Journal of Psychoeducational Assessment
2004, 22, 93-105

ASSESSMENT OF CHILDREN WITH ATTENTION AND READING DIFFICULTIES USING THE PASS THEORY AND COGNITIVE ASSESSMENT SYSTEM

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This study evaluated the Planning, Attention, Simultaneous, and Successive (PASS) characteristics of children assessed for Attention Deficit/Hyperactivity Disorder (ADHD referred), children with a Reading Disability (RD), and children in Regular Education (RE). The Cognitive Assessment System (CAS) was used to assess PASS processes for the 119 children (48 in ADHDR; 23 in RD; and 48 in RE groups). The results showed that the ADHDR group had lower Planning scores than the RE group (effect size = 0.6). The RD group had lower Successive scores than the RE group (effect size = 1.1) and the ADHDR group (effect size = 1.2), and lower Simultaneous scores than the RE group (large effect size of 0.9). The implications for using PASS theory to assist in the identification process as well as for the design of interventions for children with ADHDR and children with RD are discussed.

Attention Deficit/Hyperactivity Disorder (ADHD) and Reading Disabilities (RD) are among the most challenging disorders in the field of psychology and education. This is especially apparent upon inspection of the literature in assessment that shows that these groups are difficult to differentiate, for example, using tests of intelligence (Kavale & Forness, 1984). Despite the widespread use of tests of general intelligence with children suspected of ADHD, Kaufman and Lichtenberger (2000) concluded that "research findings do not indicate that the WISC-III can be used as a diagnostic test for ADHD" (p. 207). Additionally, researchers who studied the Freedom From Distractibility Factor (FFD) (e.g., Anastopoulous, Spisto, & Maher, 1994) have not found it suitable for identification purposes. To have relevance for diagnosis, however, a test should measure cognitive factors that underlie the behavioral and/or academic failure. For example, children with Attention Deficit Disorder exhibit problems with control.

This study was funded in part by a grant (R215K010121) from the U.S. Department of Education.

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Barkley (1997, 1998) has posited that ADHD involves problems with behavioral inhibition and self-control, which are associated with poor executive functions. Similarly, neuropsychological researchers have described ADHD as an executive control problem (Nigg, 2001; Pennington & Ozonoff, 1996), and Goldberg (2001) suggested that ADHD is a mild form of frontal lobe dysfunction that impairs goal-directed planful behavior. If ADHD is seen as a problem of inhibition, planning, and control, then it is reasonable that tests of general intelligence, which were not designed to measure these cognitive processes (Wasserman, 2002), should provide limited aid in the diagnosis of these children. Tests that include measures of planning should show some sensitivity to the problems experienced by children with ADHD. A similar situation exists for children with reading disabilities.

Children with learning disabilities have traditionally been identified using a discrepancy between intelligence and achievement along with a history of adequate education and absence of sensory deficits (Sattler, 2002). Tests of general intelligence have been criticized because they have not been shown to be sensitive to the problems these children experience (Siegel, 1988; Vellutino, Scanlon, & Lyon, 2000). Despite widespread use of the general intelligence model and attempts to identify children with learning disabilities using scale or subtest profiles, researchers have concluded that these methods have not been effective (Kavale & Forness, 1984; McDermott, Fantuzzo, & Glutting, 1990). Kaufman and Lichtenberger (2000) concluded that subtest patterns, reorganizations of subtests, and verbal nonverbal differences "do not have adequate power on which to base differential diagnosis" (p. 205). Naglieri (2000) argued that the general intelligence model is insensitive to the cognitive problems experienced by reading-disabled children because it does not measure basic psychological processes related to reading failure. There is some research to suggest that a cognitive processing approach may have greater sensitivity to the problems experienced by children with reading disabilities and attention deficits.

Researchers have recently examined the utility of the Planning, Attention, Simultaneous, and Successive (PASS) theory as operationalized by the Cognitive Assessment System (CAS; Naglieri & Das, 1997a) for children with ADHD and LD. Paolitto (1999) studied matched samples of ADHD (n = 63) and non-ADHD (n = 63) children and found that children with ADHD as a group earned significantly lower scores on tests of planning. He concluded that these results supported Barkley's view (1997, 1998) that ADHD involves problems with behavioral inhibition and self-control, which is associated with poor executive processing (e.g., Planning from PASS). In addition, Paolitto concluded that the CAS "is a useful tool in the assessment and identification of children with ADHD [because] the CAS was able to successfully identify about three of every four children having ADHD" (p. 4). Similarly, Dehn (2000) and Naglieri, Goldstein, Iseman, and Schwebach (2003) found that groups of children diagnosed with ADHD earned significantly lower mean scores on meas-

ures of planning. Although these studies suggest that the PASS theory may provide a useful perspective as an alternative to the general intelligence model, further research is needed. Thus, the purpose of this study was to examine the performance of children referred for ADHD and RD using the PASS theory. It was anticipated that because this theory includes measures of cognitive processing, differences between groups of children would be found. Specifically, based on previous research, we anticipated that the children with reported attention problems would evidence lower performance on tests of Planning, nondisabled children would have similar PASS profiles, and the students with a reading disability would be low in Successive processing as suggested by Das, Naglieri, and Kirby (1994).

METHOD

Participants

The participants in the study were 48 children (38 males and 10 females) referred to an ADHD specialty clinic (ADHDR), 48 children (38 males and 10 females) in regular education (RE), and 23 children (13 males and 10 females) diagnosed with a specific reading disability (RD; a learning disability in reading decoding). The ADHDR group was comprised of children who were consecutive referrals to an ADHD specialty clinic whose parents and/or teachers noted significant problems with hyperactivity, impulsivity, or inattention. They were being evaluated for the first time and were not taking any psychotropic medication. The RD sample was comprised of children who were selected from a larger pool of subjects with learning disabilities (N = 197) who were tested during the standardization and validity efforts of the CAS (Naglieri & Das, 1997b). They earned an average WISC-III Full Scale IQ Score of 90 or higher and a difference score greater than 14 between their Full Scale IQ Score and reading achievement as measured by the Woodcock Johnson–Revised (Woodcock & Johnson, 1989) Word Attack subtest score. The regular education students were participants in the CAS standardization sample who were selected on the basis of several key demographic variables (age, gender, parental education, and race) so as to ensure similarity of the three groups on as many variables as possible. Examination of the demographic characteristics of the three samples provided in Table 1 shows that the groups were similar on the basis of age range, mean age, race, and gender. The RD sample had relatively more females (44%) than the ADHDR and RE groups (21% each). Parental education levels were very similar for the ADHDR and RE groups, whereas the average education level for the parents of the RD children was high school or less. The average education level for the parents of the ADHDR and RE children was 4 or more years of college.

Table 1
Demographic Characteristics of ADHDR, RE, and RD groups

Group	ADHDR	RE	RD
Age			
Mean years	11.0	11.0	10.9
SD	2.5	2.5	2.4
Age range			
Gender			
Males	79%	79%	56%
Females	21%	21%	44%
Race			
Caucasian	92%	92%	87%
Non-Caucasian	8%	8%	13%
Parent Education Level			
High school education or less	17%	17%	73%
1-3 years of college	17%	17%	23%
4 or more years of college	66%	66%	4%

Measures

The four PASS processes were measured using the Cognitive Assessment System (CAS; Naglieri & Das, 1997), an individually administered test for children aged 5 through 17 years designed to measure basic psychological processes. The CAS is organized according to the PASS theory and comprised of four scales: Planning, Attention, Simultaneous, and Successive, each set at a mean of 100 and standard deviation of 15. The CAS was standardized on a sample of 2,200 children aged 5 years 0 months to 17 years 11 months who were selected to reflect the demographics of the United States in terms of race, gender, parental education, geographic location, community setting, and educational placement. Evidence for the reliability and validity of the CAS is presented in the CAS *Interpretive Handbook* (Naglieri & Das, 1997b) and Naglieri (1999). The four PASS Scales are described below.

Planning scale. The Planning subtests require the child to consider how to solve each item, develop a plan of action, apply the plan, modify the plan as needed, and control the impulse to act without careful consideration. In addition, Planning subtests require the use of strategies for efficient performance (Naglieri & Das, 1997b). Matching Numbers requires children to underline two identical numbers out of six that appear on a row. There are eight rows of numbers on each of five pages. The numbers within each row have an equivalent number of digits, and the numbers gradually increase by row from one to seven digits. Children who use strategies such as scanning the row and examining the numbers carefully in sequence to find a match earn higher scores on this test than those who do not use a strategy (Naglieri & Das, 1997). The subtest score is based on the combination of number correct and time taken to complete each page. The Planned Codes subtest requires the child to complete a page of codes (e.g., XX; OX) that correspond to letters (e.g., A; B) as provided in a legend at the top of the page. The page contains seven rows and eight columns arranged in a manner that lends itself to strategy use. The child

is required to fill in the appropriate codes in the empty boxes beneath each letter. Children are allowed to complete each page in whatever order they choose to allow for application of strategies such as filling in all the As, then Bs, and so on, a strategy that resulted in higher scores. The subtest score is based on number correct and time taken to complete each page.

Attention scale. The Attention subtests require the child to focus cognitive activity, detect particular stimuli, and inhibit responses to competing stimuli. Each of the CAS Attention subtests requires focus and includes competing demands on the child's attention. The Expressive Attention task includes color words (i.e., Blue, Yellow, Green, and Red) printed in a different color than the colors the word name. The child is required to name the color the word is printed in, rather than read the word. The subtest score is based on the number of correct items and the time taken to complete the task. Number Detection consists of pages of numbers printed in different formats. For each page, children are required to find the target stimulus (e.g., the number 1, 2, and 3 in an open font) among distractor items (e.g., the same numbers printed in a different font).

Simultaneous scale. The Simultaneous processing subtests require the child to synthesize separate stimuli into an interrelated group. Simultaneous processing involves spatial and logical dimensions for verbal and nonverbal content. Nonverbal Matrices consists of shapes and geometric designs that are interrelated through spatial or logical organization. Children are required to discern the relations among parts of the shape or geometric design and choose the best of six options that fits a missing space in the grid. Verbal-Spatial Relations requires children to match objects and shapes arranged in a specific spatial manner to their verbal description.

Successive scale. Successive processing involves the integration of material into a specific serial order in which each element is related to those that precede and follow it. The Successive processing subtests involve the repetition or comprehension of the serial organization of events. Word Series requires children to repeat a series of words in the correct order, and Sentence Repetition requires children to repeat a sentence in the correct order.

Procedure

The ADHDR, RD, and, RE samples were administered the CAS by trained examiners, and all test protocols were checked for accuracy. Standard scores were obtained from the test manuals and used in all data analysis. Means and standard deviations of each PASS scale were computed for each group. The significance of the differences between the groups was examined by a multiple analysis of variance (MANOVA). The differences between the mean standard scores were examined by computing *d* ratios, which compare the groups in standard deviation units (Cohen, 1988) using the formula:

$$(X_1 - X_2) \,/\, \text{SQRT}\,[(n_1 * SD_1{}^2 + n_2 * SD_2{}^2)/(n_1 + n_2)].$$

The *d* ratios were interpreted using Cohen's (1988) guidelines of .2, .5, and .8 as small, medium, and large effect sizes, respectively. Finally, the cumulative frequency distributions of the four PASS scores were compared across the ADHDR, RD, and RE groups. The cumulative percentage of children in each group who earned scores below particular cut-off values (85, 90, 95, and 100) was examined.

RESULTS

The PASS standard score means and standard deviations for the ADHDR, RE, and RD groups are presented in Table 2 and shown graphically in Figure 1. These results indicate that the children in regular education settings earned mean PASS scores that were all about average, ranging from 98.6 to 103.6. In contrast, the ADHDR group earned similar mean scores on the Attention, Simultaneous, and Successive scales (range: 97.4 to 104.0) but a lower mean score on the Planning scale (90.3). The RD children earned comparable mean scores on Planning, Attention, and Simultaneous scales (range: 93.4 to 95.0) but a lower mean score on the Successive scale (88.0).

Table 2
Comparison of Means of CAS Standard Scores for ADHDR, RE, and RD Sample

	ADHDR (n = 48)		RE (n = 48)		RD (n = 23)	
CAS Scales	Mean	*SD*	Mean	*SD*	Mean	*SD*
Planning	90.3	12.6	98.6	14.6	94.9	10.9
Attention	97.4	13.3	99.3	12.4	93.4	11.9
Simultaneous	99.3	13.8	103.6	9.7	95.0	8.2
Successive	104.0	12.4	102.2	12.5	88.0	14.4

A one-way MANOVA was conducted to compare the PASS scale scores of the ADHDR, RD, and RE samples. The overall MANOVA results indicated that there were significant differences among the three groups on the PASS processing scales (Wilks's Lambda = .708, $F[8, 226] = 5.33$, $p < .01$). All of the PASS scores were significantly different: Planning, $F(2, 119) = 5.1$, $p < .01$; Attention, $F(2, 119) = 3.33$, $p < .05$; Simultaneous, $F(2, 119) = 5.05$, $p < .01$; and Successive, $F(2, 119) = 11.8$, $p < .01$. Post hoc comparisons were conducted to determine on which PASS scales the groups differed. Results indicated that ADHDR children did not differ significantly from RE children on the Attention, Simultaneous, and Successive processing scales. In contrast, the ADHDR group had significantly lower scores than RE children on the Planning scale ($p < .01$). RD children differed from RE children on Attention ($p < .05$), Simultaneous ($p < .01$), and Successive ($p < .01$) scales but did not differ on the Planning scale. The PASS processing scores of RD and ADHDR children were significantly different on the Successive ($p < .01$) processing scores but not on the other processing scales.

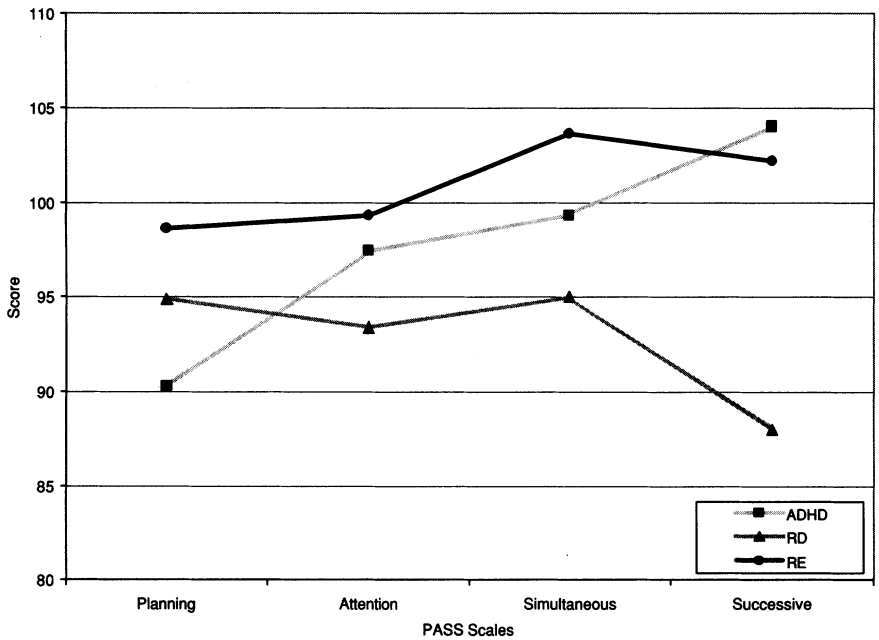

FIGURE 1. Graphic representation of mean PASS scores for ADHD, RD, and RE samples.

Further examination of the differences between the three groups is provided in Table 3 where *d* ratios are given. Sizable differences between the RE and ADHDR groups were found on the Planning scale (the *d* ratio of 0.61 is considered medium in size). This finding suggests that the ADHDR children's poor performance in planning distinguished them from the children in regular education. In contrast, the RD group showed large *d* ratios between the regular education ($d = 1.08$) as well as the ADHDR ($d = 1.22$) groups in Successive processing. Finally, a large *d* ratio between the RD and RE groups ($d = .93$) was found on the Simultaneous processing scale. Although these groups differed on both Simultaneous as well as Successive processing scales, it is important to consider that the elevated Simultaneous scale mean for the RE group augmented this *d* ratio.

Table 3
Mean Score Differences and d ratios for ADHDR, RD, and RE Samples

	RE vs. ADHDR		RD vs. RE		RD vs. ADHDR	
CAS Scales	Difference	*d* ratio	Difference	*d* ratio	Difference	*d* ratio
Planning	8.3	0.61**	3.7	0.28*	4.6	0.38*
Attention	1.9	0.15	5.9	0.48*	4.0	0.31*
Simultaneous	4.3	0.36*	8.6	0.93***	4.3	0.35*
Successive	1.9	0.15	14.2	1.08***	16.0	1.22***

Note.—*d* ratio = (Mean 1 - Mean 2) / SQRT $[(n_1 * SD_1^2 + n_2 * SD_2^2)/(n_1 + n_2)]$. *d* ratios are designated as * = small (.2-.4); ** = medium (.5-.7); and *** = large (.8 and above).

The data were further examined by calculating the percentages of children in each group who earned PASS scores below several different cut-off values between standard scores of 85 through 100 in 5-point increments. The results, presented in Figure 2, show that the ADHDR sample's Planning scores and the RD group's Successive scores reflected the difficulty these two groups experienced in these two different types of cognitive processing. For example, approximately 80% of the ADHDR children earned a standard score of 100 or less on the Planning scale. Additionally, about 40% of ADHDR children earned a score of 85 or less on the Planning scale and about half of that group earned a score that was below the Average classification (standard score of 90). In the normal population the standard scores and associated percentiles are as follows: 85 = 15; 90 = 25; 95 = 37; and 100 = 50. The regular education group was close to expected normal values in each instance. In contrast, about 40% of the RD group had a score of 85 or less and 80% of the group had scores of 100 or less on the Successive processing scale. These results, of course, reflect the differences in mean scores but also highlight the nature of the differences across the range of standard scores. The results for the Simultaneous and Attention scales did not show evidence that any one of the scales was particularly difficult for any one of these groups.

DISCUSSION

The present findings suggest that different groups of children earn different scores on PASS processing tests. The poor performance of the group of children referred for ADHDR on Planning and the poor performance of RD children on Successive are consistent with past research and imply that there may be different cognitive explanations for the academic problems these children experience. It is reasonable to anticipate that children with cognitive deficits in one of these processes will likely experience academic problems because of the strong relationships between tests of achievement and PASS processes (Naglieri & Bornstein, 2003; Naglieri & Das, 1997b; Naglieri & Rojahn, 2004). Additionally, Naglieri (2000) has shown that children with cognitive weaknesses in any one of the four PASS processes are more likely to have experienced significant academic problems than are children without a PASS weakness.

The present findings also suggest that planning and successive processes may hold some utility for identification of the cognitive problems associated with attention and reading disabilities, respectively, for some children. The finding that 40% of the ADHDR sample as well as 40% of the RD samples earned low standard scores (less than 85) on the Planning and Successive scales, respectively, suggests that these scores could be used as part of a procedure for identification. The detection of a cognitive weakness (see Naglieri, 1999) in one of these processes might be used as a factor that contributes to diagnosis (Naglieri, Goldstein, & Schwebach; in press) and treatment planning.

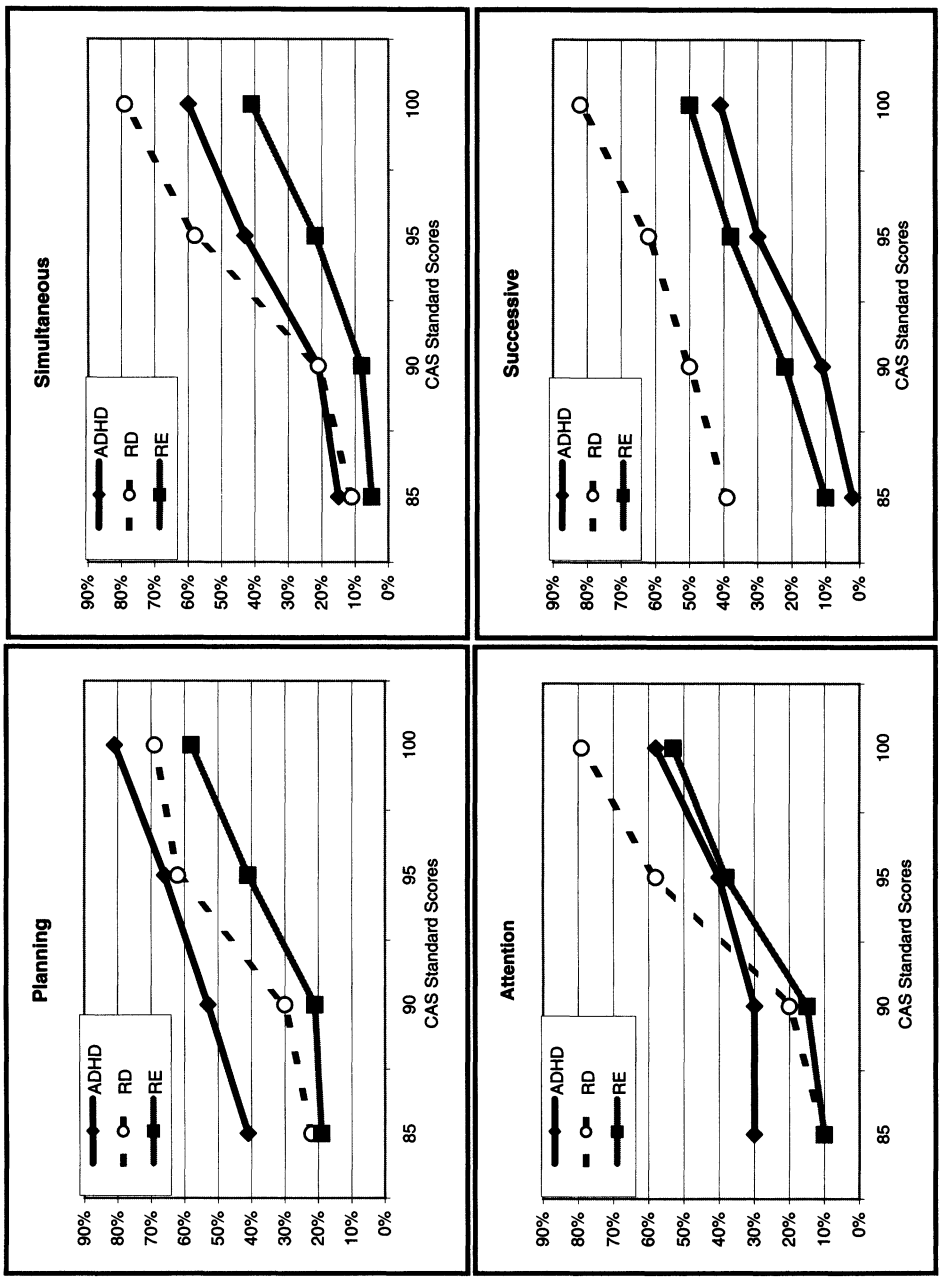

FIGURE 2. Percentages of children with PASS standard scores of 85, 90,95, and 100 or less.

Researchers have suggested that there is a connection between planning problems and intervention (Das et al., 1994; Naglieri, 1999; Wasserman, 2002). The relationship between planning and intervention was initially shown in research conducted by Cormier, Carlson, and Das (1990) and Kar, Dash, Das, and Carlson (1992). These authors found that children who were poor in plan-

ning improved significantly more than children who were not poor in planning when they were taught to approach tasks in a more strategic manner. Naglieri and Gottling (1995, 1997) extended this initial research and demonstrated that a planning intervention (Planning Facilitation) led to improved math performance for children with low planning scores but minimal improvement for those with good planning scores. Hald (2000) also found that teaching children to be more planful had the most beneficial effects for students low in math and low in planning. Additionally, Hald (2000) reported that students low in math but higher in planning appeared to benefit more from the intervention that included direct instruction regarding their mathematics errors. Naglieri and Johnson (2000) showed that children with a cognitive weakness in one of the four PASS processes showed considerable improvement in math calculation following Planning Facilitation, whereas each of four contrast groups showed substantially lower rates of improvement. Most recently, Haddad, Garcia, Naglieri, Grimditch, McAndrews, and Eubanks (2004) reported that children with a cognitive weakness in planning showed substantial improvement in reading comprehension but contrast groups low in successive processing or those without any cognitive weakness did not improve. These results suggest that an academic intervention like Planning Facilitation may have utility for children who are low in planning (e.g., like the children in this study) or who have academic problems in math calculation or reading comprehension.

The poor performance in Successive processing found for children with reading problems is consistent with past research (Das, Kirby, & Jarman, 1979; Das et al., 1994). Although the demands of reading are complex, Successive processing appears to play an especially important role in early acquisition of prereading and early reading skills. Successive processing is important because reading involves working with phonetic segments of words in order, the correspondence of the sequence of letters with sounds, and holding the sound sequence in memory. Children who are poor in Successive processing, therefore, have difficulty "breaking down words into an ordered sequence of sounds" (Das, 2001). Simultaneous processing is also important for seeing the word as a whole, grouping letters into sounds, and associating groups of letters to the corresponding sounds of the words. In this study, the RD group scores were substantially different from the RE group on Successive and Simultaneous processing scales (d ratios were about 1.0). The view that these processes are especially important for reading has formed the basis for a cognitive intervention method designed to facilitate Successive and Simultaneous processing in children with reading problems (see Das et al., 1994).

The PASS Remedial Program (PREP; Das, 1999) is a systematic and carefully prescribed intervention method designed to help children be more effective with the Successive and Simultaneous processing demands of reading through both nonacademic and academic tasks. The program has been studied in a variety of settings by several researchers. Initial studies (Brailsford, Snart, & Das, 1984; Kaufman & Kaufman, 1979; Krywaniuk & Das, 1976) found

that students trained to use Simultaneous and Successive processes more efficiently "improved their performance on that process and some transfer to specific reading tasks also occurred" (Ashman & Conway, 1997, p. 169). Similarly, Carlson and Das (1997) and Das, Mishra, and Pool (1995) found that reading-disabled children in PREP experimental groups outperformed control groups in pseudo word and real word reading. These findings suggested that PASS "process training can assist in specific aspects of beginning reading" (Ashman & Conway, 1997, p. 171).

The current study has some important limitations in the methodology that warrant recognition. First, the samples are relatively small in size, especially for the reading-disabled group. Additionally, the children included in the ADHDR group were referred, diverse, and mostly hyperactive and they were not divided into subtypes of ADHD. This is an important avenue for future research because children with different types of attention deficits and learning disabilities may have different levels of competence on the PASS cognitive processes. Although the results of this study and those that preceded it suggest that measurement of PASS cognitive processes may have utility for assessment of children with Attention Deficit Disorder and reading disabilities, these measures, like any other, should not be used in isolation, but rather, as a portion of a larger battery of tests that leads to accurate diagnosis. Other measures such as interviews, tests of achievement and phonological skills, measures of social/emotional status, behavioral observation, and behavior rating scales should be included when evaluating children who may have learning disabilities or attention deficits. Despite these cautions, the results of this study and those that precede it suggest that assessment of PASS cognitive processes should be included when practitioners evaluate children who may have reading and attention problems and for instructional planning (see Naglieri & Pickering, 2003).

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