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Summary of Outcomes from First grade Study with *Read, Write, and Type* and *Auditory Discrimination in Depth* instruction and software with at-risk children

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Purpose of the Study:

To examine the relative effectiveness of two computer supported approaches to teaching beginning reading skills that differed in important aspects of their instructional approach and emphasis. One of the programs was *Auditory Discrimination in Depth*, which provides very explicit instruction and practice in acquiring phonological awareness and phonemic decoding skills. In this program, children spend a lot of time practicing word reading skills out of context, but they also read phonetically controlled text in order to learn how to apply their word reading skills to passages that convey meaning. This method of instruction is widely used in the United States to help reading disabled children acquire beginning reading skills. The other program was *Read, Write, and Type*, which provides explicit instruction and practice in phonological awareness, letter sound correspondences, and phonemic decoding, but does so primarily in the context of encouraging children to express themselves in written language. In this program, children spend a greater proportion of their time processing meaningful written material, and they are encouraged to acquire "phonics" knowledge to enable written communication.

Method:

Selection of subjects

All the first grade children in five elementary schools were initially screened using a test of letter-sound knowledge. Children performing in the bottom 35% of this test were screened with three other tests: a measure of phonological awareness, a measure of rapid automatic naming of digits, and the vocabulary subtest of the Stanford Binet IQ test. 104 children were identified with the lowest combined scores on these predictive measures, who also had estimated Verbal IQ above 80. These selection procedures identified the 18% of children most at risk in these schools to develop problems in learning to read. These 104 children were randomly assigned to the ADD group, and the RWT group. About 34% of the sample were minority children (almost all African American), and about 35% of the sample was receiving free or reduced lunch supplements. There was a wide range of socio-economic status among the children in the study.

Instruction.

Children were seen from October through May in groups of three children. The children received four, 50 minute sessions per week during this time. Approximately half the time in each instructional session was devoted to direct instruction by a trained teacher in skills and concepts that would be practiced on the computer. In the RWT condition, this instruction consisted of the "warm up" activities outlined in the teacher's manual. The remainder of the time was spent with the children working individually on the

computer, with the teacher in a support role. Occasionally, if a particular child was having difficulty with a specific skill, the teacher would provide additional individualized instruction while the other two children in the group were working on the computer. The ADD group received instruction in exactly the same way, except that the nature of the teacher led activities, as well as the computer support activities, was different.

Results:

All children were tested during the month of May. The Table below provides a comparison of the scores obtained by children in each group.

Table 1: *End of Year Outcomes in First Grade Study*

	Instructional Group							
	ADD				RWT			
	Pre		Post		Pre		Post	
	X	S.D.	X	S.D.	X	S.D.	X	S.D.
Word Attack	74.2	7.3	109.7	14.0	74.7	10.1	106.3	13.6
Word Identification	86.2	10.5	107.1	14.3	85.3	8.5	105.1	13.4
Passage Comprehension	--	--	99.9	12.5	--	--	99.3	10.5
Word Efficiency	84.6	6.7	101.2	9.4	83.9	8.3	98.1	8.8
Nonword Efficiency	--	--	107.5	15.5	--	--	102.6	12.5
Phoneme Blending	7.5	4.4	18.8	5.3	7.6	4.8	18.9	4.9
Phoneme Elision	4.7	2.2	14.3	4.5	5.4	2.6	13.5	4.5
Phoneme Segmenting	2.6	3.5	16.2	6.6	5.3	2.5	15.3	5.3
Estimated Verbal IQ	95.5				95.5			

Explanation of Tests: *Word Attack* – a measure of phonemic reading ability, child reads nonwords, score is standard score based on national sample with a mean of 100 and standard deviation of 15. *Word Identification* – a measure of word reading vocabulay, child reads list of words of increasing difficulty, standard score. *Passage Comprehension* – measure of ability to comprehend the meaning of short passages, standard score. *Word Efficiency* – measure of fluency of reading words out of context, standard score based on local norms, (Mean = 100, S.D. = 15). *Nonword Efficiency* – measure of fluency of reading nonwords, standard score based on local norms. *Phoneme Blending* – ability to blend separately presented sounds together to form words, raw score. *Phoneme Elision*, ability to manipulate sounds in words, raw score. *Phoneme Segmenting* – measure of ability to isolate and pronounce the sounds in words, raw score. *Estimated Verbal IQ* – based on vocabulary subtest of Stanford Binet IQ test.

Children in both instructional groups showed large gains in relative standing in reading skills from pre to posttests. The only statistically reliable difference in reading gain between the groups occurred on the Nonword Efficiency measure, and the *Auditory Discrimination in Depth* Group was stronger on this measure.

Discussion of overall group comparisons:

The big surprise here was how well everyone did. Particularly in phonemic reading skills, the children in both groups showed very large gains (two full standard deviations) in this area, and their gains in fluency were almost as strong as those for accuracy. The results are encouraging for both intervention programs.. It is also important to note that the reading comprehension scores were *higher* than expected based on the children's estimated general verbal ability.

Our conclusion is that both the RWT and the ADD curriculum are effective ways to teach early reading skills to children at risk for reading problems. In one sense, it was a bit surprising that the RWT program, which is not as explicit nor intensive in providing instruction and practice in phonological awareness and phonemic reading skills, produced just as much growth in these areas as the ADD program did. In part, this may be because the program was so engaging for the children who worked with it.

Of course, in a study such as this in which both teachers and computers are involved, it is impossible to tell whether it was teacher skill or computer practice that produced the effects observed. What we can say for sure is that the general methodology of instruction embodied in the RWT program is equally effective with that utilized in the ADD program.

Number of Children who remained weak readers at the conclusion of the intervention

In addition to knowing how the instructional groups performed as a whole, it is also useful to know what proportion of the children remained "poor" readers at the end of the intervention. For purposes of this study, we will define "poor" readers as any child who performs below the average range on our measures of reading ability. We will define the average range as any performance above the 30th percentile, which corresponds to a standard score of 92. Although this is a relatively stringent standard, if children are allowed to fall too far behind in the development of critical early word reading skills, recent research suggests that they will have less actual opportunities to practice reading than other children, they will have reduced opportunities for vocabulary growth, they will acquire negative attitudes toward reading, and they will miss opportunities for the development of reading comprehension strategies. In short, early failure to maintain normal development in word reading skill has a variety of serious consequences on the development of both reading and broad cognitive skills. The table below indicates the proportion of children in each group who finished the study performing below the 30th percentile in each kind of reading skill we examined. The percent of children who had an estimated verbal IQ below the 30th percentile is also listed, because of the influence of vocabulary on reading comprehension. Normally, it would be unusual for children to have reading comprehension scores substantially above their general verbal ability.

Table 2: *Percent of children who fell below the 30th percentile in reading skill and estimated verbal intelligence at the end of first grade*

	Instructional Group	
Reading measure	ADD	RWT
Word Attack	12%	19.6%
Word Identification	10%	15.7%
Passage Comprehension	20%	23.5%

Est. Verbal IQ	40%	37%

If we consider that the sample constituted the 18% of children most at risk for reading failure, we can estimate that, if the ADD curriculum is applied in the way it was applied in this study, about 2% of children from the entire population (.18 x.12 = .0216) would still have poor phonetic decoding skills at the end of first grade. The corresponding percentages for Word Identification and Passage Comprehension in the ADD group are 2% and 4%. The estimated percentage of children who would remain below the 30th percentile in the entire population if the RWT curriculum were applied as in this study was 4% for Word Attack, 3% for Word Identification, and 4% for passage comprehension. Thus, it appears that the ADD curriculum was marginally stronger in building phonetic decoding skills than the RWT curriculum, but overall the differences in outcome for the two curriculums were not substantial.

Did the preventive interventions increase reading growth beyond that obtained by children receiving only whole class instruction and interventions by the schools?

In order to answer questions about the effectiveness of our experimental interventions in contrast to classroom instruction and interventions provided by the schools (tutoring and special education), we must use a subset of the sample, because we were not able to recruit sufficient numbers of control children at two of the schools. Thus, in these comparisons between the Experimental and control groups, only children receiving instruction at three of the schools are utilized. In the table below are presented the post-test scores for children in the ADD, RWT, and control groups. Although the children in the control groups were not given the full range of pre-test measures, they were selected by the same criteria, and their probability of having a reading disability, as well as their estimated verbal intelligence, was similar to children in the two treatment groups. The classroom reading curriculum in 2 of the 3 schools used in this comparison was Open Court's *Collections for Young Scholars*.

Table 3: Posttest scores on reading, spelling, and phonological awareness outcome measures for children from schools providing children for no treatment control group.

	Instructional Group			
	ADD (n=36)	RWT (n=36)	Control (n=41)	Signif.
Word Attack	113.7 (12.2)	108.3 (12.1)	99.5 (14.5)	<.01
Word Identification	110.6 (12.2)	107.0 (12.4)	100.1 (15.6)	<.01
Passage Comprehension	102.2 (10.0)	100.2 (9.6)	95.4 (14.4)	<.05
Developmental Spelling	25.1 (2.7)	25.0 (2.6)	23.4 (3.2)	<.05
Phoneme Blending	20.6 (4.5)	20.1 (4.5)	18.2 (5.4)	n.s.
Phoneme Elision	15.3 (4.2)	13.8 (4.2)	12.5 (4.6)	<.05
Phoneme Segmenting	15.6 (3.7)	15.4 (4.7)	11.7 (4.5)	<.01
Estimated Verbal IQ	96.1 (12.5)	95.9 (11.2)	95.9 (11.3)	n.s.
Probability of R.D.	.69 (.22)	.65 (.22)	.70 (.19)	n.s.

Explanation of Probability Estimate for Reading Disabilities. This number was derived from a logistic regression using screening scores on phonological awareness (phoneme elision), rapid naming of numbers, and letter sound knowledge. The *Developmental Spelling Score* was derived by asking the children to spell five words, and scoring their production on the extent to which it was phonetically correct.

As can be seen from Table 3, the interventions significantly improved reading scores in all three areas (phonetic decoding, sight word reading, and passage comprehension) over children in the school-based control group. The data were analyzed with analysis of covariance, with the probability for reading disability score being the covariate in each case. In follow-up comparisons among each group, only the ADD group was significantly stronger than the control group for Word Identification and Passage Comprehension, while both experimental groups performed significantly higher on the Word Attack Measure. Both groups were also stronger than the control group on Phoneme Segmentation and Developmental Spelling, but only the ADD group was stronger on the Phoneme Elision task. The individual contrast analyses also showed that the ADD group and RWT groups were not reliably different from one another on any of the measures.

Percentage of children remaining weak readers at the end of the intervention

Analogous to Table 2, the table below provides a direct comparison of the percentage of children in each group who attained scores below the 30th percentile on each of the reading measures.

Table 4: *Percent of children from schools providing children for the control group who fell below the 30th percentile in reading skill and estimated verbal intelligence at the end of first grade*

	Instructional Group		
Reading measure	ADD	RWT	Control
Word Attack	6%	11%	34%
Word Identification	3%	8%	25%
Passage Comprehension	17%	19%	39%
Est. Verbal IQ	42%	36%	33%

The percentage of children in the experimental groups with reading skills at the end of the intervention is slightly smaller for this subgroup than for the whole sample. This is likely due to two factors. First, the three elementary schools contributing subjects to this sample served neighborhoods of slightly higher SES and smaller percentage of minority children (20% minorities vs. 34% in the complete sample) than for the treatment sample as a whole. Second, two of the three schools in this analysis employed a first grade reading curriculum that more explicitly and systematically supported the growth of word level reading skills than in the two schools excluded from the analyses.

If the ADD condition is compared to the Control condition, it is apparent that introduction of the preventive intervention would reduce the number of children with poor reading skills in a comparable population at the end of the first grade from 6% to 1% for phonetic decoding, from 4.5% to less than 1% for sight word reading, and from 6% to 3% for passage comprehension.

General Discussion of Results

This study suggests that both the *Auditory Discrimination in Depth* and *Read, Write, and Type* curriculums are effective ways to provide instruction to prevent reading problems in at-risk first grade children. Overall, the ADD curriculum seems slightly stronger, although the differences between the two curricula are not large. In our experience, it is much more difficult to train teachers to administer the ADD curriculum effectively than is the case for the RWT curriculum. The comparison of the experimental curricula with school based intervention provided in this study is likely to provide a conservative estimate of the effectiveness of these interventions because of the strong instruction in reading provided by regular classroom teachers in two of the three schools to which the control children attended. We are still collecting data about the number of children in the no treatment group who actually received supportive instruction from school personnel.

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