

# Prevention and Remediation of Reading Disabilities

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The research reported in this presentation was supported by grant number HD30988 from the national Institute of Child Health and Human Development, and by grants from the national Center for Learning disabilities, and the Donald D. Hammill Foundation. Questions regarding the content should be sent to the Joseph Torgesen, Psychology Department, Florida State University, Tallahassee, FL 32306-1270, e-mail: [torgesen@psy.fsu.edu](mailto:torgesen@psy.fsu.edu)

This report is adapted from a presentation given by Joseph Torgesen to a NICHD sponsored conference on intervention research in September, 1998. The report covers research we have conducted over the past five years to study both preventive and remedial instruction for children with phonologically based reading disabilities. We will describe three studies, and will include a brief description of the methodology of each as well as an outline of the most important results. The three studies include:

1. **Prevention Study 1**, which involved 1:1 tutoring using three methods during kindergarten through second grade. We have two year follow-up data available
2. **Prevention Study 2**, in which first grade children were provided with small group instruction and individualized computer-based practice from October through May of first grade.
3. **Remediation Study** involving 67 hours of 1:1 instruction over an 8 week period for 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> grade reading disabled students using two methods. We have one year follow-up data at this point.

In all of our prevention and remediation studies, **the central instructional contrast** has been between:

1. a method that places heavy emphasis on building phonetic decoding skills through explicit instruction in phonological awareness at the articulatory level coupled with extensive practice in alphabetic reading skills; and,

2. a method that provides systematic and explicit instruction in phonetic decoding skills in the context of increased opportunities to engage in meaningful reading and writing experiences at the sentence, paragraph, and story level.

All of our studies had **three broad questions** in common:

1. Which instructional method is most effective for students with weak phonological processing skills?
2. Do any of the instructional conditions produce reading growth within the average range?
3. Which child characteristics are most predictive of reading growth within instructional conditions?

**First Prevention Study:** Intervention in kindergarten through second grade

The children in this study were selected in the first semester of kindergarten: they were the bottom 12% of a group of 1436 children in letter knowledge and phonemic awareness. Their average verbal IQ was 91.9, with a range from 76 to 126.

The intervention groups received four, 20 minute sessions of 1:1 instruction per week for two and one-half years. 47 hours of teacher instructional time, 41 hours of aide instruction.

Children were randomly assigned to one of four conditions:

1. **Phonological Awareness plus Synthetic Phonics** (PASP) – this condition placed a heavy emphasis on explicit instruction in phonological awareness and phonetic decoding strategies.  
**(added by CRC: This is essentially the program we use and we have placed our initials next to each mention of this program to help you identify the programs that relate to Colorado Reading Center, Inc.)**
2. **Embedded Phonics** (EP) – this condition provided explicit instruction in phonetic decoding skills in the context of whole word instruction and meaningful reading and writing activities.
3. **Regular Classroom Support** (RCS) – in this condition, project teachers consulted with classroom teachers and provided tutorial instruction in direct support of the classroom teacher's instructional goals.
4. **Control group** (Control) – this group received whatever interventions the school would normally provide

We videotaped instructional sessions and determined that the following percentages of time were spent either on :1) instruction to stimulate

phonemic awareness or build phonetic decoding skills; 2) practice in learning sight words; or, 3) reading or writing of connected text.

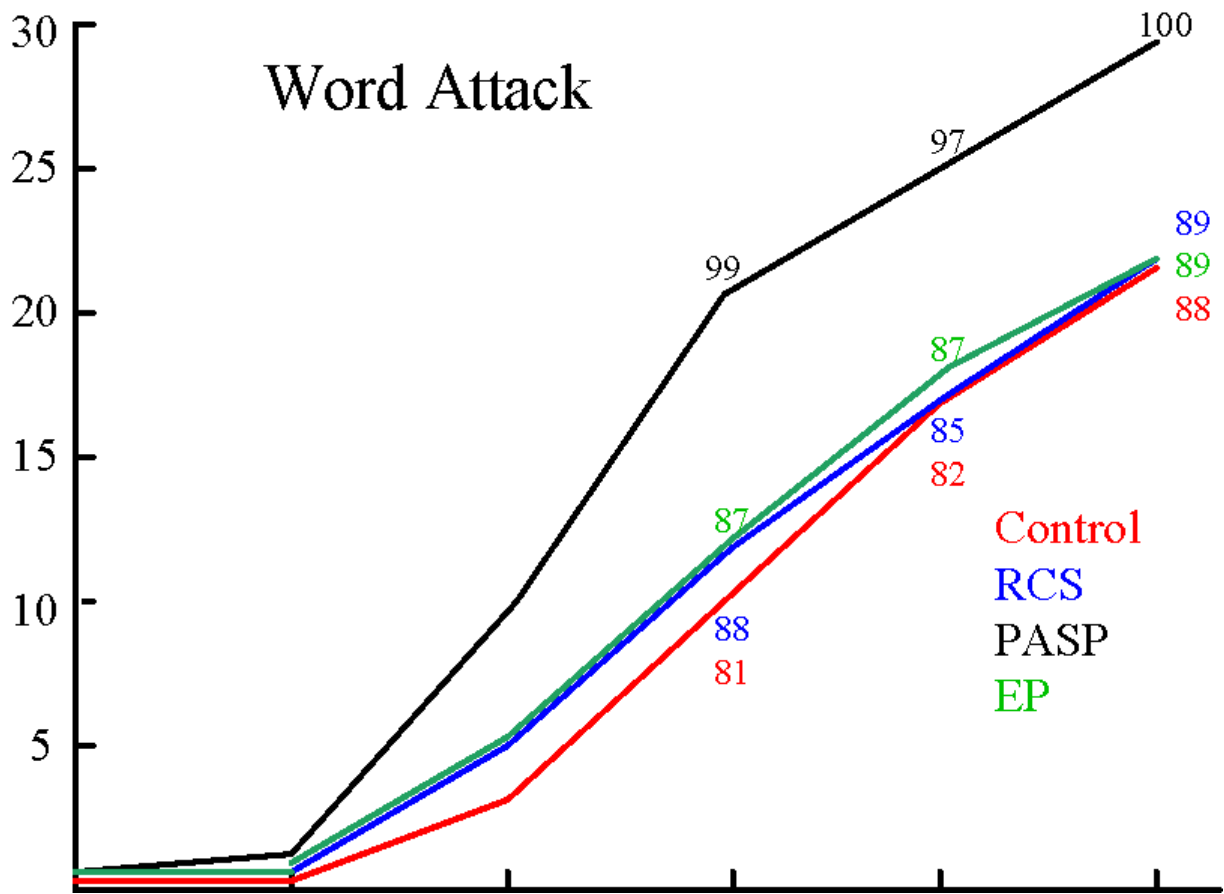


	<b>Group</b>	<b>Group</b>
<b>Activity</b>	<b>PASP(CRC)</b>	<b>EP</b>
Phon. Awareness and Phonetic Decoding	74%	26%
Sight Word Practice	6%	17%
Reading or Writing Connected Text	20%	57%

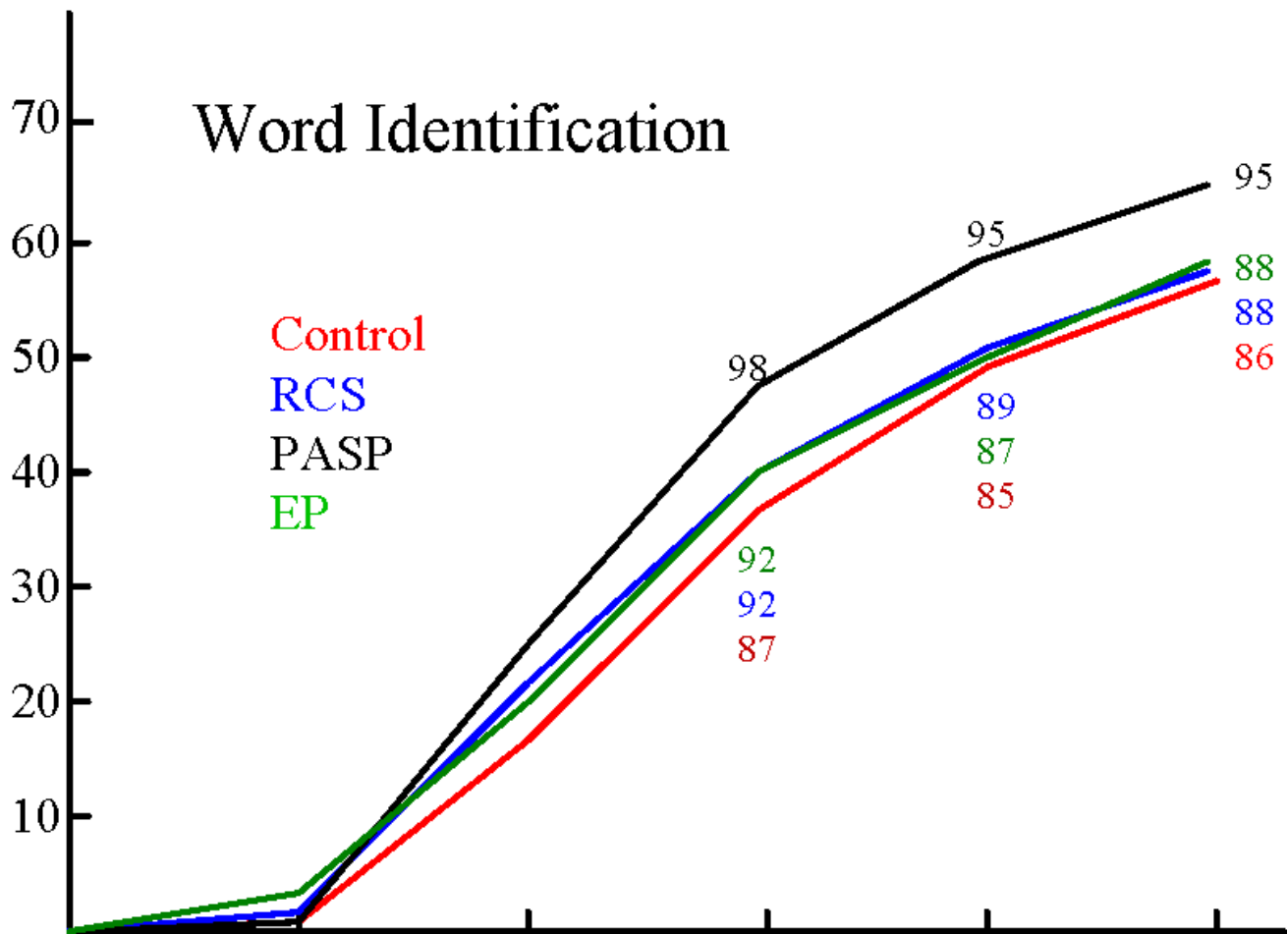


From kindergarten through second grade, **a different percentage of children across groups experienced at least one grade retention.** Percentages for each group were: **PASP (CRC)– 9%, EP – 25%, RCS – 30%, Control – 41%.** Although the overall rates of referral for school based special education services was not reliably different across groups, the PASP and EP groups did differ in this respect. The percentages of placement in special services was: **PASP – 18%, EP – 42%. RCS – 24%, Control – 22%.**

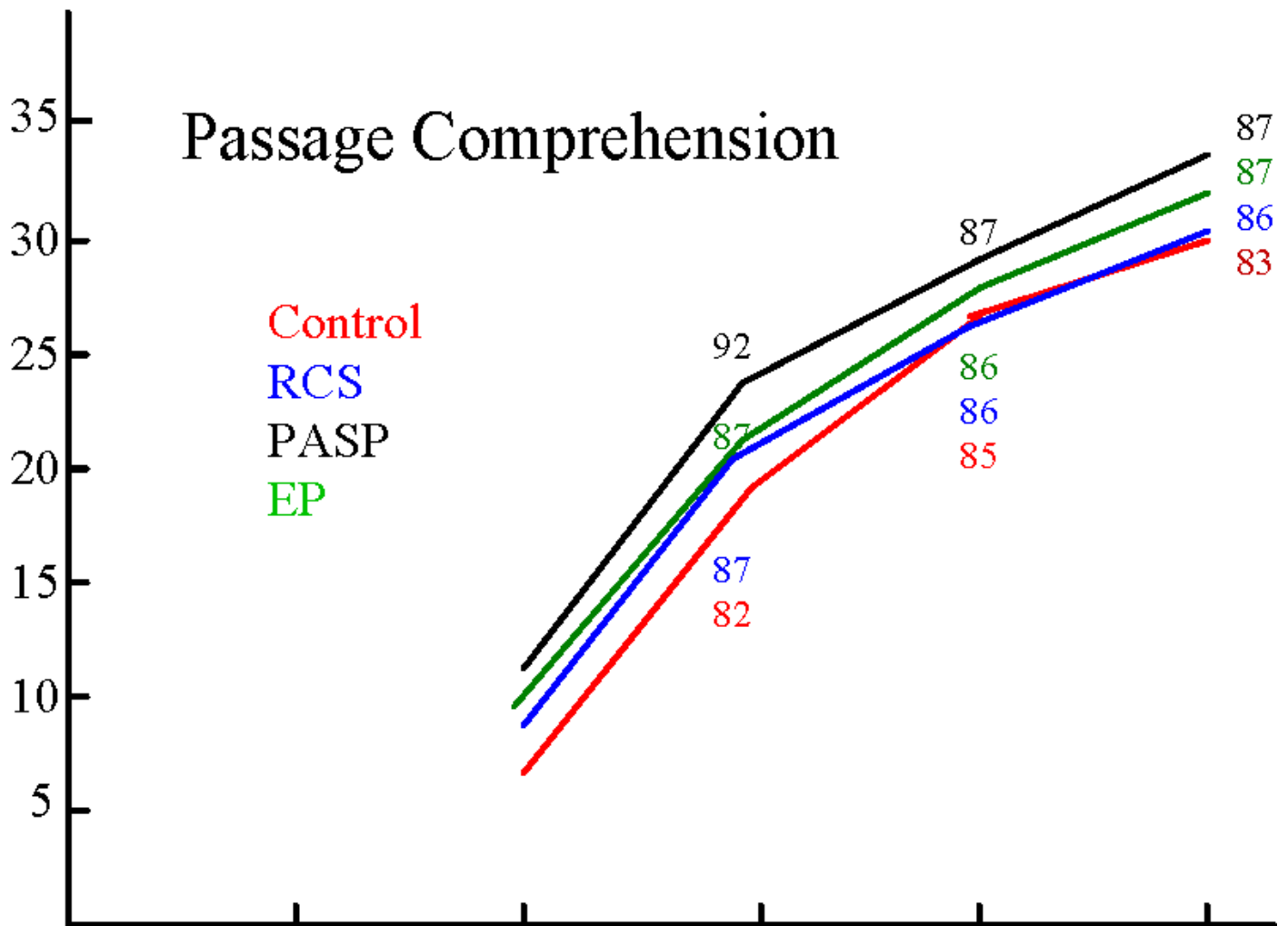
**The graph below** shows progress in **phonemic decoding skills** as measured by the Word Attack Subtest of the Woodcock Reading Mastery Test-Revised. The number written on the graph represent standard scores for each group at the end of second, third, and fourth grades. The groups were significantly different in this skill, with the PASP group being stronger than the other groups.



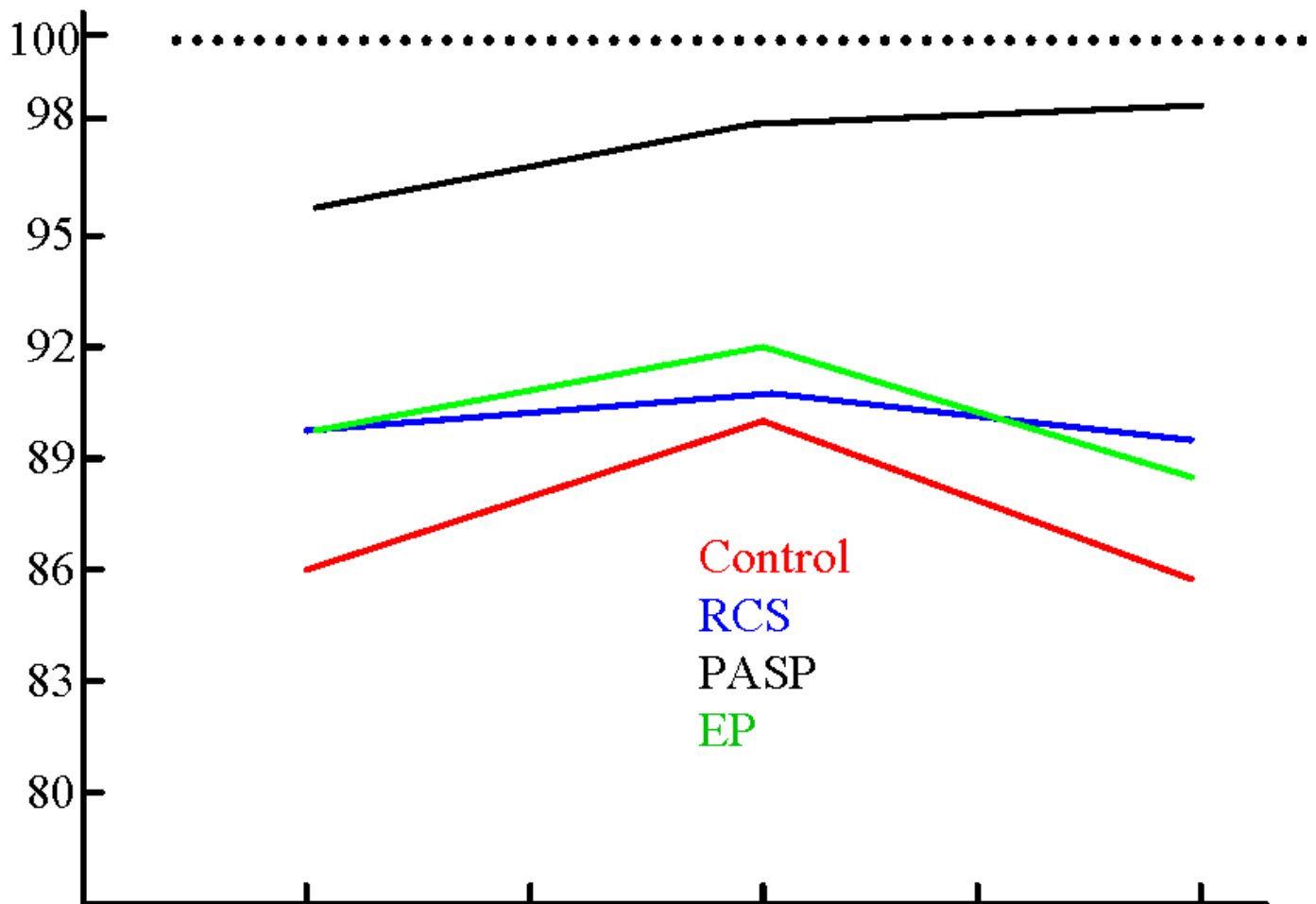
**This next graph** shows growth in ability to identify real words out of context. It is primarily a measure of sight word vocabulary at the higher grade levels. The groups were also reliably different on this measure, with the PASP group being stronger than the other groups.



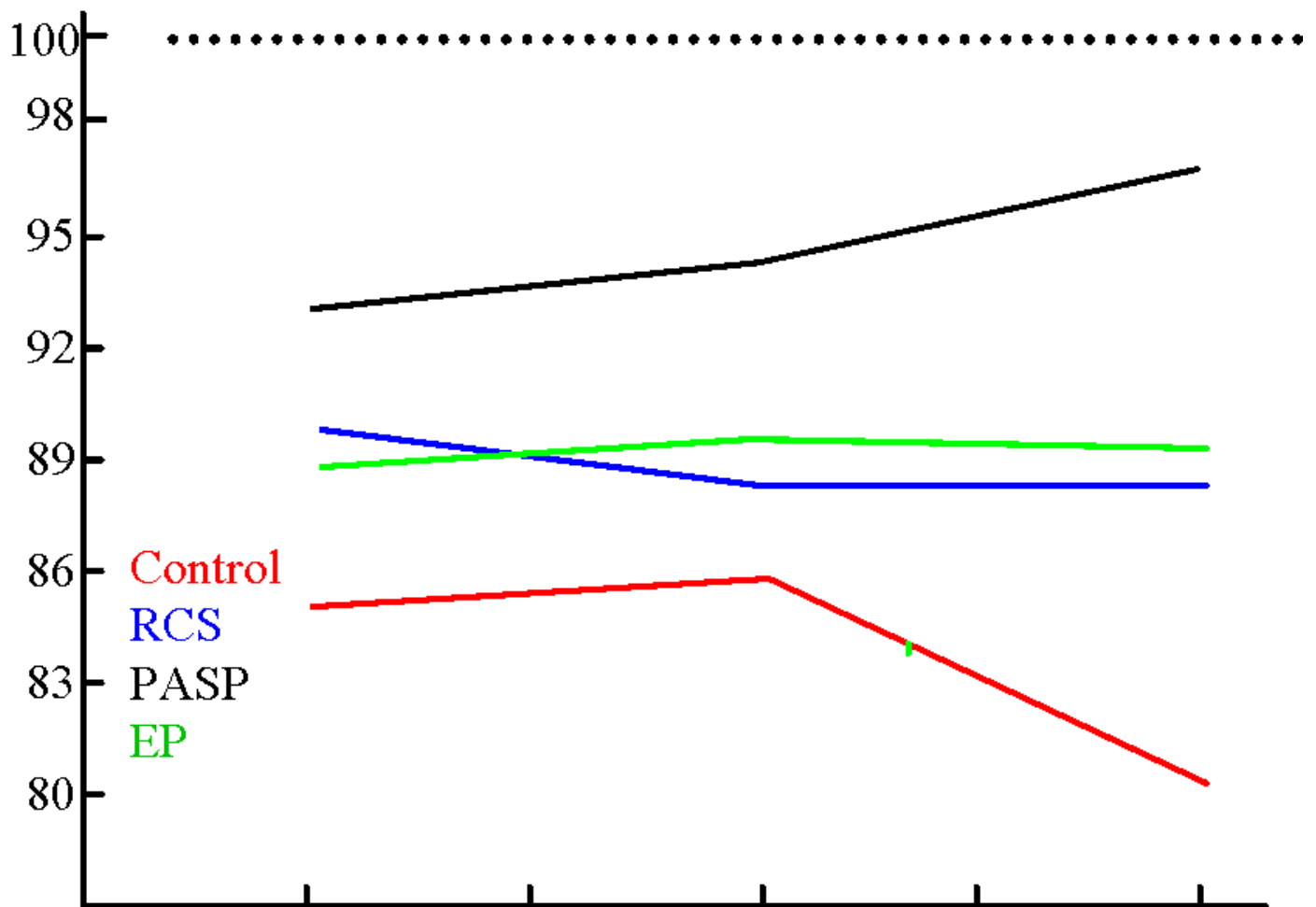
The graph below shows performance on the Passage Comprehension test of the WRMT-R, which is a cloze test. Overall group differences were reliable, but none of the specific differences between groups was statistically significant.



This graph shows **text reading accuracy** as measured by the Gray Oral Reading Test-Revised, at the end of 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> grades. Overall differences among the groups was reliable, and the PASP(CRC) group performed better than the other three groups. The graph reports standard scores (mean = 100, S.D. = 15), so stable standard scores indicate that the children are showing a normal growth rate in these skills. Improved standard scores indicate that the children are "closing the gap" with normal readers.

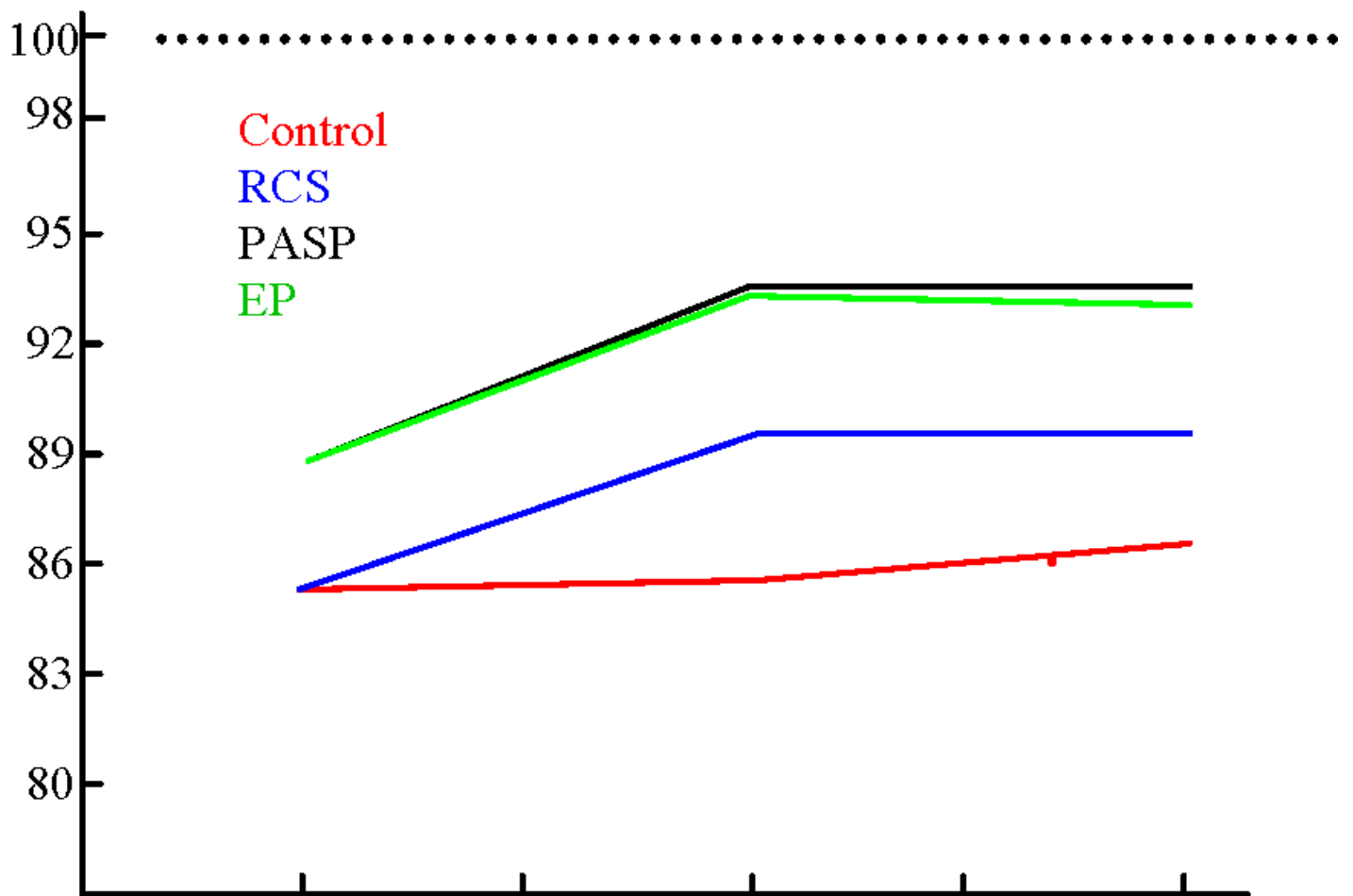


The graph below shows a measure of **reading rate** from the GORT-R. Overall differences are statistically reliable, and again the PASP(CRC) group performed better than the other groups.



This graph shows performance on the **comprehension questions** from the GORT-R. Children in the **PASP(CRC)** and **EP** groups are showing reading comprehension that is easily consistent with their general level of verbal ability.





We **calculated growth curves** for individual children and found that the three variables that most reliably and uniquely predicted growth in word-level skills were **rapid automatic naming of digits, socio-economic level of children, and classroom teacher's behavior ratings**. Children who had slower naming rates for digits, came from homes in which parents had lower income and less education, and who were rated as less attentive and with a higher incidence of behavior problems showed less growth in their reading skills. General verbal intelligence was not a unique predictor of growth in word-level skills as long as any of the phonological variables were also in the prediction equation. However, general verbal ability did play a unique role in prediction individual differences in passage comprehension at the end of the study.

### Conclusions from first prevention study:

1. Appropriate early intervention can bring the reading growth of children weak in phonological processing skills within the normal range, in terms of both accuracy and rate of text processing.
2. An instructional program that heavily emphasized phonetic decoding skills produced better word level skills, but not comprehension skills, than

a program that explicitly taught phonetic decoding but also emphasized text-level reading and writing experiences.

3. General verbal ability is not a unique predictor of growth in word level reading skills, even in a sample with wide variability in estimated Verbal Intelligence.

### **Second Prevention Study: Intervention during First Grade**

The children in this study were selected in the first month of first grade: they were the bottom 18% in letter knowledge, phonological awareness, and rapid naming. Their average estimated verbal IQ was 96, with a range from 76-130.

The intervention groups received four, 50 min. sessions per week from October through May. Half of each session involved teacher led instruction in groups of 3 children, and half of each session involved individualized computer based instruction/practice. The purpose of the teacher led instruction was to introduce information and provide initial practice in a way that would help children to profit from their reading and writing experiences on the computer. In total, the children received 40 hours of small group instruction, and 35 hours of computer based practice.

The children were randomly assigned to two instructional conditions and a control group:

1. **Auditory Discrimination in Depth (ADD)***(CRC utilizes this program)*. This program emphasizes explicit instruction in phonemic awareness and phonemic decoding skills. As the basis for acquiring phonemic awareness, children are led to discover the articulatory gestures associated with each phoneme. The computer software contained five different kinds of exercises that helped to establish the awareness and skills taught in the program.
2. **Read, Write, and Type (RWT)**. This program provided explicit instruction in phonological awareness and phonemic decoding skills while at the same time teaching them to touch type. Activities with text involved mostly writing, and most of the text that the children read was the product of their own writing.
3. **Control Group**. This group received whatever special services were routinely provided to children at-risk for reading difficulties, which for most of the students, meant minor adaptations of the regular classroom curriculum.

The classroom instruction provided to all students receiving intervention was Open Court's Collections for Young Scholars. This curriculum contains a good

balance and integration of systematic and explicit instruction in phonemic awareness, phonemic decoding skills, and literature based, meaningful experiences in reading and writing. It has been shown to be effective with children such as those selected for participation in this study. Thus, this study provided an examination of the benefits of more intensive instruction for at-risk children what was provided *in addition to*, good classroom instruction in reading.

The table below provides a summary of the end of first grade outcomes on a variety of reading measures for each of the groups. For the three reading measures, the scores are standard scores in which a score of 100 signifies average performance at the child's age level. The numbers in parentheses are pretest values.



<u>Measure</u>	<u>ADD</u> (n=36)	<u>RWT</u> (n=36)	<u>Control</u> (n=41)	<u>Significance</u>
Word Attack	(74) 114	(76) 108	99	<.01
Word Identification	(87) 111	(86) 107	100	<.01
Passage Comprehension	102	100	95	<.05
Developmental Spelling	25	25	23	<.05
Phoneme Blending	21	20	18	n.s
Phoneme elision	15	14	12	<.05
Phoneme segmenting	16	15	12	<.05
Estimated Verbal IQ	96	96	96	n.s.
Probability of RD*	.69	.65	.70	n.s.



\**Probability of being Reading Disabled.* This is a probability value derived from a logistic regress that combined pretest scores on phoneme elision,

rapid naming of digits, and letter knowledge into a single index. The higher the value, the higher the risk for reading disability.

In addition to the average achievement scores for each group, we were also interested in the number of children in each group that continued to perform below the 30<sup>th</sup> percentile on our reading measures at the end of the year. Those percentages are given in the table below.



<u>Measure</u>	<u>ADD</u>	<u>RWT</u>	<u>Control</u>
Word Attack	6%	11%	34%
Word Identification	3%	8%	25%
Passage Comprehension	17%	19%	39%
Est. Verbal IQ	42%	36%	33%



### Conclusions from Second Prevention Study

1. Children in the ADD(*CRC utilizes this program*) and RWT groups showed essentially the same amount of reading growth during the first grade year, and both groups showed higher achievement in reading than children who received excellent classroom instruction, but who received either less systematic, or no special intervention.
2. There were substantial differences in the proportion of children who remained poor readers at the end of the study between the intervention groups and those who had not received intervention.

### Remediation Study: Intervention during 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> grade.

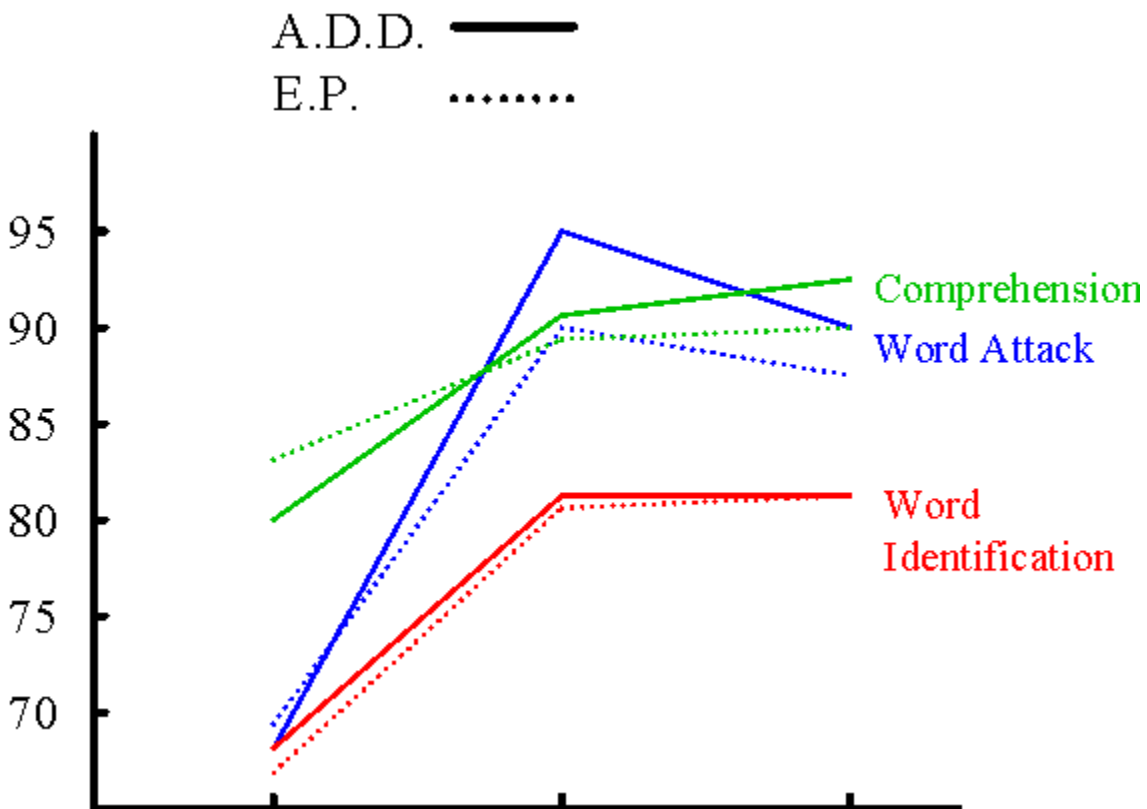
Children who were nominated by their learning disabilities teachers as having particular difficulties acquiring word-level reading skills were further screened for reading difficulties. Children whose word attack or word identification scores were at least 1.5 S.D's below the mean for their age were included in the study. The average verbal IQ for children in the sample was approximately 90.

All children received 67.5 hours of 1:1 instruction in two, 50 min. sessions per day for approximately 8 weeks. This was followed by a 50 min. session each week for eight weeks of "generalization" training in which children were

helped to generalize their new reading skills to classroom content and activities.

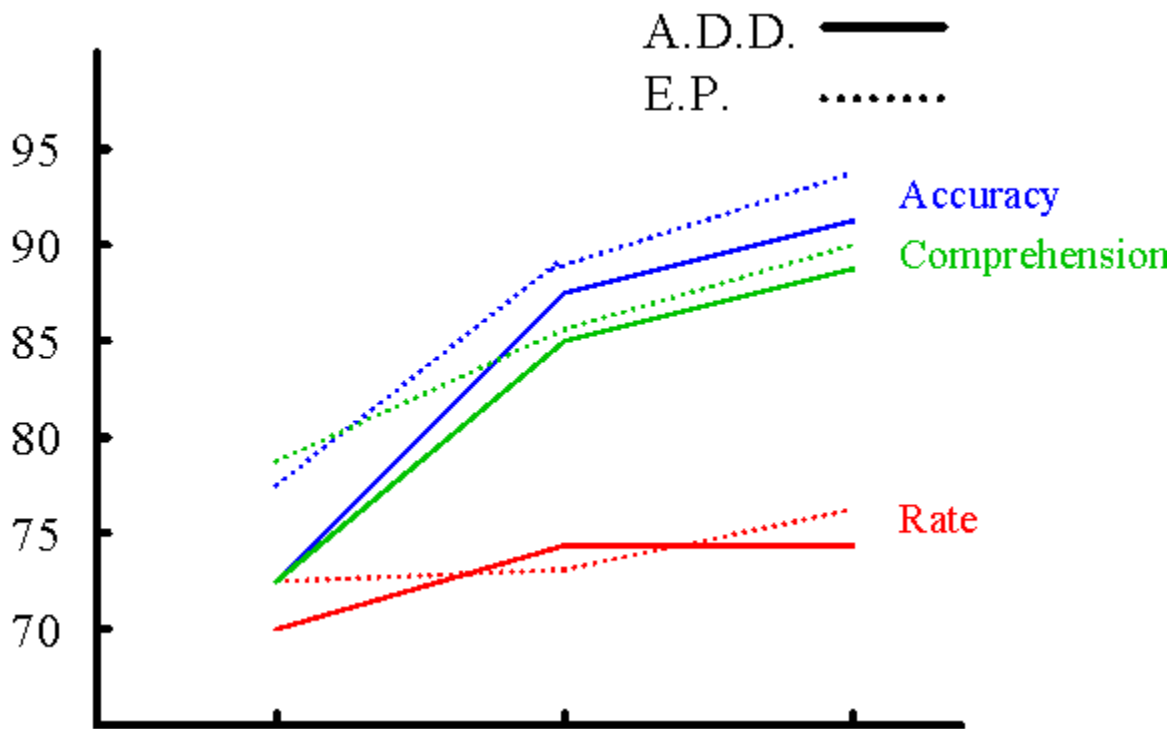
Sixty children were randomly assigned to two instructional conditions. The ADD(CRC utilizes this program) condition and EP conditions were similar to those in the first prevention study, except that, in this study, the EP condition provided slightly more explicit and systematic instruction in phonemic decoding skills. It still involved substantially more sight word instruction and reading and writing of connected text than the ADD condition.

**The graph below** shows the pretest, posttest, and 1 year follow-up standard scores on the **Word Attack, Word Identification, and Passage Comprehension** subtest of the Woodcock Reading Mastery Test-Revised. The only statistically significant differences between groups occurred on the Word Attack Subtest for the immediate posttest. Both groups showed substantial growth in all three reading skills that was maintained in the 1 year follow-up testing. The children either continued in their learning disabilities class, or were returned to the regular classroom.



**This graph** shows performance on the **Gray Oral Reading Test-Revised** in terms of standard scores that have a mean of 100 and standard deviation of 15. The most striking finding from this graph is the large disparity between improvements in reading accuracy and growth in reading fluency. Whereas the children end up close to the average range in accuracy, they showed

very little improvement in their rate scores from pre- to posttest, and one year following intervention.



As with the prevention studies, there were substantial individual differences in response to the treatments. The table below shows the percentage of children in each group who began and ended the intervention one standard deviation below average in three different reading skills.



	<u>ADD</u>		<u>EP</u>	
	<u>Pre</u>	<u>Post</u>	<u>Pre</u>	<u>Post</u>
Word Attack	96%	10%	96%	27%
Word Identification	100%	62%	100%	60%
Passage Comprehension	47%	21%	53%	33%



### Conclusions from Remediation Study

1. Through a program of intense instruction, it is possible to produce relatively large gains in phonetic decoding (1.3 to 1.8 S.D's), word

identification (.9 to 1.0 S.D's), and passage comprehension (.5 to .6 S.D's) in severely disabled readers over an eight week period.

2. Programs that differ in level of instruction in phonological awareness as well as their relative emphasis on phonetic decoding skills produce essentially the same reading gains, except in the area of phonetic decoding skill.
3. Reading gains achieved during this intensive intervention period are relatively stable over a period of one year from the end of instruction while the children are returned to their previous classroom environments.
4. Reading fluency is much more difficult to affect than reading accuracy. In spite of large gains in accuracy, reading fluency remained substantially impaired, even a year following treatment.

**The following measures were used in all three studies to monitor the growth of different reading skills.**

#### Phonetic decoding skill:

1. Word Attack from the Woodcock Reading Mastery Test-Revised
2. Phonetic Decoding Efficiency from the Test of Word Reading Efficiency
3. An experimental list of pronounceable nonwords

#### Word Reading Skills

1. Word Identification from the Woodcock Reading Mastery Test-Revised
2. Sight Word Efficiency from the Test of Word Reading Efficiency
3. An experimental list of words increasing in difficulty
4. Text reading accuracy from the Gray Oral Reading Test-Revised
5. Text reading fluency from the Gray Oral Reading Test-Revised

#### Reading Comprehension

1. Passage comprehension from the WRMT-R
2. Comprehension from the GORT-R

**We monitored treatment fidelity in the following ways:**

**Prevention studies: Videotape record of 1/4 of the instructional sessions that was reviewed biweekly and discussed with teachers**

**Remediation Study: Weekly staff meetings to discuss instructional progress and instructional strategies.**

**Note: A complete report of the first prevention study can be found in:**

Torgesen, J.K., Wagner, R. K., Rashotte, C.A., Rose, E., Lindamood, P., Conway, T. , & Garvin, C. (in press). Preventing reading failure in young children with phonological processing disabilities: Group and individual responses to instruction. *Journal of Educational Psychology*.

### **Partial earlier reports of the study appeared in:**

Torgesen, J.K. (1998). Instructional Interventions for Children with Reading Disabilities. In B.K. Shapiro, P.J. Accardo, and A. J. Capute (Eds). *Specific Reading Disability: A View of the Spectrum*. Timonium, MD: York Press.

Torgesen, J.K., Wagner, R.K., Rashotte, C.A., Alexander, A.W., & Conway, T. (1997). Preventive and remedial interventions for children with severe reading disabilities. *Learning Disabilities: An Interdisciplinary Journal*, 8, 51-62.

Torgesen, J.K., Wagner, R.K., & Rashotte, C.A. (1997). The prevention and remediation of severe reading disabilities: keeping the end in mind. *Scientific Studies of Reading*, 1, 217-234.

Torgesen, J.K. (1997). The prevention and remediation of reading disabilities: Evaluating what we know from research. *Journal of Academic Language Therapy*, 1, 11-47.

### **Partial early reports of the remediation study appeared in:**

Torgesen, J.K. (1998). Instructional Interventions for Children with Reading Disabilities. In B.K. Shapiro, P.J. Accardo, and A. J. Capute (Eds). *Specific Reading Disability: A View of the Spectrum*. Timonium, MD: York Press.

Torgesen, J.K., Wagner, R.K., Rashotte, C.A., Alexander, A.W., & Conway, T. (1997). Preventive and remedial interventions for children with severe reading disabilities. *Learning Disabilities: An Interdisciplinary Journal*, 8, 51-62.

Torgesen, J.K. (1997). The prevention and remediation of reading disabilities: Evaluating what we know from research. *Journal of Academic Language Therapy*, 1, 11-47.