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# An Evaluation of the Dyslexia Training Program: A Multisensory Method for Promoting Reading in Students with Reading Disabilities

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**Abstract**

The development of reading and spelling skills in students with dyslexia, by definition, is delayed and often remains delayed despite years of instruction. Three qualities are thought to facilitate reading development in these children: the provision of a highly structured phonetic-instruction training program with heavy emphasis on the alphabetic system, drill and repetition to compensate for short-term verbal memory deficits, and multisensory methods to promote nonlanguage mental representations. The Dyslexia Training Program, a remedial reading program derived from Orton-Gillingham methods, embodies these qualities. Following their 2-year program, students displaying dyslexia demonstrated significantly higher reading recognition and comprehension compared with a control group. The two groups did not differ in spelling. In addition, the degree of improvement in reading demonstrated by students who received the Dyslexia Training Program by videotape and by those who received it live from instructors did not differ.

Dyslexia is a language learning disorder that results in deficits in reading, spelling, and, often, written language. Students who evidence dyslexia have adequate general cognitive ability but manifest considerable difficulty in learning to read via conventional instruction (Critchley, 1970). According to the National Joint Committee for Learning Disabilities, this disorder is "intrinsic to the individual and presumed to be due to central nervous system dysfunction" (Hammill, Leigh, McNutt, & Larsen 1981, p. 336).

A substantial body of research examining the neurocognitive basis of dyslexia (Pennington, 1991) shows word recognition to be the locus of difficulty in dyslexia and the strongest predictor of reading comprehension (Perfetti, 1985; Stanovich, 1980). The primary difficulty with word recognition in students with developmental dyslexia is based in a deficit in their phonological coding-the process of translating subvocal units of print into sound (Van Orden, 1991). Students with dyslexia have difficulty with phonics (i.e., the ability to sound out words), making reading less automatic and slower, thus interfering with their reading comprehension. Also, deficits in phonics make spelling considerably less accurate and automatic. The close relationship between reading and spelling exists because students use the same phonological code in different directions. When reading, one moves from letters to phonological representations; when spelling, one moves from phonological representations to letters.

Problems associated with translating print to sound are assumed to be associated with a heritable deficit (Olson, 1989) in phonemic awareness (i.e., the ability to count or manipulate speech sounds below the syllable level). Children's phonemic awareness ability is the strongest language-related predictor of success in reading and correlates highly with reading ability through 12$^{th}$ grade (Calfee, Lindamood, & Lindamood, 1993). There is strong evidence that phonemic awareness and phonological coding, related processes in oral and written language, constitute the primary or core deficit in dyslexia. Despite the primacy of phonemic awareness and phonological coding, related neurocognitive processes also may influence reading ability and its prognosis. A high proportion of students with dyslexia, along with their phonological weaknesses, exhibit dysfunction in other aspects of speech and language development (Denckla, Rudel, & Broman, 1981). This finding has led some investigators to suggest that dyslexia is best conceptualized as a class of developmental language disorders. Problems in verbal short-term working memory (Torgesen, Wagner, Simmons, & Laughon, 1990) and name retrieval (Wolf, 1991) may impede reading development.

Dyslexia often co-exists with an attention-deficit disorder, a condition that can interfere with reading performance and learning during instruction (Felton & Wood, 1984). Despite evidence that mild and moderate visual-perceptual deficiencies are an uncommon cause of reading problems, the progress of disabled

readers may depend in part on their ability to utilize visual-orthographic knowledge (Foorman & Liberman, 1989). Visual processing also may contribute to dyslexia-related spelling errors by interfering with access to or retrieval of the visual details in words (Firth, 1983). Strengths in higher order cognition (e.g., the ability to reflect on one's own thinking, to learn and apply rules flexibly) would be expected to help students with dyslexia to compensate for their phonological deficits.

Implications for remedial instruction for students with dyslexia can be drawn from the preceding review. First, they need highly structured phonetic-instruction training with a heavy emphasis on the alphabetic system. To compensate for deficits in verbal working memory, they need drill and repetition. Also, multisensory presentations will help anchor verbal information through nonlanguage mental representations. Learning objectives should be highly sequential because the logic of language structures may escape these students. Comprehension and metacognitive processes need to be taught to assist these students in the conscious use of language rule systems to guide their reading and spelling. The Orton-Gillingham instructional methods are based on these theoretic premises.

### *Remedial Intervention Studies*

Reviews of the treatment literature on developmental dyslexia reveal a limited number of scientifically sound and clinically relevant reports of significant treatment effects. The consensus among general field studies favors decoding over whole word approaches and suggests that students with dyslexia can acquire word-identification skills when taught using structured phonics techniques (Clark, 1988; Mather, 1992). Some of the best of these studies are flawed due to lack of adherence to accepted experimental methods, as well as to teacher bias (Wise, 1991). Many community-based studies reflect other basic flaws in methodology and often lack control groups (Clark, 1988). Short-term intervention studies in laboratory settings allow relatively tight control but do not yield results that easily generalize to long-term application in school settings (Lovett, Warren-Chaplin, Ransby, & Borden, 1990; Vellutino & Scanlon, 1987). Some professionals still doubt that the phonological deficits in dyslexia respond positively to instruction in phonology-dependent skills, including phonemic analysis and blending as well as letter-sound knowledge (Siegel, 1985).

### *The Treatment Program*

Alphabetic Phonics is a derivation of the Orton-Gillingham multisensory approach to teaching reading, writing, and spelling to children with dyslexia in small-group or one-to-one tutorial settings (Cox, 1985). As the name implies, Alphabetic Phonics stresses important characteristics of the English alphabet, especially phonology and letter sequence. Major emphasis is placed on teaching phonic skills for reading and spelling. The program began in the mid-1960's at Texas Scottish Rite Hospital and has expanded to several teacher training centers and numerous school districts across the United States.

Alphabetic Phonics is built upon Samuel Orton's theory that dyslexia is caused by neurophysiologic-based disabilities that may be helped by multisensory teaching techniques that provide linkages between the visual, auditory, and kinesthetic senses (Orton, 1937). Its theoretic support also can be found in more recent literature on reading development, including relationships of phonics instruction and phonologic processing to dyslexia (Pennington, 1991).

The Dyslexia Training Program (DTP), a recent adaptation of the Alphabet Phonics curriculum, also has its origins at Scottish Rite (Beckham & Biddle, 1989). The DTP core curriculum provides a cumulative series of 350 one-hour lessons starting with very basic abilities (e.g., letter recognition) and extending sequentially to sophisticated levels of linguistic knowledge (e.g, syllabicating and coding polysyllabic words). As they progress through the curriculum, students are taught an extensive vocabulary to apply to their language learning, code marks that indicate speech sounds, symbols plus abbreviations related to word decoding, and formulas for syllable division and spelling. Reading comprehension intervention begins after decoding skills

have reached a minimal level of accuracy and automaticity, as documented by criterion-referenced measures that are administered at seven intervals during the 2-year curriculum.

A videotape version of the DTP became available in 1987. It was designed to be supervised by a monitoring teacher who has not received extensive teacher training in dyslexia. The video version of the DTP has been distributed widely and is being used in more than 30 states and by more than 400 Texas school districts. Although the program has been well received by educators and parents and implemented widely with students with dyslexia, relatively little research has been conducted to validate the effectiveness of the Orton-Gillingham approach and its adaptations. The few evaluation studies of Alphabetic Phonics conducted have shown that it holds promise for improvements in reading and spelling when implemented in both individual and small-group settings (Clark, 1988; Frankiewicz, 1984; Hutcheson, Selig, & Young, 1990). However, the only study that used a control group and was published in a peer-reviewed journal was a summer program for college students with learning disabilities (Guyer & Sabatino, 1989). To date there has been no published evaluation study of the DTP.

## Method

Forty-eight students with dyslexia participated in this study. Twenty-two students (3 girls and 19 boys), assessed and identified by the Texas Scottish Rite Hospital for Children (TSRHC), constituted the experimental group. Twenty-six students (4 girls and 22 boys) identified by the Austin Neurological Clinic, The University of Texas's Learning Abilities Center, or the TSRHC, made up the control group. All students had Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974) Full Scale IQ scores above 90, had standard scores below 90 in reading achievement on the Word Recognition subtest of the Wide Range Achievement Test-Revised (WRAT-R; Jastak & Wilkinson, 1984), and demonstrated at least a 15 standard score discrepancy between their WISC-R Full Scale IQ and their Word Recognition WRAT-R. All students had normal or corrected vision and passed a pure-tone hearing screening. Students with acquired or congenital focal brain lesions or major emotional disturbances and those who were not native English speakers were excluded.

TABLE 1

Comparisons Between the Experimental and Control Groups at the Onset of Study

| | Experimental | | Control | | |
|---|---|---|---|---|---|
| | M | SD | M | SD | Difference |
| Age | 11 | 2 | 11 | 2 | NS |
| SES | 2.9 | 1.1 | 1.8 | 1.2 | $p < .05$ |
| Grade | 4.3 | 1.6 | 4.7 | 2.4 | NS |
| Ravens | 48 | 29 | 54 | 21 | NS |
| WISC-R | | | | | |
| VIQ | 100 | 11 | 99 | 9 | NS |
| PIQ | 108 | 9 | 109 | 11 | NS |
| FSIQ | 104 | 9 | 105 | 9 | NS |
| CELF-R SS | 20 | 17 | 43 | 26 | $p < .01$ |
| Word Rec. | 72 | 10 | 76 | 8 | NS |

*Note.* Age = age in years; SES = socioeconomic status on the Hollingshead; Ravens = Raven's standard Progressive Matrices (Raven et al., 1983) (total score); VIQ = Verbal IQ; PIQ = Performance IQ; FSIQ = Full Scale IQ; CELF-R SS = Clinical Evaluation of Language Functions, Screening Test-Revised (Semel & Wiig, 1980) standard scores; Word Rec. = word recognition.

Students in the control group were selected to provide a suitable match with those in the experimental group on intelligence, reading achievement, gender, age, grade, and socioeconomic status (SES). Diagnostic and demographic qualities that characterized the two groups prior to the beginning of the study were comparable except for oral language and SES (see Table 1).

Students in the experimental group attended reading classes at TSRHC. Such children typically do not have access to suitable school programs and/or lack financial resources to obtain private remediation services. Twelve students received the video-directed version of the DTP while the other 10 students received teacher-directed instruction in the DTP. The live and videotaped versions of DTP differed only in mode of presentation. The instructional content of each lesson and the nature of students' participation were identical. Students in each version were taught in groups of four and followed the same choral, listening, reading, spelling, and writing procedures. In the classrooms providing live teaching, a certified dyslexia therapist followed the same daily lesson plans as were presented by the therapist on television. The therapist in the videotape classrooms served only to redirect the students' attention and answer questions after the instructional hour. Videotapes served as their primary teacher.

Instruction was provided 5 days per week for approximately 10 months a year for 2 years. Approximately half of the experimental group's students began instruction the first year of the study and half began a year later. Differences between the two groups that began the program 2 years apart were not significant; thus, they were collapsed into a single group for all analyses. Fifteen experimental students received school-based reading assistance. The ancillary programs that they and the control group received are identified in Table 2. For all experimental students, the DTP was their primary form of reading instruction and their only code-emphasis method.

TABLE 2

Number of Students Who Received Ancillary Programs From Their School

| | DTP group | Control group |
|---|---|---|
| Chapter 1 | 1 | 0 |
| Content Mastery | 7 | 8 |
| Dyslexia | 4 | 1 |
| Learning disabilities | 7 | 6 |
| Resource room | 7 | 6 |

Students in the control group received reading instruction as normally provided in their schools. As can be expected, the nature of their instruction differed considerably. Most received modified basal reading programs. The educational objectives of the school-based reading programs were fewer in number and were more broadly stated, and the programs provided less continuous and sequential instruction and offered fewer opportunities for skill practice and reinforcement. Ten students in the control group received supplementary reading instruction.

Information from the following scales was acquired on students prior to the initiation of the study, as well as at the end of Years 1 and 2. Students were administered the Reading Comprehension subtest of the Gates-MacGinitie Reading Test (Gates; MacGinitie & MacGinitie, 1989), the Word Recognition and Spelling subtests of the WRAT-R (WRAT-R Word, WRAT-R Spell), and the monosyllabic and polysyllabic phonological transfer indices of the Decoding Skills Test (DST-MS, DST-PS; Richardson & DiBenedetto, 1985)—measures used to assess students' ability to decode non-sense words.

## Results

This study addressed the following two questions: Do students with dyslexia who receive the DTP through either the teacher-directed or the videotaped method differ in the amount of progress that they make in reading and spelling skill development? and, Do students with dyslexia who receive the DTP show significantly greater progress in reading and spelling achievement over a 2-year period than similar students who receive other instructional programs?

### *Two DTP Methods*

Differences between teacher-directed versus tape-directed instruction were examined through 2 x 3 (Group x Time) repeated-measures analyses of variance (ANOVAs) on the following measures: reading comprehension, word recognition, spelling, monosyllabic phonological decoding skills, and polysyllabic phonological decoding skills. The main and interaction effects observed in these analyses are shown in Figure 1. On reading comprehension, the main effect for year was significant, $F(2, 20) = 8.77$, $p < .001$, but neither the main effect for group, $F(1, 20) = .16$, $p > .05$, nor the interaction between group and year, $F(2, 20) = 1.22$, $p > .05$, was significant. A similar pattern was observed on word recognition: The main effect for year was significant, $F(2, 20) = 23.93$, $p < .05$, but neither the main effect for group, $F(1, 20) = .02$, $p > .05$, nor the interaction between group and year, $F(2, 20) = .46$, $p > .05$, was significant. The pattern of performance on these two tests suggests that both groups made significant progress in reading comprehension and word recognition and that the groups did not differ significantly in their amount of progress.

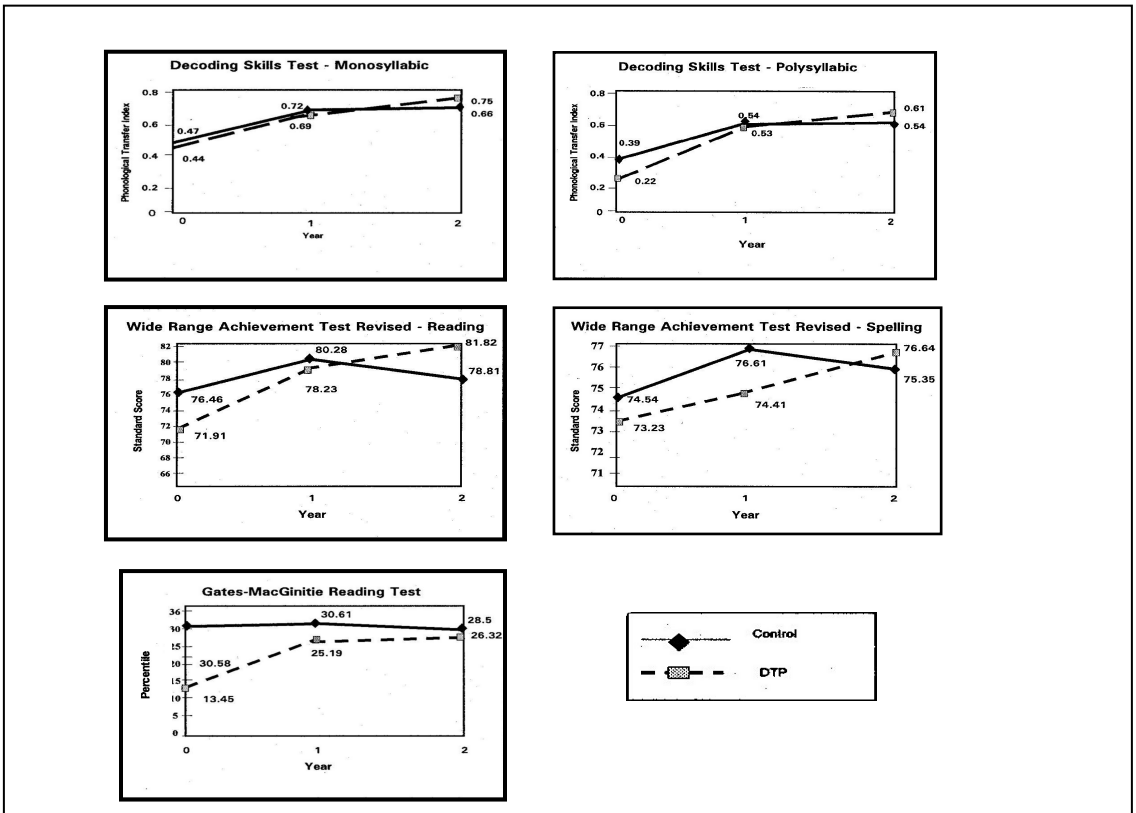


Figure 1. Performance by the experimental and control groups on five measures prior to the treatment and at years 1 and 2.

On spelling, none of the effects was significant. The main effect for group, $F(1, 20) = .41$, $p > .05$, and interaction between group and year, $F(2, 20) = .16$, $p > .05$, did not differ significantly. The main effect for year approached significance, $F(2, 20) = 2.73$, $p < .08$, indicating that the two groups performed comparably, but their spelling skills did not improve significantly over the 2-year period. On monosyllabic phonological decoding, main effects were significant for year, $F(2, 20) = 26.79$, $p < .0001$; for group $F(1, 20) = 5.47$, $p < .05$; and the interaction between group and year, $F(2, 20) = .46$, $p < .05$. Prior to instruction, the test performance of the teacher-directed group was significantly lower than that of the tape-directed group in monosyllabic skills: $t(18) = -2.8057$, $p < .05$. However, these initial differences disappeared over the 2 years, and both groups made significant progress. On polysyllabic phonological decoding, the main effect was significant for year, $F(2, 20) = 28.19$, $p < .0001$, but neither the main effect for group, $F(1, 20) = .28$, $p > .05$, nor the interaction between group and year, $F(2, 20) = .28$, $p > .05$, was significant. Consistent with the students' performance on word recognition, this pattern indicates that both groups made comparable and statistically significant progress in phonological decoding.

Inasmuch as the two experimental instructional methods were comparable in reading comprehension, word recognition, and spelling, students within these two groups were combined to form a single Dyslexia Training Program (DTP) group. Subsequent analyses compared this combined DTP group with students receiving other instructional reading methods (i.e., the control group). Consistent with previously reported comparisons between teacher-directed and tape-directed instruction, a series of 2 x 3 (Group x Time) ANOVAs was performed on the participants' reading comprehension, word recognition, spelling, and monosyllabic and polysyllabic phonological decoding skills. The main and interaction effects on these ANOVAs are shown in Figure 2.

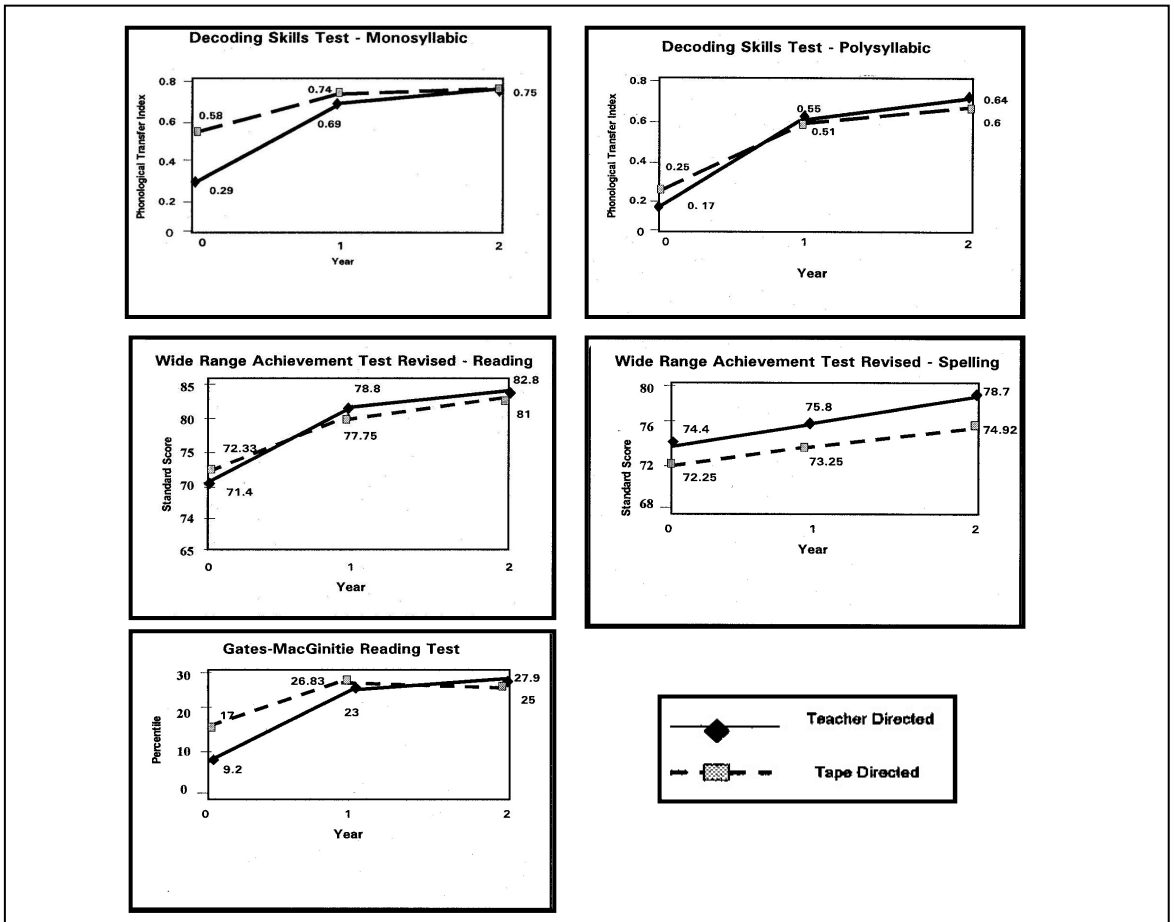


Figure 2: Performance by students in the teacher-directed and tape-directed groups of five measures prior to the treatment at years 1 and 2.

### *Experimental and Control Group Performance*

On reading comprehension, the main effects for year, $F(2, 46) = 1.71$, $p > .05$, and group, $F(1, 46) = 1.34$, $p > .05$, were not significant. However, the interaction between group and year, $F(2, 46) = 4.80$, $p < .05$, was significant. The DTP group made significant progress over the 2 years, whereas the control group did not. On word recognition, the main effect was significant for year, $F(2, 46) = 16.76$, $p < .0001$, but not for group, $F(1, 46) = .04$, $p > .05$. The interaction between group and year, $F(2, 46) = 6.18$, $p < .005$; was significant. The DTP group initially performed lower than the control group on word recognition and after 2 years performed better than the control group; the control group displayed little improvement over the 2 years.

All effects on spelling were non-significant: For group, $F(1, 46) = .00$, $p > .05$, year, $F(2, 46) = 1.77$, $p > .05$; and the interaction between group and year, $F(2, 46) = .67$, $p > .05$. Thus, on spelling, the two groups performed comparably, and their performance did not improve significantly during the 2-year period.

On monosyllabic phonological decoding, the main effect for year was significant, $F(2, 46) = 28.01$, $p < .0001$, but the main effect for group, $F(1, 46) = .19$, $p > .05$, was not significant. The interaction between group and year, $F(2, 46) = 2.34$, $p > .05$, also was not significant, despite the fact that the DTP group initially was below the control group and ended somewhat higher. Thus, the two groups made significant, comparable progress over the 2 years in developing their monosyllabic decoding skills.

On polysyllabic phonological decoding, the main effect was significant for year, $F(2, 46) = 40.23$, $p < .0001$, but not for group, $F(1, 46) = .21$, $p > .05$. The interaction between group and year, $F(2, 46) = 7.32$, $p < .005$, was significant. Thus, in contrast to the control group, the DTP group initially performed lower on decoding polysyllabic nonsense words and ultimately performed significantly higher.

## Discussion

The Dyslexia Training Program was found to be effective in promoting the reading development of students with dyslexia. Moreover, students made comparable progress when the DTP was presented either on videotape or through live teaching. During their program, students who were trained in this Orton-Gillingham-derived method made significant gains in their ability to decode nonsense words, word recognition, and reading comprehension when compared with control students in reading programs that did not use explicit instruction in the alphabetic code. Although the experimental students generally maintained their below-average levels in word recognition at the conclusion of the program, their abilities to decode nonsense words and to comprehend what they read reached average levels. These findings are consistent with other recent evidence supporting the efficacy of intensive, explicit phonologically based training (Pennington, 1991).

This investigation eliminated many of the flaws found in previous field studies of reading intervention (Perfetti, 1985). The 2-year intervention and study interval was relatively long, yielding positive results not obtained by short-term studies that do not have sufficient time to train students to adopt an alphabetic decoding strategy (Stanovich, 1980). Problems in consistency and control of the experimental instruction method were resolved by the use of either videotape presentation or teachers who adhered strictly to the Dyslexia Training Program curriculum and instructional methods. Confounding instructional practices were excluded by obtaining information through parent and teacher questionnaires that enabled us to identify regular direct phonics instruction according to a decoding or subword method.

A control group was used and matching characteristics were described. The experimental and control groups were closely matched on multiple factors thought to possibly influence reading ability. The groups varied somewhat on two factors: oral language and SES. The experimental group was lower on oral language and SES. Language deficits are known to attenuate reading development. Given equivalent language abilities, students in the experimental group may have benefited even more from DTP instruction. Subsequent studies are planned to investigate whether the students with higher language abilities demonstrated greater improvement than those with lower language abilities.

In reference to SES characteristics, families from both the experimental and the control group could be considered middle class. Students in the experimental group were more likely to be from lower middle class families, whereas those in the control group were more likely to be from upper middle class families. Subsequent studies will investigate whether students who differed by SES demonstrated differences in reading development.

We were unable to fully control for supplementary reading instruction. Fifteen experimental- and 10 control-group students received supplementary reading assistance. Although we know that the DTP represented the primary reading program for all students in the experimental group, we are unable to determine for them or for those in the control group the benefits or liabilities associated with their receiving supplementary reading instruction.

This research extends our understanding of the effectiveness of Alphabetic Phonics and its derivatives (Brightman, 1986; Frankiewicz, 1984, 1985; Guyer & Sabatino, 1989; Hutcheson, Selig & Young, 1990; Roy, 1986). Students with dyslexia typically show deficiencies in phonological processing, verbal memory span, and naming speed (Calfee et al., 1993; Olson, Wise, Conners, Rack & Fulker, 1989; Van Orden, 1991). They often have difficulty coordinating multiple mental processes central to reading and with self-regulatory processes (e.g., monitoring, checking, revising; Denckla et al., 1981). Conventional reading programs usually do not sufficiently address these and other concurrently appearing impediments to reading and spelling acquisition.

The DTP seems to provide the instruction focus, length, and strategies needed by many students with dyslexia. Although most students do not require special intensive methodology to learn to read, those with dyslexia require explicit teaching in the application of phonologic rules to print (Torgesen, Wagner, & Simmons, 1990). Reading programs that are not phonologically based fail to provide the student with dyslexia sufficient opportunity to practice and learn phonics rules. In the DTP, students are taught an extensive vocabulary and rule system for synthetic phonics (segmentation and blending of letter sounds in words) and analytic phonics (recognition of common spelling patterns in words). Modeling; supervised feedback, and practice of reading, decoding, and spelling rules address the students' need for direct instruction in strategy use (Wolf, 1991).

Educators are being bombarded by a variety of multimedia training programs and devices for remedial reading instruction. However, evidence in peer-reviewed journals of their efficacy when used with students with dyslexia is scant. Computer-assisted reading software, with and without synthesized speech and speech feedback, that presents lessons on isolated skills for drill and practice are prevalent (Felton & Wood, 1984). The Colorado Reading Project, which uses computer-based remediation with synthetic-speech feedback, has demonstrated improved word recognition scores and phonological decoding of nonwords in severely disabled readers (Foorman & Liberman, 1989).

Outcome studies relying on long-term videotaped remedial reading instruction could not be located. Thus, the finding that progress made with the DTP using videotape instruction was comparable to that made by teacher instruction adds to our literature. The DTP videotape series seems to offer an effective alternative for students with dyslexia whose schools or teachers lack curricula and extensive training in phonological-coding remedial techniques.

The DTP had little impact on promoting the development of spelling skills. The differential response of reading and spelling to intervention has been well documented (Guyer & Sabatino, 1989). Spelling is rarely mastered by individuals with severe reading disabilities; it is a complex linguistic skill that requires precise simultaneous integration of phonological, morphological, semantic, and orthographic knowledge (Mather, 1992). The complexity of spelling makes accuracy an elusive goal, even with intensive efforts during remedial instruction to make students aware of and able to manipulate key elements of language. Lack of spelling mastery has been documented in more than 2,000 children using the DTP in Texas schools on criterion-referenced progress measures that assess the spelling rules and situations covered in the curricula (Rumsey & Browne, 1996).

Although the reading gains made by students in the DTP were clinically significant, they were relatively modest (e.g., two thirds of a standard deviation in word recognition), given the intensity and duration of the intervention. Additional work is needed to identify those student qualities that are strongly related to success,

and what components of the program are most responsible for gains. Comparing DTP with other instruction of similar intensity is required to establish that progress is secondary to specific program characteristics. Future efforts also will examine the effect of alterations in the DTP designed to improve attainment in reading and spelling. Long-term follow-up studies are needed to determine if the benefits of DTP and other programs persist.

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