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The Effect of the DISTAR Instructional System on First and Second Grade Achievement: An Evaluation of the 1971-1972 Title I Program of Winthrop, Massachusetts

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The Distar I Reading, Language and Arithmetic programs were used with two first grade classes. The Distar II programs were used with two second grade classes. One first grade Distar class appeared to make some progress in oral language. Comparison of the first grade Distar classes with a first grade control class that used a Scott-Foresman basal reader program showed initial differences in reading readiness favoring the control group but no differences in IQ or reading achievement at the end of first grade. The first grade reading test was constructed in two forms, one using Distar reading font and the other traditional type font.

A second grade subgroup of nineteen Distar pupils was compared to a group of twenty non-Distar pupils on reading readiness and achievement in first grade, and IQ and achievement in reading, language, and arithmetic in second grade. A significant difference in arithmetic computation favored the Distar group.

The total (n = 51) second grade Distar group was found significantly below grade norms (2.9) on four of seven achievement subtests.

Recommendations included supplementing the Distar program with instruction for greater transition to reading connected sentences and paragraphs, and instruction on specific comprehension skills. Changes should be made in the program to avoid the confusion about number symbols that were detected on the achievement test.

Description of the Title I Program

The Title I program at Winthrop consisted of the use of the Distar program, published by SRA, in several first and second grade classes at Center and Shirley Street Schools. The Distar program is a carefully structured program for teaching reading, arithmetic and language. It is a many-faceted program that includes special teaching materials, specially designed letter and number forms for presenting words and numbers, specific recommended teaching procedures, and supplementary instructional personnel. Therefore, it is a program having special methods, materials, and media. It would be difficult without extensive, controlled research involving the varying of the several facets of the program to decide what facet is responsible for what result. The effectiveness of the published program as a whole, in other situations, will be discussed in a later section of this report.

In Winthrop, as in any community, the program of instruction presented to the children reflects both the selected published program and the decisions and actions of the schools and the teachers involved. Among the decisions are those to supplement the published Distar program with additional instruction in phonics and spelling and the use of related teacher-made or published phonics and spelling materials. The teaching procedures recommended in the Distar program were at times modified. Modification may reflect conscious decision-making or normal variations in teaching style. In some cases the modifications were contrary to the recommendations of the published Distar program (e.g. one teacher presented single consonant sounds with considerable stress, with the result that a vowel (schwa) was appended to the consonant). Therefore, the program described in this report is the Distar program as taught, supplemented and modified by the teachers. The impression of this

evaluator is that, while extensively supplemented by second grade teachers and the first grade class at Shirley Street, the teaching program adhered in most respects to the publisher's recommendations.

One unavoidable but serious discrepancy between the publisher's recommendation and the program's implementation did exist. In several places, the publisher indicates the program is for pre-school and primary grade children. This suggests that Distar I should be completed before children enter first grade if a pre-first grade class is conducted. Since neither pre-school nor kindergarten classes were held in Winthrop, Distar I was the first grade program. Naturally, pupil achievement reflects this circumstance.

Non-Distar pupils were used as control groups for certain aspects of the evaluation. A first grade class at Highland Street School was the control group for first grade Distar children at Center and Shirley Street. The reading program for these non-Distar first graders was Scott-Foresman basal readers (1960 edition), Phonetic Keys, supplementary readers, and SRA reading laboratory materials. Children made use of a central school library. There was no formal language program prior to Roberts English which was introduced in third grade. The Addison-Wesley mathematics program was used.

Selected pupils in several second grade non-Distar classes at Center School were the second grade control group. Selection was made a year earlier when non-Distar first graders were "matched" with Distar children on sex, IQ, and reading readiness. Because specific "pairs" of "matched" children were not identified, the non-Distar second graders are compared as a group to the children with whom they were "matched" (now, one of the two second grade Distar classes). These second grade non-Distar pupils followed the Scott-Foresman program (1960 edition), and used Phonetic Keys to Reading,

SRA laboratories, and other supplementary material. The language program included the Roberts English materials (text and workbook) but was somewhat informal. Instruction provided for in Roberts English includes capitalization, punctuation, sentences, plurals, pronouns, verb tense, and compound words. The mathematics program was that published by Addison-Wesley.

The similarity of program components for first and second grade non-Distar pupils is important. It supports the assumption that, although the "controls" were from two different schools, the primary curriculum for these children was substantially the same and represents the alternative to Distar employed by the Winthrop public schools.

The Published Distar Program

The methods, materials and media comprising the published Distar program were examined by the evaluator. These are effectively summarized in three publications by SRA: Behavioral Objectives Distar Reading I, II, Behavioral Objectives Distar Arithmetic I, II, and Behavioral Objectives Distar Language I, II. The major skill areas of Reading I and II are reading, decoding, and comprehension. In Arithmetic I children are taught to count, to use numerals, plus and minus signs, and symbols for equality and inequality. They learn to group and regroup numbers. In Arithmetic II children learn problem solving, multiplication, and fractions. Language I stresses the language used in the classroom. In Language II children learn to analyze language, perform logical operations, and answer questions. A more detailed discussion of what Distar consists goes beyond the scope of this report.

The published Distar program, and the related teaching approaches of Engelmannand Bereiter, are discussed and criticized elsewhere (see Aukerman, R. C. Approaches to Beginning Reading, New York: Wiley, 1971

pp. 448-457; Friedlander, B. Z.,"The Bereiter-Engelmann Approach," The Education Forum, 32:3 (March, 1968) pp. 359-362). It would be impractical to attempt a detailed critique of the published program in this report. A few general comments will have to suffice. Certain assumptions about disadvantaged children, on which Engelmann bases his program, can be, and have been, disputed. Whether the disadvantaged possess a language deprivation, a structural language difference, a vocabulary reflecting some differences of experience, or none of these is debatable. Also, the situation for one group of children may differ considerably from that of another.

Certain teaching procedures appear to this evaluator to be less effective than others that might have been used. The published program seems not to provide sufficient transition from isolated phonics and reading isolated words to reading connected text. The observed result was that children often were not adept at reading sentences and paragraphs. Also, there seems to be a lack of emphasis in the published program on building specific comprehension skills(e.g. comprehending main idea; comprehending the sequence of events).

The authors sometimes communicated to pupils incorrect statements that can cause later confusion. The word "sound" is treated as synonymous with "letter," whereas in later reading the pupils will have to differentiate between sounds of a spoken word and letters of its written form.

Prior Research on Distar

The evaluator consulted Distar Instructional System: Summaries of Case Studies on the Effectiveness of the Distar Instructional System (Chicago: SRA, 1971). This publication describes twenty-one case studies in which the Distar system was employed. No studies involving Distar were found in annual summaries of reading research

reported in Reading Research Quarterly. (The Distar system has been available only since 1969). The SRA publication appeared therefore to be a reasonably complete listing of the available research.

Reports are cited which show that Engelmann prekinderkarten and kindergarten programs have a beneficial effect on IQ score and reading readiness. Also, several reports show a positive correlation between the Distar lesson reached and reading readiness or achievement in reading and arithmetic.

Several studies compared children who participated in a traditional kindergarten program with participants in a kindergarten that employed Distar. Standardized achievement tests (that normally are used with first graders and above) showed that children of the Distar program had attained significantly greater reading and arithmetic achievement. Of course, since formal instruction in reading and arithmetic normally is not undertaken in kindergarten, the result is not surprising. The question early childhood educators might raise is whether something else of value was lost when kindergarten children were taught reading and arithmetic.

Of greater importance are studies of primary grade children where performance of children taught with Distar is compared with that of control groups on achievement tests of reading and arithmetic. A comparison of SRA Reading Test scores for first-grade children with two years of Distar reading and language instruction and first graders at the same school taught with another instructional system favored the Distar pupils. Also, the Distar pupils scored above national norms (Summaries of Case Studies... pp. 22-23). It should be noted that the results of two years of instruction are apparently being compared with the effects of one year of instruction in the traditional program.

The use of Distar in kindergarten, therefore, appears benefi-

cial in building reading and mathematics ability when measured at the end of kindergarten and first grade. How Distar would compare to another system of teaching reading and arithmetic in the kindergarten is not established by the case studies reported. Moreover, the effect of Distar instruction that is initiated in first grade is considered in only one of the studies. Achievement of first graders using Distar was significantly greater than achievement of first graders the previous year who used basal texts. Achievement of the two groups (n = 98 and 112 respectively) was measured on the Stanford Achievement Test, Primary I, Form W (Summaries of Case Studies ... p. 9).

The present evaluation of the use of the Distar system in Winthrop in part compares the achievement of first and second graders who have received Distar instruction since the first grade with that of children who have received traditional instruction.

Evaluation Design

First grade Distar and control classes were pre- and post-tested on the Basic Concept Inventory to assess gains in oral language ability. Achievement in reading was measured on a test designed by the evaluator. Distar first graders were tested with a form employing the alphabet font used in the Distar program. Control first graders were tested with a typewritten form. Achievement of the two groups was compared.

Achievement of second grade Distar and control children was measured on the Stanford Achievement Test, Primary II. A subgroup of Distar pupils had been matched with a group of non-Distar pupils when the children were in the first grade. A comparison was made of the achievement of this subgroup and the non-Distar pupils on the Stanford as well as achievement on the Gates-MacGinitie (administered at the end of first grade), the Metropolitan Readiness Test

(administered at the beginning of first grade), and the second grade Otis-Lennon IQ scores.

The Stanford Achievement mean scores of all second grade Distar pupils were compared to national norms (grade placement at time of testing was 2.9).

Tests Used

The Otis-Lennon Mental Ability Test was used for measuring IQ. Reading readiness, measured in September of each child's first grade in school, was measured with the Metropolitan Readiness Test.

Oral language of first graders was measured on the Basic Concept Inventory. This test yields five scores: Score 1 is Basic Concepts, Score 2 is Statement Repetition, Score 3 is Statement Comprehension, Score 4 is Pattern Awareness, and Score 5 is Total Test. Scores are in number of errors.

Reading achievement of first graders was measured with a test constructed by the evaluator. The forty-item test consisted of short passages followed by questions. The vocabulary load reflected both typical first grade vocabulary and the spelling patterns taught in Distar I. Only occasional Distar words (e.g. hamburger), that were likely learned as sight words by Distar pupils and not used in traditional material, were avoided. This first grade reading test was prepared in two forms. The Distar form employs the Distar reading font. The non-Distar form employs traditional type-font. The test yielded four subscores, based on four question types, and a total score. The subscores were for comprehension of 1) main ideas, 2) stated details, 3) inferences, and 4) sequence. A check was made of the reliability of the test using the results obtained on the pupils in this study. The test was divided in two halves. Each of the four question types was split equally between the two halves. The two halves of the test were correlated. The split half coeffi-

cients were corrected by using the Spearman-Brown formula. High reliability coefficients were obtained on both forms (see Table 1).

TABLE 1

RELIABILITY COEFFICIENTS OBTAINED FOR THE FIRST GRADE READING TEST

	N	Split-half reliability coefficient	Spearman-Brown correction
Distar Form	49	.9216	.959
Non-Distar Form	19	.9236	.960

The Gates-MacGinitie, Primary A, was used to measure reading achievement of a subgroup of second grade Distar pupils and a control group at the conclusion of first grade. At the conclusion of second grade the Stanford Achievement Primary II was used. Form W was used with all but two pupils in the control group, who used sections of form X. For this reason grade equivalents, rather than raw scores, are used in the analysis. Seven of the eight subtests were administered. These cover the areas of reading, language, and arithmetic. The subtests are: Word Meaning, Paragraph Meaning, Spelling, Word Study Skills, Language, Arithmetic Computation, and Arithmetic Concepts.

Results

First Grade Language

Oral language development was measured by means of the Basic Concept Inventory. Pretesting was done in December 1971-January 1972. Posttesting was done in June 1972. Distar pupils at Center and Shirley Street Schools were tested, as was a control first grade at Highland Street School. Of twenty-one children tested at Highland Street, results on only nineteen were analyzed because, of the two not counted, one was bilingual and the other had hearing loss. Results at each

school were analyzed by using a t test for correlated observations. The .05 level was considered significant on a two-tailed test. Results are shown in Table 2. At Center School, significant gain was shown in oral language on Score 1 (Basic Concepts), and Score 5 (Total Test). However, significantly poorer posttest performance occurred on Test 4 (Pattern Awareness). At Shirley Street School no changes were significant. At Highland Street significantly poorer posttest results occurred on Score 1 (Basic Concepts), Score 4 (Pattern Awareness), and Score 5 (Total Test).

If the Distar program were especially helpful in developing oral language, gain on the Basic Concept Inventory would be expected. Gain could also be expected at the control school, but of lesser magnitude. Because significant loss cannot be explained except possibly as due to test unreliability or examiner inconsistency, it is not possible to draw firm conclusions from the data. The data suggest that pupils at Center School made significant gain in Basic Concepts and Total Test.

TABLE 2

PRETEST AND POSTTEST RESULTS ON THE BASIC CONCEPT INVENTORY

		Center School N = 22			
		Mean	SD	t	P
Score 1	Pre	11.09	3.72	-7.136	<.001
	Post	7.00	3.79		
Score 2	Pre	2.05	3.02	-1.241	NS
	Post	1.05	1.73		
Score 3	Pre	2.55	3.59	-0.944	NS
	Post	1.82	1.68		
Score 4	Pre	2.41	1.71	2.928	<.01
	Post	3.59	1.79		
Score 5	Pre	18.09	8.65	-2.815	<.05
	Post	13.45	6.30		

TABLE 2 (Cont.)

		Shirley Street School N = 30 Mean	SD	t	P
Score 1	Pre	3.93	4.03	-1.736	NS
	Post	3.13	4.31		
Score 2	Pre	1.30	2.61	0.559	NS
	Post	1.60	2.44		
Score 3	Pre	1.00	1.49	-1.848	NS
	Post	.53	.78		
Score 4	Pre	1.90	2.25	0.311	NS
	Post	2.03	2.31		
Score 5	Pre	8.13	9.12	-0.817	NS
	Post	7.30	7.22		
		Highland Street School N = 19 Mean	SD	t	P
Score 1	Pre	3.05	1.75	5.160	<.001
	Post	7.11	3.65		
Score 2	Pre	1.37	2.65	1.392	NS
	Post	2.00	4.08		
Score 3	Pre	2.32	1.46	-0.205	NS
	Post	2.21	2.10		
Score 4	Pre	1.79	1.65	4.313	<.001
	Post	3.16	1.68		
Score 5	Pre	8.56	5.37	3.951	<.001
	Post	14.47	9.37		

First Grade Reading

First graders at Center and Shirley Street Schools were compared on IQ, reading readiness, and reading achievement to determine whether these two groups could be treated as one during further analysis. As Table 3 indicates, no significant differences were found on these measures. The groups were combined and were compared to the control group at Highland Street School (Table 4). Signif-

icant differences on a t test for independent observations (.05 level on a two-tailed test accepted as significant) were found only on reading readiness and favoring the control group. Although not significant, the direction of difference in reading subscores and total score consistently favored the control group. Each Distar first grade was separately compared to the control group. Again, no significant differences in reading were found.

TABLE 3

COMPARISON OF FIRST GRADERS AT CENTER AND SHIRLEY STREET ON THE OTIS-LENNON, METROPOLITAN READINESS TEST, AND THE FIRST GRADE READING TEST, DISTAR FORM

School	Test Score	Mean	SD	N	t	P
Center	Otis IQ	104.4	10.2	20	0.272	NS
Shirley		103.4	14.5	29		
Center	MRT raw score	54.9	17.5	20	-1.060	NS
Shirley		59.3	11.8	29		
Center	Read. M.I.	2.8	2.1	20	-0.934	NS
Shirley		3.4	2.4	29		
Center	Read. Details	7.2	5.9	20	0.458	NS
Shirley		6.4	5.3	29		
Center	Read. Infer.	3.3	2.7	20	-0.263	NS
Shirley		3.4	2.5	29		
Center	Read. Seq.	2.2	1.6	20	0.164	NS
Shirley		2.1	2.3	29		
Center	Read. Total	15.4	11.3	20	0.002	NS
Shirley		15.3	11.7	29		

Because of a missing readiness score, one child at Center School was not included in the analysis although tested in reading (Total Score was 3). A bilingual child (Total Score 14) and a child with hearing loss (Total Score 0) at Highland Street were tested but not included in the analysis of data.

TABLE 4

COMPARISON OF DISTAR AND NON-DISTAR FIRST GRADERS ON THE OTIS-LENNON, METROPOLITAN READINESS TEST, AND THE FIRST GRADE READING TEST, DISTAR AND NON-DISTAR FORMS

Group	Test Score	Mean	SD	N	t	P
Distar	Otis IQ	103.8	12.8	49	0.211	NS
Non-Distar		103.1	13.7	19		
Distar	MRT raw score	57.5	14.4	49	-2.721	<.01
Non-Distar		67.5	11.6	19		
Distar	Read. M.I.	3.1	2.3	49	-1.538	NS
Non-Distar		4.1	2.5	19		
Distar	Read. Details	6.7	5.5	49	-1.211	NS
Non-Distar		8.5	5.1	19		
Distar	Read. Infer.	3.4	2.6	49	-1.205	NS
Non-Distar		4.2	2.6	19		
Distar	Read. Seq.	2.1	2.0	49	-1.185	NS
Non-Distar		2.8	2.0	19		
Distar	Read. Total	15.3	11.4	49	-1.387	NS
Non-Distar		19.6	10.9	19		

The first grade reading results indicate the Distar pupils and the non-Distar controls, tested on Distar and non-Distar forms, respectively, of a specially constructed test, did not differ significantly in reading ability despite initial differences in readiness. Examination of individual scores obtained by Distar pupils shows a range from none correct or attempted to near perfect performance (38 of 40 correct by one child). This suggests that a considerable range of achievement exists among Distar pupils. Some pupils apparently acquired the skills needed for fluent reading of simple passages and others did not. For these first graders, Distar did not appear to give virtually all children the needed basic skills. The

program itself might be improved by encouraging transition from reading isolated letter sounds and words to reading connected passages and by teaching specific reading strategies of determining main idea and related details, making inferences, and recalling sequence of events.

Second Grade Achievement

A subgroup of second grade Distar pupils at the Center School were "matched" with non-Distar pupils at Center School when they were in the first grade. Although no attempt is made in this analysis to treat the pupils as pairs, the Distar subgroup and controls are compared on a number of variables. The comparison covers both first and second grade achievement for the same children. A t test for independent observations was used setting significance at the .05 level on a two-tailed test.

Table 5 shows the two groups did not differ on initial reading readiness or on second grade IQ testing. There were no significant differences on first grade reading achievement using the Gates-MacGinitie. On the Stanford Achievement administered at the end of grade 2 there were no significant differences in reading, spelling, or language. A significant difference favoring the Distar group appeared in Arithmetic Computation.

Results on the Stanford Achievement subtests for all second grade Distar pupils are compared to national norms. The results are those of all fifty-one second grade Distar pupils tested. Because of absence when certain subtests were given, as few as forty-four were tested and as many as fifty-one. Results are reported in Table 6. A comparison of Tables 5 and 6 shows that the Distar subgroup reported in Table 5 was generally the better pupils among second grade Distar pupils. On Table 5, all Stanford Achievement subtest means of the Distar subgroup were at or

TABLE 5

COMPARISON OF DISTAR AND NON-DISTAR SECOND GRADERS ON IQ; FIRST GRADE READING READINESS AND READING ACHIEVEMENT; SECOND GRADE ACHIEVEMENT

Test & Date Administered	Scores Reported	Distar (N = 19) Mean & SD	Non-Distar (N = 20) Mean & SD	t	P
MRT 9/70	raw scores	62.0 14.9	65.2 12.1	-0.738	NS
Otis-Lennon 1/72	IQ	110.9 16.9	105.0 13.3	1.223	NS
Gates-MacGinitie Prim. A 6/71	raw scores				
Vocabulary		36.3 9.5	39.8 8.5	-1.213	NS
Comprehension		22.6 7.7	23.3 5.9	-0.284	NS
Stanford Achievement Prim. II 6/72	grade equiv.				
Word Meaning		2.98 1.27	3.09 .73	-0.336	NS
Paragraph Meaning		2.91 1.25	2.75 1.09	0.429	NS
Spelling		3.17 1.05	3.23 .89	-0.165	NS
Word Study Skills		3.45 2.01	3.05 1.26	0.764	NS
Language		3.13 1.22	2.61 .66	1.684	NS
Arithmetic Computation		3.23 .39	2.80 .59	2.687	<.05
Arithmetic Concepts		3.43 .92	2.83 1.05	1.861	NS

above grade placement (2.9). However, the IQ and Stanford scores of the fifty-one Distar children (Table 6) are uniformly lower than the scores on Table 5. The Stanford subtest mean scores on Table 6 were uniformly below grade placement (2.9). Four of the seven subtest means are significantly below grade placement of 2.9.

TABLE 6

OTIS-LENNON IQ SCORES AND STANFORD ACHIEVEMENT TEST
GRADE EQUIVALENTS OF SECOND GRADE DISTAR PUPILS
TESTED ON STANFORD IN JUNE 1972
(GRADE PLACEMENT AT TIME OF TESTING = 2.9)

Test & Date Administered	N	Mean	SD	t*	P
Otis-Lennon 1/72	51	101.4	16.8		
Stanford Achiev. Prim. II 6/72					
Word Meaning	48	2.49	1.00	-2.847	<.01
Para. Meaning	46	2.55	.97	-2.448	<.05
Spelling	44	2.85	.83	-0.400	NS
Wd. St. Skills	49	2.88	1.45	-0.097	NS
Language	49	2.72	.97	-1.295	NS
Arithmetic Computation	51	2.49	.82	-3.565	<.001
Arithmetic Concepts	49	2.56	1.01	-2.361	<.05

*t value is result of test for difference between observed mean and hypothetical mean of 2.9 (grade placement)

Examination of pupils' test booklets revealed at least one testing problem resulting from the Distar program. In Distar Arithmetic pupils are taught to record a number like 23 as $2^{0}3$, using a 0 as a superscript. This caused serious problems when children were tested. Some children evidently continued to record the zero for this purpose, others no longer did so, and others recorded zero as a superscript when writing a number like two-hundred-one (written $2^{0}1$) as well as when writing the number twenty-three (written $2^{0}3$). For the reason that a number like 201 would be written $2^{0}1$, zero was always interpreted as indicating its normal use when papers were scored. This frequently resulted in some pupils' being penalized for four or five items in arithmetic computation. What is more important is that the children are ap-

parently confused on this point. For example, one child recorded the following: item 19, required answer 25 recorded as $2^{0}5$; item 26, required answer 201 recorded as $2^{0}1$. Evidently the child fails to distinguish consistently between numbers like 21 and 201, or 25 and 205. Pupils' booklets should be examined carefully by teachers to detect other problems and confusions.

Summary and Conclusions

First grade Distar and control pupils were pre- and posttested in oral language. Results were not conclusive but suggest some gain in one Distar class in Basic Concepts and Total Test of the Basic Concept Inventory. A comparison of Distar and control first grade pupils in reading, on a specially constructed first grade reading test, showed no significant differences in reading ability.

A second grade Distar subgroup of nineteen children was compared to twenty non-Distar controls on reading readiness, first grade reading achievement, IQ, and second grade achievement. Only one significant difference, second grade arithmetic computation favoring the Distar group, appeared.

The fifty-one second grade Distar pupils tested on the Stanford Achievement Test were compared to national norms for their grade placement. They were significantly below grade placement on four of the seven subtests on which they were tested.

Recommendations

1. To improve evaluation procedures, in view of the limited research on Distar to date pupils should be assigned to Distar and control groups by random assignment. Distar children in 1971-1972 apparently were selected on the basis of poor reading readiness. This is not justified until there is some evidence that the program is more effective than traditional instruction.

2. Because of equivocal results on the Basic Concept Inventory, examiners should be instructed on its use to assure standard administration practices, or on the use of a comparable instrument.

3. Certain changes in the instructional program may be in order. Transition should be provided from reading separate letter sounds and isolated words to reading connected sentences and paragraphs. Instruction on specific comprehension skills should be provided. These changes are largely in the nature of supplementing the program, rather than altering it.

4. Actual alteration of the Distar program may be needed to avoid teaching incorrect ideas (the example of referring to letters as sounds was discussed earlier), and to avoid problems with number symbols that were detected by this evaluator.

5. With the introduction of kindergarten programs in Winthrop, a Distar kindergarten might be established and its effectiveness compared to that of a traditional program.