effects of prior attention training on subsequent composition instruction with attention bridges in fourth, fifth, and sixth graders who had a significant discrepancy between their WISC-III Verbal Comprehension Index and reading or writing skills. Results showed that the group that had prior attention training was able to improve writing skills more, following composition instruction with attention "bridges," than the control (reading fluency training) group. The attention process group also showed greater improvement in oral verbal fluency than did the reading fluency group.

Hypothesis 1: Students in Attention Process Training Group Will Make Greater Gains in Writing Skill

A review of Table 1 shows that, on the WIAT-2 Written Expression subtest, both groups declined in mean scores from pretest to midtest (when no writing instruction was given), but the overall decline was not significant. At time two (midtest to posttest), the reading fluency group continued to decline, while the attention group improved. Since the two groups were statistically identical at pretest, and since they both received the same writing composition lessons at the same time in the same large groups, the most likely explanation for the improvement shown by the attention group is that prior training with the *Pay Attention!* program had a beneficial effect on subsequent demonstration of writing skills. The sustained, alternating, and divided attention practice that the attention group students obtained from the *Pay Attention!* program may have helped students focus on classroom activities and use planning and revising strategies more effectively than their reading control group peers.

The mean score decline from midtest to posttest for the reading fluency control group (93.3 to 90.2) may be due, in part, to two individuals who showed sizable drops of

about a standard deviation in size. However, an examination of individual score increases and declines in both groups supports the direction of the effects shown by the group means. In the *Pay Attention!* group, eight of the ten students showed a score gain from midtest to posttest, while two showed a score decline. In the reading fluency group, two students showed a score gain from midtest to posttest, three students stayed the same, and five showed a score decline.

Hypothesis 2: Gains in Writing Will Occur After Writing Instruction as a Function of Prior Attention Training

Results of testing right after the students completed attention process or reading fluency training showed that improvement in writing, as measured by the WIAT-2 Written Expression subtest, did not occur at midtest. Therefore, the beneficial effect of the *Pay Attention!* training on writing skills did not happen until the students had received specific writing instruction. There was not an immediate transfer from attention training to writing skill; rather, prior attention training appears to have facilitated acquisition of composing skill once explicit instruction in composing, with built in attentional bridges, was provided.

Hypotheses 3 and 4: Attention Group Will Show Greater Gains on Attention Measures, and Reading Group Will Show Greater Gains on Reading Measures

As explained earlier, these two hypotheses were not confirmed when standardized pretest, midtest, and posttest measures were used as criteria. However, all the students made progress on the *Read Naturally* and *Pay Attention!* programs to which they were assigned from pretest to midtest, and both of these programs require certain levels of mastery before progression to the next step in the curriculum. Thus, some learning was likely taking place. The Read Naturally program is a widely recognized and widely used curriculum that has been appropriately validated in other studies. This study was not intended as an examination of the Read Naturally program. The lack of demonstrable standard score gains on the GORT Rate subtest for the Read Naturally group following

this short term of training should not be construed as indicating that this instructional program is not effective in improving reading fluency. These children were not selected for their reading fluency problems—they were selected for their persisting writing problems.

Although the transfer of attention training to writing may not have been apparent at midtest and the transfer of reading fluency training to reading may not have been apparent on a standardized test of reading after a short training period, the effects of training may have been apparent had a standard set of writing and reading probes been administered to both treatment groups. Standardized tests are designed to assess relative standing in a group of age or grade peers. Students may be learning without changing in their relative learning ability compared to peers.

Although the two groups did not make differential progress on standardized measures of reading fluency or attention from pretest to posttest, both groups did demonstrate general progress in these areas, as well as in handwriting, spelling, and writing fluency. There are two possible explanations for this positive result. First, students may have actually improved their skills in all those areas as a result of the individual attention they received.

The second possibility is that practice effects from repetition of tests influenced apparent score improvement. However, the fact that a reliable treatment-specific effect was found for written expression argues against the improvement in written expression being solely due to practice effects. Even with practice, one group improved, on average, and one group decreased, on average.

Unexpected Improvement in Oral Verbal Fluency for Attention Group

The attention group made significantly greater gains in oral verbal fluency from midtest to posttest than did the reading fluency group. Oral verbal fluency assesses the executive function of controlled search through and retrieval from long-term memory. The supervisory attention system (Stuss et al., 1996) plays an important role in this search which necessitates attention to relevant items and active suppression or disregard of

irrelevant items. The prior training in attention could facilitate the retrieval process by improving selective attention in general that in turn generalized to the process of finding and retrieving verbal information automatically and quickly from long-term memory. In sum, *Pay Attention!* training probably helped attention group students focus on relevant clues as they searched their memories for words from their internal word bank that fit search criteria. The attention training may have also helped the treatment group to focus their attention more efficiently during the process of retrieving words and content during written expression.

Implications of This Study:

Results of this study add to the body of research (Carlson & Das, 1997; Hooper et al., 2002; Kerns et al., 1999; Naglieri & Gottling, 1997; Naglieri & Johnson, 2000; Semrud-Clikeman et al., 1999; Thomson et al., 2001) that has found a positive impact of attention training on academic or cognitive efficiency skills. This study, however, is unique in its design compared to the others listed. None of the other studies followed the "test/instruct attention/test/instruct academic skill/test" format used here.

Many of the previous studies focused on measuring attentional skills rather than academic skills, considering academic progress as just an indicator of attentional improvement. Kerns et al. (1999) reported that children with ADHD who were trained with the *Pay Attention!* materials showed improved attentional skills, and they also improved in untrained measures of math calculation, used as an index of cognitive efficiency. Naglieri and colleagues (1997, 2000) used arithmetic calculation worksheets as a context for self-reflection and verbalization of strategies about how problems were completed in a remedial mathematics classroom. They found that students with a deficit in planning (as diagnosed with the Cognitive Assessment System) benefited most from this reflective metacognitive training, as measured by improvement in number of math problems correctly solved. Hooper et al. (2002) assessed the writing level of subjects in a heterogeneous public elementary school setting, then administered tests of executive function (initiation, set shifting, sustain, and inhibition/stopping) to investigate the

cognitive characteristics of good and poor writers. They found that better initiation and set-shifting ability distinguished good from poor writers.

In contrast, as in this study, Carlson and Das (1997) set out to use attention process training to improve an academic skill. They targeted reading decoding skills in a Chapter 1 reading population, using the Process-Based Reading Enhancement Program (PREP). PREP relies on inductive learning rather than rule-based deduction, providing a structured series of exercises that require application of sequential strategies, planning, and attentional resource allocation. Initial activities are of a global nature with no reading content. Then the lesson proceeds to bridging activities that have the same type of cognitive demands in a reading context. For example, the global level of one module asks students to look at a strip of pictures of different vehicles, and then reproduce the order of the pictures on a blank matrix from memory. In the bridging activity, students look at a word, then choose the proper letters from among other distracter letters and build the word from memory. These authors reported that the PREP trained group made significantly more progress on reading decoding than the comparison group. They attributed the positive results to memory enhancement, increased knowledge base, expanded attentional capacity and/or deployment, and greater efficiency in successive processing that resulted from PREP training.

Like the Carlson and Das (1997) study, this research focused on an expected academic outcome, rather than targeting an attentional outcome. Also like Carlson and Das, global attention process training was offered through the *Pay Attention!* program, then bridge attention activities were provided in a literacy context. Unlike Carlson and Das, in this study, academic instruction was the same for all participants and occurred in the same context as the attention bridges. (The Carlson and Das subjects received reading instruction in their regular LAP classes.) The global attention training and the attention bridges were not taught at the same time, as Carlson and Das had done. As in Carlson and Das and the two Naglieri group studies (1997 and 2000), this study found that academic skills improved when attention process training was offered in conjunction with academic lessons.

In a result different from Kerns et al. (1999), attention-trained subjects' scores did not improve on tests of attention when compared to the control (reading fluency) group. In a result similar to Kerns et al. (recall that Kerns et al. found an improvement in math calculation, used as a measure of cognitive efficiency, among students who had received attention training), this study also demonstrated an untrained benefit of attention process training. That is, oral verbal fluency improved in the attention training group compared to the reading fluency group. Students who received attention process training followed by composition instruction with attention bridges became more efficient in searching their memory bank of words and deciding whether the words fit search criteria, even though they received no direct training in this skill. This result parallels the increased efficiency of Kerns' subjects in performing rapid math calculations following training with the *Pay Attention!* program.

The other significant result of this study--the differential improvement in compositional skill of the attention training group over the reading fluency group--may represent more than increased cognitive efficiency. As Hooper et al. (2002) reminded us, executive functions have been considered keys to the writing process and have been included implicitly, if not explicitly, in many models of writing and writing remediation (Hayes & Flower, 1980; Wong et al., 1989). Hooper et al. determined that the executive functions of initiation (that is, getting started on something) and set shifting (flexibly changing from one activity or focus to another) were most important in differentiating good from poor writers, although effect sizes were small. The Hooper group concluded that their findings not only underscored the importance of verbal organization and working memory in the writing process, but also demonstrated that executive function skills of "problem-solving efficiency, self-monitoring, and attention regulation" (page 65) as being key factors in writing success.

In this analysis of Hooper and colleagues lies another explanation for the differential composition skill increase of the *Pay Attention!* group in the present study. Because of the problem solving efficiency training that came through the sorting, set shifting, and attention regulation activities of that program, students in the attention

training group got increased practice in many of the executive function skills that are crucial to writers. Thus, when their previous attention training was combined with attention bridges in a literacy context and with composition instruction, they were better able to take efficient advantage of the instruction and to demonstrate better writing skill.

The executive function processes of focusing attention, planning, and revising are a critical and constant part of mature writing. This study shows that these processes benefit from the enhanced attentional management taught by the *Pay Attention!* program, as shown by the attention process training group's improved ability to organize and plan written responses, compared to the reading fluency group. In addition, the increased oral verbal fluency of the attention training group shows another significant positive effect, that of improved efficiency of information retrieval from memory stores. As in the Kerns et al. (1999) study, this enhanced oral verbal fluency suggests a sort of improved efficiency of cognitive operations, this time for verbal material, that may be particularly important for those with dyslexia.

Efficient learning is extremely important for students with dyslexia, because they must be explicitly taught many of the literacy processes that seem to come automatically for others. When first learning to decode, they must have methodical teaching of phonological analysis and synthesis skills for reading (Felton & Pepper, 1995; Torgesen, 1991; Torgesen & Davis, 1996), and specific teaching of letter forms (Berninger et al., 1997) for writing. Since these students need so much more instruction, it is crucial for all of their instruction to be as effective as possible. Many studies (Abbott & Berninger, 1999) show that students with dyslexia can acquire reading skills through intensive remediation efforts. Results of this study indicate that writing composition instruction for students with dyslexia may be made more efficient with prior attention training of the type found in the *Pay Attention!* program, coupled with attention bridges in a process writing approach with a high level of adult support. There is evidence that a similar approach has been effective in teaching reading (Carlson & Das, 1997), and calculation skills following a different protocol with a similar perspective. It is intriguing to consider

the possibility that attention process training may be useful across a broad spectrum of academic and general cognitive efficiency areas.

Suggestions for Future Research:

There are other possible connections between the attentional/executive function system and literacy skills that were not studied here. This study raises many possibilities for future research. The connection between attention training and the development of automatic processes could be a very fruitful area of investigation. Automaticity in letter and word naming, fluency of letter formation and letter recognition, and automaticity of letter/sound correspondence are often significant problem areas for those with dyslexia. If attention process training could assist in the development of automaticity for naming, letter writing, and sound-symbol association, many children who are having problems with reading and writing could be helped.

Further, the fact that oral verbal fluency skills increased for the attention-trained group raises the possibility that attention training will raise cognitive efficiency in other areas crucial for literacy skills. For example, short-term memory efficiency, necessary for reading decoding, might be improved by attention training. The smooth code-switching between auditory, visual, and motor systems that is necessary for reading and writing might also be aided by attention process training.

Also, it may be that building attention bridges within the composition instruction is sufficient. However, composition instruction alone, even with attention bridges in phase two preceded by phase one reading fluency training, was not as effective as composition instruction with attention bridges in phase two preceded by phase one attention training. Future research might keep total instruction time constant and compare a group that receives only composition instruction with attentional bridges to a group that first receives pay attention training that is followed by composition instruction with attentional bridges.

Limitations of This Study:

This study had several limitations. First, the small sample size and limited time period of intervention calls for replication with larger groups of students and longer training periods. Second, future research might compare the response of different clinic groups to the combined attention and written expression training. Clinic groups that might be compared include dyslexia only, attention deficit only, and combined dyslexia and attention deficit. Not only children with dyslexia but also children with attention deficit disorder are known to have difficulty with the writing process. Children with combined dyslexia and attention deficit might respond the most to the benefits of prior attention training followed by composing instruction with attentional bridges.

Third, measurement of growth in written composition poses challenges. Writing is a very complex process and subprocesses may show some growth before major improvement in all writing processes may be observed. Also, a one-time writing product may not reflect the processes that contributed to generating that product. If time had permitted, it would have been valuable to collect writing probes in each writing session to use in growth curve analysis. Although it was not possible to obtain follow-up measures of written expression, that would have been desirable. Finally, it is a limitation that all measures could not have been administered at three time points: pretest, midtest, and posttest.

Conclusion:

Most researchers agree that dyslexia and ADHD are distinct disorders, but both occur on a continuum and may overlap. This study indicates that attention training may be valuable in instructional programs designed to remediate the writing problems of dyslexics. Although one does not learn to read or write simply by practicing attention training activities, in this study, attention training, followed by literacy instruction with attention bridges, resulted in students improving, on average, in written composition, assessed on the basis of content, organization, and writing mechanics. If the results of this study are borne out by future research, attention training activities should become

part of the remedial educator's general toolkit for helping students achieve in spite of dyslexia.

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APPENDIX A: WRITING COMPOSITION LESSON PLANS

Script for Introduction of Writing Club

Greet the students, then say:

Today, we begin the St. Luke "Pay Attention to Writing" Club. We will meet on Tuesday and Thursday mornings for writing lessons combined with some attention activities.

Writing is the school activity that probably involves the most different types of skills. For example, in order to write down your opinions about something, you have to

- **think of what you want to say,**
- **choose the best words to say it with,**
- **think of how to make complete sentences,**
- **remember how to spell the words,**
- **know how to write the letters,**
- **and know how to use the punctuation marks you need.**

While you are writing, you need to constantly re-read what you have written to be sure it makes sense.

On top of that, when you are through you have to think of how you could make it better so you are really getting your ideas across.

When you write, you have to pay attention to many different things at once! That's why we want to teach you some ways to pay attention to words and to writing that you might not have thought about before. Here is a chart to show you the types of activities that you will be able to get credit for.

(Pass out "Pay Attention to Writing!" charts)

Each day, we will do three warm-up Attention Activities. (point to first block on chart.) **We will be word detectives, listening for target sounds or word parts, sorting out word clue cards, and scanning word lists for clues. You and your teacher helper will keep track of your progress in the first rows of the grid.**

After our detective warm-up time, we will do some things to keep our attention focused while we write. During the group instruction time when the teacher is explaining the assignment, she will slip in an instruction for careful listeners, like "touch your nose," "pat the top of your head," "scratch your knee," and similar statements. Those who show they are paying attention by doing the Attention Actions correctly will earn a point for themselves or their team.

While you are writing your composition, a timer bell will go off. (demonstrate the sound) **When you hear the bell, you are to ask yourself, "Was I paying attention to my writing when the bell went off?" Mark a check or minus to show your answer. Try to improve your attention every day.**

Part of staying focused on a task is setting a goal and trying to meet it. The fourth row in the chart lists a goal we want you to meet: For every composition you write, make your first draft one sentence longer than you produced on your last first draft. Write the number of sentences in each first draft on the grid so that you and your teacher can keep track.

When we are revising, one of the teachers will come around the room and give you a star for recognition if you are working well when the teacher comes to you.

We think these Attention Bridges will help you become a better writer!

NOTE TO TEACHERS:

General Attention Task Instructions

Task Types

Listen Tasks: These tasks correspond to the CD/buzzer tasks in Pay Attention. Students listen while a list of words is read aloud at a rate of one per second and put out a chip whenever they hear a word that meets the target criteria. Examples should be given orally. There are Listen Tasks for Phonology and Morphology attention.

Card Sort Tasks: These tasks correspond to the card sorts in Pay Attention. Students are given a set of cards and sort into one pile all the cards that meet the target criteria. Examples should be written on board. There are Card Sort Tasks for Phonology, Orthography, and Morphology attention.

Text Scan Tasks: These tasks correspond to the house scan tasks in Pay Attention. Students are given a sheet with rows and columns of words. They circle as many words that

meet the target criteria as they can find in two minutes. Examples should be written on board. There are Text Scan Tasks for Phonology, Orthography, and Morphology attention.

Attention Focuses

Phonology Attention: Target criteria will always be a phoneme (or multiple phonemes) and should be given in the form of a phoneme (i.e., not as a letter or letter team or a description, so when instructions say "short /i/" the instructor should just pronounce the phoneme /i/ rather than say "short /i/"). I haven't used the correct symbols for all of the phonemes, but you can figure out what the phoneme is from the examples.

Orthography Attention: Target criteria will be a letter or letter group (e.g., blend or vowel team).

Morphology Attention: Target criteria will be a suffix or prefix. Students will sometimes need to determine whether the same letter group (e.g., "ing") is a prefix or suffix or just part of a word (e.g., running vs. ring). On one lesson students will need to determine the meaning of a suffix (Lesson 7).

Lesson 1--Attention

1. **Phonology Attention:** Listen—Initial Phoneme /b/

   Examples: Beautiful (Y)
   Purple (N)

   Need: Word List 1p
   Chips

2. **Orthography Attention:** Card Sort—Begins with "gl"

   Examples: Glass (Y)
   Grass (N)

   Need: Card Set 1o

3. **Morphology Attention:** Text Scan—Suffix "ing"

   Examples: Running (Y)
   Ring (N)

   Need: Text Scan Sheet 1m

Lesson 1 Persuasive Essay Writing--Opinions. "Which is better, a pencil or a computer?" (adapted from Berninger & Abbott, 2003)

PLANNING

Teacher-led Reflective Discussion: Encourage children to talk about the following questions. What are the advantages of a pencil? What are the disadvantages of a pencil? What are the advantages of computers? What are the disadvantages of computers? Encourage children to talk about the following questions: (*At about this point in the discussion, or when you think attention is wandering, say, "Put your hand on your head," but do not demonstrate. Have students who complied give themselves a good listener point. Resume discussion.)* How expensive are pencils and computers? How many people have pencils and computers? How easy is it to take pencils and computers wherever you go? What can pencils do that computers cannot do, and what can computers do that pencils cannot do? Encourage children to come up with own

questions for comparing pencils and computers.

Ask children to have a "pretend argument". One child should take one position. The other child should take an opposite position. (Ask them to pretend play if both have the same point of view.) Ask them to present all the evidence they can think of to support their point of view.

Graphic Organizers for Student Partners to Use in Planning: Use SIDES OF ARGUMENT Plan and ARGUMENT Plan. On the one side of the SIDES OF ARGUMENT plan sheet write one side of the argument (opinion) and list all the evidence supporting that opinion. On the other side write the contrasting side of the argument (opinion) and list all the evidence supporting that opinion. Use the Argument Plan to decide what you believe, reasons (evidence) for your opinion, and conclusion.

WRITING THE FIRST DRAFT

Writing Prompts: "You are to write an essay on which is better, a pencil or computer. Tell the advantages and disadvantages for both pencils and computers. Tell your concluding opinion and support it with evidence. *Scratch your knee—good listener points.* You may use your written plans, but you should also add other sentences to make your informative essay as complete and as interesting as possible. Remember you can keep planning and do not have to stick to your written plans exactly. As you write, think about the words you use, the sentences you build, and the organization you create in your essay. It is important that you write for 10 minutes. *Touch your nose—good listener points.* Remember that the first draft does not have to be perfect. Concentrate on generating your ideas and filling in the details in your plans." If any student stops writing before 10 minutes, say, "What else can you think of? Reread what you have written already and think of something else to say."

Feedback: Teachers should give each student oral feedback on whether sentences are complete and well structured, whether sentences are organized in a meaningful way, and whether word choice is interesting.

Lesson 2

1. **Phonology Attention:** Text Scan—long /i/ anywhere in word

   Examples:
   Side (Y)
   Sight (Y)
   Silly (N)

   Need: Text Scan Sheet 2p

2. **Orthography Attention:** Text Scan—Ends with "rd"

   Examples: Card (Y)
   Cart (N)

   Need: Text Scan Sheet 2o

3. **Morphology Attention:** Card Sort—Suffix "ly"

   Examples: Normally (Y)
   Rally (N)

   Need: Card Set 2m

Lesson 2 Persuasive Essay--Argument: "Should children be able to watch TV whenever they want and choose the shows they watch? Take a position and convince others that you are right." (adapted from Berninger & Abbott, 2003)

PLANNING

Teacher-led Reflective Discussion: Encourage children to talk about the following questions. What is your opinion about whether children should be able to watch television (TV) whenever they want? What is your opinion about whether children should choose the shows they watch? What are some of the arguments (evidence + persuasion) that support your position on each question? What kinds of evidence can you provide to support each of your arguments? Ask children to have a "pretend argument". One child should take one position. The other child should take an opposite position. (Ask them to pretend play if both have the same point of view.)

Graphic Organizers for Student Partners to Use in Planning. Use the BOXING MATCH AND TAKING SIDES PLAN and ask them to try to "throw punches" in each other's arguments.

Then ask students to state their opinions in the form of a general statement at the top of the TAKING SIDES plan sheet. Then ask them to come up with reasons or facts that support the opinion. Then ask them to list as many reasons or facts as they can to reject the opposing opinion. Then have them summarize by integrating the opinion with the reasons for it and end with a conclusion and reasons for it.

WRITING THE FIRST DRAFT

Writing Prompts: Say, "You are to write an essay on whether children should be able to watch television (TV) whenever they want and choose the shows they watch. Tell the advantages and disadvantages for children deciding which shows to watch and when. *Scratch your nose.—good listener points.* Give your opinion and then arguments to support your opinion and then evidence to support your arguments. You may use your written plans, but you should also add other sentences to make your informative essay as complete and as interesting as possible. *Tap your foot three times—good listener points.* Remember you can keep planning and do not have to stick to your written plans exactly. As you write, think about the words you use, the sentences you build, and the organization you create in your essay. It is important that you write for 10 minutes. *Raise your hand if you can hear me—good listener points.* Remember that the first draft does not have to be perfect. Concentrate on generating your ideas and filling in the details in your plans. Use as many action words as you can." If any student stops writing before 10 minutes, say, "What else can you think of? Reread what you have written already and think of something else to say."

Feedback: Teachers should give each student oral feedback on whether sentences are complete and well structured, whether sentences are organized in a meaningful way, and whether they used action words.

REVIEWING AND REVISING (Reflecting/Extending) for Lesson 1 Composition

Feedback: Teachers and students set realistic writing goal for improving sentence construction, sentence organization, or word choice from Lesson 1 composition.

Teacher-led Reflective Discussion: Students are instructed to listen to their peer's composition being read and first tell something they liked or enjoyed about the paper, then suggest a change to make it better. Teacher reads each partner's composition aloud, and leads discussion of how clarity can be improved. Students and teacher suggest how each composition could be improved in terms of whether word choice is interesting, whether sentences are complete, and whether the essay is organized meaningfully (order of sentences). Children make notes on their original draft to use when they compose later at the computer. If necessary, teacher models how to add ideas, rewrite sentences, and change words.

Using keyboard and word processing program to enter revised draft. Teacher assists students in entering the revised draft. Teachers show them how to use relevant features of word processing program for text entry. Students can refer to their notes on the first draft and make additional revision. Students also receive feedback on their revised drafts using the same criteria as for the feedback on their first drafts.

Lesson 3

1. **Phonology Attention:** Listen—/oy/ anywhere in word

   Examples: Boil (Y)
   Bowl (N)

   Need: Word List 3p
   Chips

2. **Orthography Attention:** Text Scan—"st" anywhere in word

   Examples: Mister (Y)
   Stink (Y)
   Outshine (N)

   Need: Text Scan Sheet 3o

3. **Morphology Attention:** Card Sort—Prefix "dis"

   Examples: Disbelieve (Y)
   Dishes (N)

   Need: Card Set 3m

Lesson 3 Narrative Writing: "If I Ran the School" **(adapted from Berninger & Abbott, 2003)**

INTRODUCING TOPIC, TEXT STRUCTURE, AND IDEA GENERATING IN PLANNING TO WRITE NARRATIVES (STORIES)

Say, "*In our first lesson you wrote your opinion about which was better, a computer or a pencil. In our second lesson, you had an argument on paper about whether kids should be allowed to watch any TV show they wanted to. Today, you are going to write a story. All stories need a topic—something to write about. The topic can also be the title. Today we thought it would be fun for you to write a story called, 'The day I Got to Run the School.'' Scratch your knee. good listener points*

Stories also need a specific kind of structure or organization. We call this organization narrative structure because it is like the one that good story tellers or

narrators use. This structure has a plot, which is a sequence of events. Cartoons are like written stories because each picture stands for something that happened in order. The first picture took place before the second picture, which took place before the third picture. This order is a sequence. Scratch your head. Stories have sequence too. We call the sequence of events the plot. Stories also need characters—the people that cause the events to take place. They are like the actors in a play. Tap your left foot three times.good listener points Stories also need a setting. The events occur in a specific place and time. Readers also like stories that are humorous. Think how you can inject humor into your story."

Graphic Organizers for Student Partners to Use in Planning. *So the first thing I want you to do is to day dream and think of the events that will take place in your story. List them in the Plot Plan. As you imagine the events, also think of the characters who will cause the events. List them in the Character Plan. Finally, think of all the settings (place and time) where the events will take place and list them in the Setting Plan. Take five minutes for planning.*

WRITING THE FIRST DRAFT

Say, *"Now write the story using the topic (title) you chose and the PLOT, CHARACTER, AND SETTING PLANS you wrote. It is important that you write for 10 minutes. Remember that the first draft does not have to be perfect. Concentrate on generating your ideas and filling in the details in your plans."* If any student stops writing before 10 minutes, say, "What else can you think of? Reread what you have written already and think of something else to say."

REVIEWING AND REVISING for Lesson 2 Composition

TEACHER MODELING: Say, *"Today we are going to revise your compositions from our last lesson in the computer lab. When you revise, you need to re-read your composition and think of what you could do to make it better. Today, we want you to think of sentences to add to make it better. In order to help you get ideas about that, I am going to demonstrate one kind of revision for you. Let's imagine that I wrote an essay*

about whether a computer was better than a pencil. Here is a sentence from my essay: 'A computer is better because it can play CD's, websites, doesn't waste paper, e-mail.' How can I add sentences to make this better?" Discuss list-making versus explanations and descriptions. Point out that this sentence needs clarification and expansion.
Be sure everyone knows who they are working with. RA's give feedback to students before taking them to computer lab. If time, read student compositions aloud for peer feedback.

Feedback: Teachers give children feedback on sentence construction, sentence organization, and word choice they used on Lesson 2 composition. Teachers and students set realistic writing goal for improving one of these in this revision.

Teacher-led Reflective Discussion: Teacher reads each partner's composition aloud, and leads discussion of how clarity can be improved. Students and teacher suggest how each partner's composition could be improved in terms of whether word choice is interesting, whether sentences are complete, and whether the essay is organized meaningfully (order of sentences). Children make notes on their original draft to use when they compose later at the computer. If necessary, teacher models how to add ideas, rewrite sentences, and change words.

Using keyboard and word processing program to enter revised draft. Teacher assists students in entering the revised draft. Teachers show them how to use relevant features of word processing program for text entry. Students can refer to their notes on the first draft and make additional revision. Students also receive feedback on their revised drafts using the same criteria as for the feedback on their first drafts.

Lesson 4

1. **Phonology Attention:** Card Sort—/j/ anywhere in word

   Examples: Giraffe (Y)
   Jeep (Y)
   Bridge (Y)
   Gate (N)

   Need: Card Set 4p

2. **Orthography Attention:** Card Sort—"ei" anywhere in word

   Examples: Either (Y)
   Tried (N)

   Need: Card Set 4o

3. **Morphology Attention:** Listen—Suffix "en"

   Examples: Darken (Y)
   When (N)

   Need: Word List 4m

Lesson 4 Planning, Writing, Reviewing, and Revising PWRR Strategy (Adapted from Berninger & Abbott, 2004)

TEACHER MODELING

Remind students of the planning we have been doing before writing each composition. Then say, *"I'm going to teach you the Plan, Write, Review/Revise Strategy (PWRR) for composing by modeling it for you. Rub your nose. good listener points First, I am going to model planning for you. I will think aloud about what I am going to write about in my story on daydreaming. Listen as I think aloud. I will write about when I daydream. I will write about why I daydream. I will write about what I daydream about. Now it is your turn to plan. When do you daydream?* (allow time for children to think and share) *Why do you daydream?* (allow time for children to think and share) *What do you daydream about?* (allow time for children to think and share)."

Say, *"Now I am going to model writing my story about daydreaming. Watch me as I write this on the board. Now look out the window.* good listener points (Write: I

daydream when I have to sit still for a long while. I daydream becaus (sic) I get board (sic). I daydream about what I would be doing if I were not here.)

Say, "*Now I am going to model reviewing and revising. First I will read my story aloud. Now I will revise it to make it better. I am thinking of sentences that I can add to it to make it better. I think I will give two examples for the last sentence. Watch while I add those sentences to what I have already written on the board. Scratch your knee.good listener points*" (Write: For example, I would rather be sailing. Or, I would prefer to see a movie.) *Now I am going to revise a sentence to make it better. I think that the first one is too wordy. I am going to strike out have. The sentence will still make sense. Now I am going to think about my word choice. I think I am going to substitute time for while in the first sentence. Now I will check my spelling. Oops I misspelled because. I forgot the e on the end. Oops I misspelled board. The spelling I used is for another meaning. I am changing it to bored. Now I will check my capitalization and punctuation. Oops I forgot to put a period at the end of the last sentence. Now it is your turn to read your story aloud and make the changes as I cue you for each kind of revising.*"

Feedback: Teachers give children feedback on sentence construction, sentence organization, and word choice they used on Lesson 2 composition. Teachers and students set realistic writing goal for improving one of these in this revision.

Teacher-led Reflective Discussion: Teacher reads each partner's composition aloud, and leads discussion of how clarity can be improved. Students and teacher suggest how each partner's composition could be improved in terms of whether word choice is interesting, whether sentences are complete, and whether the essay is organized meaningfully (order of sentences). Children make notes on their original draft to use when they compose later at the computer. If necessary, teacher models how to add ideas, rewrite sentences, and change words.

Using keyboard and word processing program to enter revised draft. Teacher assists students in entering the revised draft. Teachers show them how to use relevant features of word processing program, for text entry. Students can refer to their notes on

the first draft and make additional revision. Students also receive feedback on their revised drafts using the same criteria as for the feedback on their first drafts.

Lesson 5

1. **Phonology Attention:** Word Scan—/s/ anywhere in word

   Examples: Sing (Y)
   Circle (Y)
   Face (Y)
   Bees (N)

   Need: Word Scan Sheet 5p

> **For this phonology activity, be sure to note, using example "bees," that "s" does not always make the target /s/ sound. If they can't tell the difference, try pronouncing the words with a /z/, which will sound wrong. This might come up at the end too, with words like "cheese," etc.**

2. **Orthography Attention:** Card Sort—"le" at **end** of word

   Examples: Needle (Y)
   Barrel (N)
   Less (N)

   Need: Card Set 5o

> "le" must be at the end of the word, not anywhere in the word. If you want, you can note that at the end of the word, "le" and "el" often sound the same, as in the examples.

3. **Morphology Attention:** Word Scan—Suffix "able"

   Examples: Unbreakable (Y)
   Stable (N)
   Responsible (N)

   Need: Word Scan Sheet 5m

Lesson 5 First Part of Autobiography (adapted from Berninger & Abbott, 2003)

Text PWRR Strategy Say, *"Today you are going to use the Plan, Write, Review, and Revise strategy to write part one of a two-part autobiography (the story of your life written by you). Sometimes you have to write over longer stretches of time than one session. Today you will write about your life up until now. Look at the ceiling."* good listener points

PLANNING

Say, *"Try to remember as many events as you can before you went to school. Think of events you remember and ones your family has told you about. Good writing draws on information in your memory as well as your imagination. Now think about events after you came to school. Scratch your elbow."*

Graphic Organizer for Individual Student. *Use the Event Plan to write down as many things as you can remember. Then think more about each of these events and details you might add about them. Then think about what else you would like to share about your life up until now. Make some notes about those ideas."*

WRITING THE FIRST DRAFT

Say, *"Now write a story titled "My Life Before I Started School and During School Up Until Now." It is important that you write for 15 minutes. Remember that the first draft does not have to be perfect. Concentrate on generating your ideas and filling in the details in your plans. Use the Event Plan to write down as many things as you can. Rub your left knee. Search your memory. Good writing draws from your memory banks. Then think more about each of these events and details you might add about them. Then think about what else you would like to share about your life since you started school. Make some notes about those ideas."* If any student stops writing before 15 minutes, say, "What else can you think of? Reread what you have written already and think of something else to say."

REVIEWING AND REVISING for Lesson 4 Composition

Feedback: Teachers give children feedback on sentence construction, sentence organization, and word choice from Lesson 4 composition. Teachers and students set realistic writing goal for improving one of these in next composition.

Teacher-led Reflective Discussion. Say *"Now we will read our stories silently and then I will cue you with one prompt at a time to think about how you might change the story to make it better."*

Ask each of these questions in this order and allow children time to make the relevant revisions before proceeding to the next question. Children make notes on their original draft to use when they compose later at the computer. If necessary, teacher models how to add ideas, rewrite sentences, and change words.

1. Can you think of sentences to add to make it better?
2. Can you think of ways to improve the sentences, for example, by adding or subtracting words or replacing words?
3. Can you think of a better choice for specific words you have used?
4. Did you misspell any words? Circle each word you misspelled or are uncertain of the spelling. We will fix those if necessary."
5. Is the capitalization and punctuation correct for each sentence?

Using keyboard and word processing program to enter revised draft. Teacher assists students in entering the revised draft. Teachers show them how to use relevant features of word processing program for text entry. Students can refer to their notes on the first draft and make additional revision. Students also receive feedback on their revised drafts using the same criteria and teacher rating scale as for the feedback on their first drafts.

Lesson 6

1. **Phonology Attention:** Card Sort—/sh/ **anywhere** in word

   Examples: Wish (Y)
   Chauffer (Y)
   Suspicion (Y)
   Misheard (N)

   Need: Card Set 6p

Example "misheard" shows that "sh" does not always make the /sh/ sound. If you want, you can note that this only happens at syllable breaks. Also, included are some examples of several spellings of /sh/, but there are other spellings of /sh/ in the cards. They should focus on the sound.

2. **Orthography Attention:** Card Sort—"cl" **and** "u" **anywhere** in word

   Examples: Clue (Y)
   Outclass (Y)
   Classic (N)

   Need: Card Set 6o

Make sure they understand the "cl" has to be together, with no letters in between (i.e., a blend), but it doesn't have to be together with the "u." Might need to write the criteria on the board, with "cl" on one line and the "u" on another line. Examples should clarify this.

3. **Morphology Attention:** Word Scan—Prefix "re"

   Examples: Rewind (Y)
   Renter (N)

   Need: Word List 6m

Mention that the meaning of prefix "re" is usually "to do something again," which can be a clue to prefix v. non-prefix. This can be tricky though, as in "remove," which is one of the words on the scan sheet.

Lesson 6 Second part of Autobiography (adapated from Berninger & Abbott, 2003)

Text PWRR Strategy Say, *"Today you will use the Plan, Write, Review, and Revise strategy to continue telling your life story. Today we will write about your life in the future, in middle school, high school, and after you are out of school, as you imagine it. Scratch your left eyebrow good listener points."*

PLANNING

Say, *"Try to imagine your life in high school, and after high school."*

Graphic Organizer for Individual Student. *Use the Autobiography Part 2 plan sheet to write down as many things as you can about what life might be like. Then think more about each of the possibilities and details about them that you might add. Make some notes about those ideas. Tap your right toe.good listener points"*

WRITING THE FIRST DRAFT

Say, *"Now Write a story titled "My Life In the Future". It is important that you write for 15 minutes. Remember that the first draft does not have to be perfect. Concentrate on generating your ideas and filling in the details in your plans. Look at the door."* If any student stops writing before 15 minutes, say, "What else can you think of? Reread what you have written already and think of something else to say."

Teacher-led Reflective Discussion. Say *"Now we will read our stories silently and then I will cue you with one prompt at a time to think about how you might change the story to make it better."*

Ask each of these questions in this order and allow children time to make the relevant revisions before proceeding to the next question.

1. Can you think of sentences to add to make it better?
2. Can you think of ways to improve the sentences, for example, by adding or subtracting words or replacing words?
3. Can you think of a better choice for specific words you have used?
4. Did you misspell any words? Circle each word you misspelled or are uncertain of the spelling. We will fix those if necessary."
5. Is the capitalization and punctuation correct for each sentence?

Using keyboard and word processing program to enter revised draft. Teacher assists students in entering the revised draft. Students can refer to their notes on the first draft and make additional revision. Students also receive feedback on their revised drafts using the same criteria as for the feedback on their first drafts.

Lesson 7

1. **Phonology Attention:** Listen—Begins with /r/ **and** ends with /k/

   Examples: Rock (Y)
   River (N)
   Sick (N)

   Need: Word List 7p
   Chips

2. **Orthography Attention:** Word Scan—"ou" **anywhere** in word **but no** "d" **anywhere** in word

   Examples: House (Y)
   Hose (N)
   Pound (N)

   Need: Word Scan Sheet 7o

3. **Morphology Attention:** Card Sort (three piles)—a) Suffix "er" meaning "one who does something"; b) Suffix "er" used to compare; c) "er" not a suffix

   Examples: Renter (a)
   Bigger (b)
   Under (c)

   Need: Card Set 7m

Tell the students that there is one tricky word in the cards because it could go in more than one pile and that if they notice it, they can keep it separate from the other piles. The word is "cleaner," which could go in either first or second pile.

Lesson 7 Revising and Combining the Two Parts of the Autobiography (Adapted from Berninger & Abbott, 2003)

Remind students of the PWRR strategy for writing and ask them to tell you how far they got with Part 2 of their autobiographies last time. Tell them that we will continue revising them in a special way today, by putting the two parts together.

Getting Ready to Publish: Say, *"Today we are going to put together the chapters in your autobiography to tell your whole life story. Good writers learn to put together what they have written over time. Sometimes they publish their work to share with others. Scratch your ear.good listener points"*

Planning

Say, *"Think about how you are going to piece together the two parts. Can you write some sentences to help the reader go from what you have written in the first chapter to what will be in the next chapter?"*

Drafting

Say, *"Add those sentences to help glue together the chapters. Tap your right toe."*

Reviewing and Revising

Say, *"You can combine both parts of your autobiography and print it on the computer. Look at the ceiling. Carefully read and review each part and the connections between them and make any final revisions you wish. At this stage, you may want to share your life's story with one of the other participants in our Writers' Workshop. Remember when you are hearing another student's work, first tell something you like about the paper, and then suggest something to change to make it better.*

Illustrating

You may wish to add some photographs your family has taken of you in addition to your hand drawn illustrations for your completed autobiography.

Getting Ready to Publish: Teachers provide feedback and suggestions for revision and further development of the story.

Preparation for Final Session: Tell the students that for our final meeting next time, everyone will pick their favorite piece of writing from these lessons and polish it to share with the class.

Lesson 8

1. **Phonology Attention:** Listen—Both /n/ and short /a/ anywhere in word

   Examples: Nap (Y)
   And (Y)
   Newscast (Y)
   Never (N)

   Need: Word List 8p
   Chips

Make sure they understand that the /n/ and the /a/ don't have to be together in the word and don't have to be in any particular order or placement in the word.

2. **Orthography Attention:** Word Scan—"sh" **or** "ch" anywhere in word **but no** "e" anywhere in word

   Examples: Push (Y)
   Chimp (Y)
   Ache (N)
   Shove (N)

   Need: Word Scan Sheet 8o

3. **Morphology Attention:** Listen—Suffix "ed" pronounced /t/

   Examples: Laughed (Y)
   Lift (N)

   Need: Word List 8m
   Chips

1. **Put the following three words on the board: Wait, Yell, Pick.**
2. **Ask, "What suffix do we have to add to these words to make them past tense" (or use something like, "to show they happened yesterday").**
3. **Add the "ed" to the words, then say that we pronounce this suffix three different ways. For "waited," we pronounce it /ed/ (that's with a schwa, not a short /e/!! For "Yelled," we pronounce it /d/, but for "Picked," we pronounce it /t/. You might want to emphasize this by trying to pronounce the words with the wrong sound for "ed," e.g., /yelt/, /yell-ed/, etc.**
4. **Tell them, "Even though we pronounce the past tense suffix three different ways, we still spell it "ed."**
5. **Give criteria for today's Listen task. They are to put out a chip for words that have the suffix "ed" pronounced /t/. There won't be any suffix "ed" words with either of the other two pronunciations, but there will be other words that end with /t/. Say examples out loud (Laughed, Lift).**

Lesson 8: Final Polishing

Review the PWRR strategy. Compliment students on how much progress they have made. *"All of you are writing much more and adding in more ideas in your writing. Look at the ceiling. good listener points For our last session, we would like for everyone to be able to hear examples of the writing the group has been doing. Look through your writing folder and, with your teacher, decide on one composition you would like to share. Look at the door.good listener points Your teacher will help you write it on the computer during the first part of our session. For the last part of this session, we will come back to this classroom and one of the teachers will read the compositions aloud. You do not have to tell which one is yours if you do not want to."*

APPENDIX B: ATTENTION BRIDGE LESSON ACTIVITIES

Phoneme Attention

Lesson	Task	Example	Targets/Text	Distracters
1	Listen: Initial sound /b/	Beautiful (Y) Purple (N)	1. Black 2. Bored 3. Break 4. Bicycle 5. Breakfast 6. Biology 7. Bitter 8. Battery 9. Big	10. Delicate 11. Deer 12. Puzzle 13. Pig 14. Date 15. Potato 16. Duck 17. Danger 18. Pack 19. Pencil 20. Sheep 21. Cabin 22. Graph 23. Rabbit 24. Narrow 25. Layer 26. Sort 27. Shot 28. Musical 29. Climate 30. Tune 31. Handle 32. Noise 33. Width 34. Jaws 35. Impression 36. Aim 37. Frost 38. Jacket 39. Skip 40. Victory
2	Word Scan: long /i/		1. Bike 2. Nice 3. Shine	24. Baby 25. Bird 26. Dirty

			4. Knife 5. Write 6. Inside 7. Polite 8. Spider 9. Beside 10. Describe 11. Fight 12. Night 13. High 14. Tonight 15. Daylight 16. Rely 17. Sky 18. Goodbye 19. Dry 20. Cried 21. Pie 22. Kind 23. blind	27. Girl 28. Skirt 29. Circus 30. Thirsty 31. Birthday 32. Whirlwind 33. Sticker 34. Sister 35. Bridge 36. Glitter 37. Slippers 38. Switch 39. Waiting 40. Shrimp 41. Sting 42. Boil 43. Wrist 44. Priest 45. Against 46. Dentist 47. Noisy 48. Into 49. Beautiful 50. Instead 51. Wiggle 52. Beginning 53. Magic 54. Thankful 55. Crawl 56. Museum 57. Reason 58. Planet 59. Discover 60. Enough 61. Precious 62. Nation 63. Several 64. Unusual 65. Hour 66. Escape 67. Soup 68. Enemy 69. Either

				70. Remember
3	Listen: /oy/ anywhere in word	Boil (Y) Bowl (N)	1. Coin 2. Noise 3. Voice 4. Spoiling 5. Poison 6. Moisture 7. Choices 8. Appoint 9. cowboy 10. Joyful 11. Point	12. Owl 13. Scowl 14. Glowing 15. Snowflake 16. Growth 17. Normal 18. Morning 19. Storm 20. Crowd 21. Clown 22. Hopping 23. Preschool 24. Goodness 25. Around 26. Should 27. Bookmark 28. Wooden 29. Compound 30. Broken 31. Control 32. Pouring 33. Doubt 34. Louder 35. Couch 36. Grown 37. Coast 38. Caught 39. Meadow 40. Approach
4	Card Sort: /j/ anywhere in word	Giraffe (Y) Jeep (Y) Bridge (Y) Gate (N)	1. Giant 2. Janitor 3. Jellybeans 4. Danger 5. Cage 6. Fudge 7. Magic 8. Enjoy 9. Pages 10. Edge 11. Garbage 12. Large 13. Orange	14. Grasshopper 15. Goat 16. Gardener 17. Gallon 18. Gorilla 19. Giggle 20. Golden 21. Ghostly 22. Bigger 23. Doghouse 24. Beginner 25. Finger 26. Soggy

				27. Kangaroo 28. Again 29. Shaggy 30. Hotdog 31. fright 32. Handbag 33. Spring 34. Forget 35. Wiggle 36. Jog 37. Group 38. Zigzag 39. Writing 40. Might
5	Word Scan: /s/ anywhere in word	Sing (Y) Circle (Y) Face (Y) Bees (N)	4. Sister 5. Skate 6. Circus 1. Summer 2. City 3. Center 4. Racing 5. Castle 6. Bicycle 7. Glasses 8. Voices 9. Listen 10. Crossing 11. Fancy 12. Faster 13. Nicer 14. House 15. Pillowcase 16. Shoelace 17. Tennis 18. Place 19. Chase	20. Noise 21. Crunch 22. Caterpillar 23. Cowboy 24. Cover 25. Canyon 26. Cheese 27. Crackle 28. Boys 29. Cute 30. Electric 31. Vocal 32. Sugar 33. Shadow 34. Wishbone 35. Fashion 36. Fresh 37. Washing 38. Eyelash 39. Enjoys 40. Days 41. Tries 42. Become 43. Because 44. Unicorn 45. Carry 46. Nickname 47. Locker

				48. Teach 49. Tear 50. Club 51. Tight 52. Arrow 53. Barn 54. Familiar 55. Neither 56. Popular 57. Twenty 58. Gain 59. Quarter 60. Apart 61. Judge 62. Title 63. Curve 64. Frame 65. Writer 66. Fixed 67. Hungry 68. Wings 69. Movement 70. Pole 71. Branches 72. Thick
6	Card Sort: /sh/ anywhere in word	Wish (Y) Chauffer (Y) Suspicion (Y) Misheard (N)	1. Ship 2. Fish 3. Shopper 4. Wishful 5. Shallow 6. Shadow 7. Sheriff 8. Sugar 9. Chef 10. Special 11. Dishwasher 12. Shocking 13. Machine 14. nation	15. Dishonest 16. Mishap 17. Match 18. Chill 19. Peaches 20. Teacher 21. Rancher 22. Kitchen 23. Doghouse 24. Author 25. Anything 26. Something 27. Father 28. Brother 29. Household 30. School

				31. Thousand 32. Less 33. Mistake 34. Beside 35. Sight 36. Sign 37. Surprise 38. President 39. Grasshopper 40. Somehow
7	Listen: Initial /r/ + final /k/	Rock (Y) River (N) Sick (N)	1. revoke 2. Rack 3. Rake 4. Rank 5. Rink 6. Risk 7. Wreck 8. Reek 9. Relic 10. Republic 11. Romantic 12. Rhythmic 13. Rustic 14. Rattlesnake	15. React 16. Race 17. Rain 18. Radio 19. Ribbon 20. Rodeo 21. Rattle 22. Rocket 23. Record 24. Ranch 25. Wrinkle 26. Rubbish 27. Ridiculous 28. Brick 29. Elastic 30. Shark 31. Dislike 32. Mistake 33. Wings 34. Movement 35. Exciting 36. Branches 37. Consider 38. Position 39. Fruit 40. loud
8	Listen: Both /n/ and /a/ anywhere in word	Nap (Y) And (Y) Newscast (Y) Never (N) Cat (N)	1. Handle 2. Man 3. Dance 4. Demand 5. Captain 6. Plant	13. Seven 14. Many 15. Round 16. Behind 17. Sunshine 18. Window

			7. Kneecap 8. Happen 9. Napkin 10. National 11. Wagon 12. Nomad	19. Needle 20. President 21. Question 22. Market 23. Contain 24. Number 25. Nickname 26. Nature 27. Last 28. Backward 29. Trail 30. Stream 31. Snake 32. Rooster 33. Treasure 34. Hero 35. Impossible 36. Receive 37. Program 38. Favorite 39. Plateau 40. muscle

Orthographic Attention

Lesson	Task	Example	Targets/Text	Distractors
1	Card Sort: Begins with "gl"	Glass (Y) Grass (N)	1. Glue 2. Glamour 3. Glad 4. Glacier 5. Glide 6. Global 7. Glove 8. Glory 9. Gloss 10. Glimpse 11. Glitter 12. Gladiator	13. Grace 14. Grand 15. Goal 16. Gild 17. Giant 18. Germ 19. Geography 20. Gate 21. Galaxy 22. Good 23. Grape 24. Grandfather 25. Gull 26. Grin 27. Ground 28. Teach 29. Tears 30. Club 31. Tight 32. Arrow 33. Barn 34. Familiar 35. None 36. Flew 37. Trap 38. Neither 39. Popular 40. Twenty
2	Word Scan: Ends with "rd"	Card (Y) Cared (N) Cart (N)	41. Forward 42. Award 43. Blackboard 44. Misheard 45. Card 46. Herd 47. Toward 48. Sword 49. Bird 50. Mustard 51. Hard	57. Stride 58. Blurred 59. Bored 60. Hired 61. Learned 62. Stared 63. Stirred 64. Whirred 65. Misread 66. Cared 67. Admired

			52. Discard 53. Guard 54. Backyard 55. Regard 56. Word	68. Glared 69. Hide 70. Hired 71. Garden 72. Sort 73. Distort 74. Hand 75. Blend 76. Upend 77. Surrender 78. Depend 79. Scarred 80. Drummer 81. Pardon 82. Partner 83. Guess 84. Silent 85. Trade 86. Rather 87. Compare 88. Crowd 89. Poem 90. Enjoy 91. Elements 92. Indicate 93. Except 94. Expect 95. Flat 96. Seven 97. Interesting 98. Sense 99. String 100. Blow 101. Famous 102. Value 103. Wings 104. Movement 105. Pole 106. Exciting 107. Branches 108. Blood 109. Fruit 110. Position

3	Word Scan: "st" anywhere in word	Mister (Y) Stink (Y) Outshine (N) Something (N)	1. almost 2. blister 3. dentist 4. dishonest 5. exist 6. faster 7. first 8. frosty 9. ghost 10. guest 11. mistake 12. rooster 13. sister 14. Stable 15. Stairs 16. Stamp 17. sting 18. stool 19. straight 20. stream 21. castle	22. satisfy 23. snake 24. sailor 25. singer 26. servant 27. situation 28. babysitter 29. tennis 30. assemble 31. message 32. glasses 33. salad 34. skater 35. mask 36. slouch 37. sleigh 38. carelessly 39. asleep 40. Wishful 41. Shallow 42. Sugar 43. Special 44. Dishwasher 45. Nation 46. Teaspoon 47. Tablet 48. Turtle 49. Cotton 50. Fighting 51. Actor 52. Eight 53. Beautiful 54. outside 55. Itself 56. Saltshaker 57. Scatter 58. Chair 59. Segment 60. Sheet 61. Sample 62. Composer 63. Protect

				64. Band 65. Press 66. Range 67. Season 68. Proper 69. Silver 70. Happiness
4	Card Sort: "ei" anywhere in word	Neither (Y) Tried (N) Getting (N)	1. either 2. Weigh 3. Neighbor 4. Receive 5. Their 6. Ceiling 7. Weird 8. Deceive 9. Eight 10. Height 11. Foreign	12. Friend 13. Priest 14. Brief 15. unbelievable 16. Niece 17. Thief 18. Scientist 19. Relieved 20. Patient 21. Audience 22. Enemies 23. Libraries 24. Review 25. Beautiful 26. Fast 27. Several 28. Hold 29. Himself 30. Toward 31. Step 32. Morning 33. Passed 34. Vowel 35. True 36. Hundred 37. Against 38. Pattern 39. Numerical
5	Card Sort: ends with "le"	Needle (Y) Barrel (N)	1. Angle 2. Bicycle 3. Marble 4. Turtle 5. Handle 6. Stable 7. Jungle	14. Angel 15. Camel 16. Cancel 17. Channel 18. Ignite 19. Opposite 20. inside

			8. Middle 9. Noodle 10. People 11. Single 12. Title 13. Whistle	21. Gravel 22. Jewel 23. Nickel 24. Quarrel 25. Shovel 26. Squirrel 27. Tunnel 28. Vowel 29. Level 30. Panel 31. Shrivel 32. Sister 33. Oxygen 34. Plural 35. Various 36. Agreed 37. Wrong 38. Chart 39. Pretty 40. Solution 41. Afraid 42. Suffix
6	Card Sort: "cl" + "u" anywhere (not necessarily together)	Clue (Y) Outclass (Y) Classic (N)	1. Clause 2. Cleanup 3. Closure 4. Cloud 5. Club 6. Clumsy 7. Clutch 8. Clutter 9. Conclusion 10. Include 11. Nuclear 12. Unclassified 13. uncle 14. Unclear	15. Cleaner 16. Clown 17. Clock 18. Closet 19. Eclipse 20. Climb 21. Clever 22. Bicycle 23. Disclose 24. Eclipse 25. Outhouse 26. Uncaring 27. Crutch 28. Uphill 29. Scour 30. Tunnel 31. Attempt 32. Avoid 33. Pleasant 34. Rubbed 35. Stamp

				36. Blanket 37. Prince 38. Exist 39. Sports 40. Destroyed
7	Word Scan: "ou" but not "d"	House (Y) Hose (N) Pound (N)	1. Outrun 2. Shouting 3. Counting 4. Couch 5. Ouch 6. Scout 7. Sprout 8. Foul 9. Mouthful 10. Thoughtful 11. Cough 12. Fought 13. Fourth 14. Sources 15. Flour 16. Sour 17. Roughly 18. Although 19. trouble	20. Outside 21. Could 22. Would 23. Should 24. Cloudy 25. Found 26. Ground 27. Proudly 28. Round 29. Sound 30. Loudly 31. Hound 32. Wound 33. Doubt 34. Fowl 35. Cowardly 36. Town 37. Crowned 38. Poured 39. Grown 40. Throwing 41. Bowl 42. Showed 43. Glow 44. Flown 45. Coast 46. Throat 47. Soaking 48. Caught 49. Taught 50. Pause 51. Laughing 52. Trip 53. Whole 54. Surprise 55. Exactly 56. Remain

				57. Dress 58. Iron 59. Fingers 60. Least 61. Catch 62. Climbed 63. Wrote 64. President 65. Double 66. Cool 67. Lost 68. Symbols 69. Wear 70. Save 71. Experiment 72. Engine
8	Word Scan: "sh" or "ch" but not "e"		1. Shack 2. Shout 3. Shadow 4. Fashion 5. Wishing 6. Punishing 7. Paintbrush 8. Splash 9. Polish 10. Furnish 11. Nourish 12. Vanish 13. Foolish 14. Champion 15. Child 16. Charcoal 17. Watching 18. Ditch 19. Coach 20. Crunch 21. Starch 22. Approach 23. mismatch	24. Reaching 25. shepherd 26. shopper 27. shield 28. shoelace 29. fisherman 30. eyelash 31. outshine 32. punishment 33. selfish 34. sunshine 35. shellfish 36. chief 37. cheater 38. cheerful 39. chapter 40. teacher 41. hatchet 42. matches 43. richest 44. research 45. stench 46. beach 47. cheese 48. machine 49. stood

				50. plane 51. system 52. behind 53. round 54. boat 55. brought 56. understand 57. filled 58. among 59. power 60. cannot 61. property 62. particular 63. swim 64. current 65. shoulder 66. industry 67. block 68. spread 69. company 70. cattle 71. action 72. capital

Morphology Attention

Lesson	Task	Example	Targets/Text	Distractors
1	Word Scan: Suffix "ing"	Running (Y) Ring (N)	4. Thinking 5. Boring 6. Exciting 7. Running 8. Happening 9. Telling 10. Spelling 11. Pretending 12. Amazing 13. Enjoying 14. Bringing 15. Baking 16. Hopping 17. Stopping 18. Skating 19. Sliding 20. Waving 21. Moving 22. Swimming 23. Hoping	24. Sting 25. Something 26. Sing 27. Bring 28. Anything 29. Spring 30. Drink 31. Night 32. Assign 33. Begin 34. Align 35. Strange 36. Foreign 37. Grinned 38. Managed 39. Mighty 40. Gradually 41. Passenger 42. Goodnight 43. Fight 44. Definition 45. Excited 46. Jungle 47. Ignite 48. Organization 49. Negative 50. Singular 51. Signed 52. Magazine 53. Shown 54. Minutes 55. Strong 56. Verb 57. Stars 58. Front 59. Inches 60. Street 61. Decided 62. Contain

				63. Course 64. Surface 65. Produce 66. Ocean 67. Carefully 68. Scientist 69. Inside 70. Wheels 71. Island 72. Machine 73. Stood
2	Card Sort: Suffix "ly"	Normally (Y) Happily (Y) Rally (N)	4. Naturally 5. Easily 6. Sadly 7. Angrily 8. Quickly 9. Slowly 10. Excitedly 11. Lonely 12. Friendly 13. Loudly 14. Hopefully 15. Cowardly	16. Silly 17. Sly 18. Housefly 19. Rely 20. Bully 21. Ugly 22. Turtle 23. Handle 24. Employ 25. Destroy 26. City 27. Exciting 28. Dangerous 29. Happy 30. Dismal 31. Cattle 32. Hoping 33. Started 34. Bendable 35. Nutrition 36. Teacher 37. Lengthen 38. Larger 39. Boasted 40. Corner 41. Waiter 42. Throwing 43. Louder

3	Card Sort: Prefix "dis"	Disbelieve (Y) Dissolve (N)	1. Dislike 2. Disappear 3. Disable 4. Disprove 5. Discontinue 6. Disagree 7. Disobey 8. Dishonest 9. Disappoint 10. Distract 11. disinfect	12. Dishes 13. Diskette 14. Dismal 15. Distance 16. Distinct 17. Disturb 18. disease 19. Dentist 20. Daughter 21. Different 22. Dictionary 23. Dangerous 24. Dense 25. Segment 26. Chair 27. Composer 28. Dream 29. Protect 30. Range 31. Season 32. Spend 33. Proper 34. Silver 35. Leader 36. Guide 37. Multiply 38. Continent 39. Promised 40. Handle
4	Listen: Suffix "en"	Darken (Y) When (N)	4. Frighten 5. Tighten 6. Shorten 7. Flatten 8. Straighten 9. Brighten 10. Lengthen 11. Soften 12. Quicken 13. Sadden 14. Broken	15. Garden 16. Then 17. Kitchen 18. Even 19. Fishermen 20. Chicken 21. Eleven 22. Linen 23. listen 24. Engine 25. Cartoon 26. Machine 27. Satin

				28. Telephone 29. recent 30. attending 31. System 32. Depend 33. Stamp 34. Rubbed 35. Blanket 36. Destroyed 37. Composed 38. Needle 39. Honor 40. Successful 41. Buffalo 42. Yelled 43. lungs
5	Word Scan: Suffix "able"	breakable (Y) Audible (N) table (N)	1. Acceptable 2. Agreeable 3. Changeable 4. Dependable 5. Desirable 6. Excusable 7. Laughable 8. likable 9. Lovable 10. Manageable 11. Perishable 12. Predictable 13. Profitable 14. Readable 15. Reasonable 16. Remarkable 17. Unbreakable 18. Valuable 19. Washable	20. Stable 21. Cable 22. Fable 23. Edible 24. Visible 25. Terrible 26. Possible 27. Horrible 28. Eligible 29. Legible 30. Graceful 31. Natural 32. Unstable 33. Education 34. Separation 35. Profession 36. Affection 37. Respectful 38. Moisten 39. Future 40. Nature 41. Jumping 42. Unwinding 43. Elevation 44. Teacher 45. Held

				46. Describe 47. Speaking 48. Appearance 49. Either 50. Village 51. Factors 52. Result 53. Outside 54. Everything 55. Pushed 56. Baby 57. Century 58. Already 59. Laughed 60. Nation 61. Themselves 62. Bright 63. Everyone 64. Method 65. Section 66. Lake 67. Within 68. Dictionary 69. Amount 70. Pounds 71. Although 72. Broken
6	Word Scan: Prefix "re"	Reattach (Y) Reach (N)	1. Reappear 2. Rearrange 3. Rebuild 4. Recheck 5. Recopy 6. Recount 7. Redial 8. Rediscover 9. Redo 10. Refold 11. Reinstall 12. Relocate 13. Remove	23. Reading 24. Ready 25. Renter 26. Really 27. Reasonable 28. Redhead 29. Reeling 30. Resting 31. Restaurant 32. Rabbit 33. Racehorse 34. Racket 35. Radio

			14. Renew 15. Renumber 16. Reorganize 17. Repay 18. Resell 19. Resettle 20. Rewash 21. Rewind 22. Rewrite		36. Railroad 37. Random 38. Rattle 39. Ribbon 40. Right 41. Ripen 42. River 43. Rocky 44. Rodent 45. Romantic 46. Rotten 47. Rough 48. Bill 49. Felt 50. Suddenly 51. Test 52. Direction 53. Center 54. Farmers 55. Anything 56. Divided 57. General 58. Energy 59. Subject 60. Moon 61. Include 62. Built 63. Matter 64. Square 65. Syllable 66. Perhaps 67. Dark 68. Material 69. Special 70. Heavy 71. Circle 72. summer
7	Card Sort: a) suffix "er" meaning "person who does	Renter (a) Bigger (b) Under (c)	1. Helper 2. Teacher 3. Runner 4. Baker 5. Dancer	15. Smarter 16. Tougher 17. Slower 18. Prettier 19. Luckier	30. Finger 31. Corner 32. Deer 33. Oyster 34. Soccer

	something," b) Suffix "er" used to compare, and c) "er" not a suffix NOTE: "Cleaner" can go in either suffix pile		6. Explorer 7. Learner 8. Drummer 9. Jogger 10. Employer 11. Farmer 12. singer 13. Bowler 14. Traveler	20. Quicker 21. Louder 22. Easier 23. Older 24. Younger 25. Sleepier 26. Cleaner 27. Wider 28. Happier 29. smaller	35. Flower 36. Wonder 37. Temper 38. Monster 39. Thunder 40. summer
8	Listen: "ed" pronounced /t/	Hopped (Y) Rat (N)	4. Watched 5. Jumped 6. Stopped 7. Pushed 8. Splashed 9. Touched 10. Laughed 11. Stuffed 12. Kicked 13. Walked 14. Worked 15. Unlaced 16. Possessed 17. Wished		18. Athlete 19. Acrobat 20. Root 21. Weight 22. Minute 23. Wallet 24. Exit 25. Donate 26. Imitate 27. Light 28. Straight 29. First 30. Start 31. Want 32. Segment 33. Chair 34. Camp 35. Dream 36. Protect 37. Press 38. Range 39. Season 40. Spend 41. Proper 42. Silver 43. Leader

VITA

Belle Chenault was born in Decatur, Alabama, where she lived throughout her childhood and youth, and graduated from Decatur High School. She earned a Bachelor of Arts Degree in English, with minors in Music and History, from Northwestern University in Evanston, Illinois. Following graduation, she returned to Alabama and taught music and English at John Carroll High School in Birmingham, Alabama for two years. She then moved to Seattle, where she earned the degree Master of Music in Choral Conducting from the University of Washington. She taught music and other subjects in the public schools of Seattle, Washington, for three years, and in Bellevue, Washington, for seven years.

She returned to the University of Washington to earn a Master of Education degree with certifications in School Psychology and School Counseling, and was a school psychologist and school counselor in the Bellevue School District for seventeen years. In connection with her Ph.D. work, she completed a clinical internship at Children's Hospital in the Psychiatry and Neuropsychology departments. In 2004, she earned the degree Doctor of Philosophy in Educational Psychology and began a postdoctoral internship at the Center for Human Development and Disability (CHDD) at the University of Washington.

She is co-author of Thomson, J., Chenault, B., Abbott, R., Raskind, W. H., Richards, T., Aylward, E., & Berninger, V. (2004) Converging Evidence for Attentional Influences on the Orthographic Word Form in Child Dyslexics, to appear in a special issue on dyslexia in the Journal of Neurolinguistics.