Transition First Grade
- a Success Story-

by Ed Schafer
and Patrice Riggio
Lewes, Delaware

Once there were sixteen children who had just completed kindergarten and would soon enter first grade. For the children kindergarten had been a very trying experience. They were not being "promoted" to grade 2, but rather "administratively assigned" to grade 1. However, the expectations for these children in first grade were not very exciting. Given their performance in kindergarten, it was expected that these children would find first grade as difficult and frustrating as kindergarten, and that they would almost certainly repeat first grade.

It was not that these children were handicapped. They did not qualify for classification and placement in special education. Not were these children part of an atypical low functioning class, for every year there were 15 to 20 such children in the same predicament. Now was this school a "bad" school; rather, standardized test scores indicated that the "average" student in this school was 10 to more points above the national average.

Why, then, were these children having such difficulty in school? A number of rather typical explanations were offered:

1. They were "slow learners" (IQ scores for the 16 children ranged from 77 to 100, with a mean of around 90)
2. Their home environments were "indequate".
3. The children were simply not yet "ready" for formal academic instruction.

The authors favored the alternative explanation that these children simply had not been provided with the quantity and quality of instruction that was necessary. For these children, and for this reason, the Transition First Grade program was created in June of 1985. The transition class was designed to serve the children with a lower student-teacher ratio (15:1), a full-time instructional aide, and a radically different approach to curriculum and instruction. In the transition class the authors decided that both the teacher and the aide would use the DASTAR reading, language, and mathematics programs exclusively until the students mastered level 1 of each program. Thereafter, the "regular" reading, math, and language programs would be introduced as the students continued through level 2 of the DASTAR programs. Each of the regular first grade classes had a student-teacher ratio of 22:1, a half-time instructional aide, and followed one of the popular, traditional basal programs for reading, language, and math instruction.

Students were chosen for the transition class by the principal and kindergarten teachers who based their decisions on the students' records of performance in the regular kindergarten program and on the results of the Comprehensive Test of Basic Skills (CTBS - Level A) administered at the end of the kindergarten year. Essentially, the 16 lowest performing or most at-risk students from the entire class of about 125 kindergarteners were chosen for the transition class; the authors had no voice in the selection of students for the transition class.

Procedures
Initially students were given the placement tests for DASTAR Language I and Reading Mastery I and were grouped accordingly. The top group (6 students) was placed in Reading Mastery Fast Cycle I and DASTAR Language I - Lesson 11. The middle group (5 students) was placed in Reading Mastery I - Lessons 11 and 12 and DASTAR Language I - Lesson 21. The third group (5 students) began Reading Mastery I at Lesson 1 and DASTAR Language I at Lesson 11. Some regrouping occurred during October and November, and by the end of the year there were 9 students in the top group, 6 in the middle group, and 3 in the third group. Arithmetic instruction began at Lesson 21 of DASTAR Arithmetic I as a whole class activity, but three weeks into the school year the class was split into two groups, the higher group with 9 stu- in牦

This Issue- Information on DI
Summer Conferences & Institutes
The Midwest Direct Instruction Institute
July 8-10, 1987
Hyatt Regency Milwaukee
Milwaukee, Wisconsin

The Third Atlantic Coast Conference on Effective Teaching & Direct Instruction
July 13-16, 1987
Delaware Technical & Community College
Lewes, Delaware

13th Annual Eugene Summer Conference
August 3-7, 1987
Eugene Hilton Hotel & Convention Center
Eugene, Oregon

2nd Annual Salt Lake City Direct Instruction Institute
August 10-14, 1987
Salt Lake City Marriott Hotel
Salt Lake City, Utah

Newport Beach Direct Instruction Institute
August 17-21, 1987
Newport Beach Marriott Hotel
Newport Beach, California

Literature Search
Studies were gathered from research reports currently known to the reviewer or to the reviewer's colleagues, from reports referenced in such research, and from research listed in a computer literature search conducted on April 30, 1986 using data compiled by the Educational Resources Information Center (ERIC). Descriptors used in the search were: direct instruction; direct teaching; directed instruction; directed teaching; DISTS; direct verbal instruction; active teaching; and active-teaching.

The 25 studies in the meta-analysis for which treatment lasted for more than one week are listed in Table 1. Also listed for each study are the skills and in which treatment was delivered; whether subjects were mildly handicapped or moderately/severely handicapped; and whether the research design was experimental (E) involving random assignment; or quasi-experimental (Q) equivalent groups, but without random assignment.

Some of the studies require explanation. The spring (1983) study consisted of two phases; only the first of which was included in the meta-analysis. During the second phase, both the experimental and comparison groups received the same Direct Instruction treatment. Thus, data from the second phase are clearly of no relevance. In the Harsh (1979) report, comparisons involved both mildly handicapped students and non-handicapped students. Only effect sizes based on the comparisons involving the mildly handicapped students were included in the meta-analysis. The Lloyd, Epstein, and Cullinan (1981) and Lloyd, Cullinan, Heins, and Epstein (1980) reports described the same study, but included different dependent measures. In the meta-analysis, the two reports were considered as one study. The Walker, McConnell, and Clark (1983) report described two studies, but the first study had already been included in the meta-analysis from a separate report. (Walker, McCossell, Walker, Clark, Tolin, Cohen, & Raskin, 1983). Thus, for the purposes of this meta-analysis, citations of Walker, McConnell, and Clark (1983) refer only to the second study in that report. Finally, C. Walker's (1980) master's thesis was coded not from the complete original report, but rather from Lewis' (1982) description of the study, and from photocopies of tables from C. Walker's (1980) master's thesis.

Coeing Study Characteristics
Studies in the meta-analysis were coded on a number of study characteristics or po-
Ziggy Awarded DEAR ZIGGY
Honorary Ph.D.

Siegfried "Zig" Engelmann flew to Kalamazoo, Michigan, on April 24 to accept an honorary Doctor of Education degree from Western Michigan University. This is the third time that the Psychology Department has nominated a person for an honorary doctorate. The other two recipients are B.P. Skinner and Fred Keller.

Many people mistakenly believe that Engelmann already has a Ph.D., when in fact the highest degree he has earned for his coursework is a BA in philosophy from the University of Illinois.

The Ad Board and Members congratulate Zig on this much deserved honor.

Dr. "Zig" Engelmann

Here's an excerpt from a letter I received:

Dear Ziggy:

We begin using Reading Mastery I in kindergarten and some students as they meet mastery criteria, and see that we are in a critical situation of providing a suitable continuation of scholastic curriculum if we rely on the expanded big book material in our recently past thinking. The crunch is evident in the sixth grade this year, the second year we have used Reading Mastery in our school, but we have documentation that we will be feeling it in the fourth and fifth next year, and forever, if our success continues as it is now. Our first class to have been taught Reading Mastery since kindergarten are now third graders. They are nearly all well above level IV at this time.

We realize that levels VII and VIII are still not at the publication point, so we need some coaching to ensure continuation of a viable, substantial program for our older students.

What has been successfully used by others as they have reached this point?

What do we do with these kids?

Elizabeth Jensen, Guanol Valley Elem, School Gunnison, Utah

Dear Elizabeth,

It is a nice problem to have. Keep your data and share it with us. We'll pass it on to others, through the DI News.

The simplest procedure is to assign the students to read novels that are appropriate for their reading level and possibly non-fiction books that are interesting.

The value of reading longer works is that longer works do a better job of developing the author's viewpoint and arguments. Shorter selections do not pull in as much information and therefore do not do as good a job. Good novels are fairly easy to find.

The procedure for introducing them would be the same as those novels presented in levels V and VII. First, divide the book into sections, possibly four of them. Next, identify vocabulary that would probably give the students problems and pre-learn it. Also, give students a list of study questions, or things that they should find out during reading the section. At the end of the section, ask them questions about the information presented in the section. Don't hold them responsible for the most detailed information, just important things that happened.

The procedure for non-fiction books is a little different. Instead of assigning the work for independent study, present it through lessons, using the same procedure in Reading Mastery V and VI. The procedure would be for the students to go over the new vocabulary words, and take turns reading the selection aloud. Following the oral reading, they would independently read to the end of the chapter, and then answer questions.

The best material for this structured work is interesting non-fiction, biographies of interesting people (Madam Curie, Henry Ford, etc.), or the kind of non-fiction that holds together. Books like Rachael Carson's The Sea Around Us are written on an adult level; however, if the key vocabulary is pre-taught, they work well for these lessons. And they teach students a heck of a lot.

The big trick to making the instruction work is to use good books. I wouldn't go by what people say if "appropriate for sixth graders". I would go by what adults find interesting. The kids who complete level 6 have the skills necessary to go through these books, if given a little structure and help on some vocabulary.

But do solve the problem. Too often school districts (and schools) put a crimp on student learning. They insist that a program has a number 4 associated with it in some way, it is inappropriate for students in grade four and for no others (unless they are "remedial"). In fact, the 4 means that the program is appropriate for any student who has mastered 3. That student may be in the first grade, the second grade or the sixth.

So good for you. Show just how far kids can go if they receive good, continuous instruction through the sixth grade.

Ziggy

SRA Obtains More DI Products

C.C. Publications was recently purchased by Science Research Associates (SRA). This means that all materials previously obtained from C.C. (Expressive Writing, World of Facts, Carver Writing, etc.) should be ordered from SRA.

SRA has indicated that a catalog listing all of the new programs will be available by October. Until that time, continue using C.C.'s pricing and order numbers, and mail your orders to:

S.R.A.
155 North Wacker Drive
Chicago, IL 60606

The Direct Instruction News is published Fall, Winter, Spring and Summer, and is distributed by mail to members of the Association for Direct Instruction. Readers are invited to submit articles for publication relating to DI. Send contributions to: The Association for Direct Instruction, P.O. Box 10252, Eugene, Oregon 97440. Copyrighted by A.D.I. 1986. Editors: W. Becker, John Woodward, Russell Geister, Craig Darch, Robert H. Horner. Associate Editors: Ed Kameenui, Linda Meyer, Douglas Carmine, Samuel K. Miller, Susan Jerde, Wes Becker, Springfield News, Macintosh, Springfield News.

Departments: Teacher-to-Teacher, Administration's Briefing, Dear Ziggy, Analyses of Curricula, Software Evaluation, Microcomputers and DI, Art Director, Susan Jerde, Wilcox, Springfield News.


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Preschool for the Disadvantaged: DISTAR Language Tested in South Africa

by Miss A. Muthukrishna
University of Durban-Westville
and
Miss K. Naidon, Teacher
Westcliffe Nursery School
Westcliff, Chatsworth

The purpose of this study was to evaluate the effectiveness of DISTAR Language 1 with preschool disadvantaged Indian students. The language performance of children using DISTAR was compared with other preprimary children receiving the current language development program. The current program is a semi-structured program designed by the teacher to develop cognitive and linguistic skills of the children.

Method

The nursery school is a community project run by a group of parents and volunteer workers who began the project out of a desire to provide a service with a particular area. At the commencement of the study, there were 30 pupils between the ages of 3 to 5 years attending the school, which was staffed by a teacher who has a two-year diploma in preschool education, and a teacher's aide. Parents were encouraged to spend time with their children at school on a rotating basis to assist in the management of the preschool and to acquaint themselves with activities undertaken by their children. The roll at the school gradually increased to about 35 children at the conclusion of the study. The school is situated in an economically depressed area with families living in substandard conditions developed by the government.

Subjects

Fourteen children were selected whose ages ranged from 4 to 5 years. Seven children, 3 boys and 4 girls, were selected for the experimental group, initially on the basis of sex, and then, individual children were chosen by lot drawing. The remaining 7 children, 3 boys and 4 girls, made up the comparison group.

DISTAR Language 1 was used with the experimental group every day for 30-35 minutes. The children sat in a semicircle around the teacher, with the weakest children at arm length in the middle. The teacher and the children received a semi-structured program everyday for about 30-35 minutes. This was designed by the teacher and included activities such as story-time, vocabulary, building up, enriching, and social learning, counting, picture discussion, concept formation (color, shape, size, etc.), environmental studies, and other activities which the teacher termed 'school readiness.' Other 4 year old pupils in the school joined in with the comparison group for this program.

Both groups received some general language work, such as, daily news, morning conversation, weather, and conversation during all activities.

The arrangement was that when the experimental group was being exposed to DISTAR, the comparison group would engage in free-play under the supervision of the teacher aide and parents present for the day. The reverse would apply when the comparison group received the teacher-designed language program.

During the course of the study, certain practical difficulties were experienced. The study suffered a loss of 4 children. The family of Child 7 in the experimental group moved to another subcamp. Child 6 and Child 7 in the comparison group experienced problems of adjustment and poor health, parents decided to have the children remain at home for the year. Child 5 in the comparison group left to attend a preschool attached to a regular primary school which was situated nearer their home. However, Child 5 was followed-up in the posttesting period and remained part of the study. The programs and activities at this preschool were designed and supervised by the staff of the primary school to which it was attached. The teacher was not a qualified nursery/primary teacher, but had years of experience in the field.

Tests

Four tests, administered by the first author, were taken between the end of August and October, 1984. Posttest measures were carried out in October-November, 1984. These tests were administered:

1. Reynell Developmental Language Scales (Revised).
2. The Peabody Picture Vocabulary Test
3. The Stanford-Binet Intelligence Scale (so as not for generalization of language learned)

In addition, Expressive Language Samples of 1 hour were taken from each child during a play situation. It was hoped that the Lee (1947) Developmental Sentence Analysis procedure would be used to analyze the utterances. However, the first author was forced to abandon the idea because of certain practical problems experienced.

Results

Results demonstrated that although both groups improved in expressive and receptive language, vocabulary, and intelligence, the experimental group obtained higher gains on each of the tests administered.

The Stanford-Binet results (Table 1) were very encouraging. The experimental group mean gain was 15.3 months Mental Age. The comparison group mean gain was 11 months. The comparison group also showed a 5-point drop in IQ, while the experimental group gained 3 points.

The results are very similar to those obtained by Gregory, Richards, and Hadfield (1982) in which children with language disorders on the average gained 11.8 months on the Stanford-Binet in 12 months of teaching.

Similarly, Maggs and Morath (1976) tested by McCall (1980) reported that DISTAR Language to severely mentally handicapped pupils and on the average results indicated 23.5 Mental Age months in 24 months of teaching, and the control group gained only 7.5 Mental Age months.

The gains by the experimental group in the Reynell Developmental Language Scale are equally impressive (Table 2). The experimental group gained 22.2 months in comprehension whereas the comparison group gained 11.4 months. On the Reynell Expression Scale, the experimental group gained 18.9 months and the comparison group gained 11.7 months.

The results of the Peabody Picture Vocabulary Test demonstrated similar findings. The mean gains in vocabulary age for the experimental group was indicated as 2 years 2 months, 7 months more than the gain demonstrated by the comparison group. (See table 3.)

Discussion

The discussion will focus on a more qualitative interpretation of results and will outline some of the practical problems experienced.

During the interviews, both the teacher and the researcher found the program highly motivating to pupils. Pupils looked forward to the lessons, and on occasion when the program had to be interrupted owing to practical difficulties in the school day, pupils expressed their disappointment. It must be mentioned that initially the researcher did have certain reservations regarding the fact that the program was developed in the U.S.A. and that certain "Americanisms" might confound the pupils. However, it was found that this did not present a problem and no major changes were made to the content of the original adapted lessons. It was found that pupils were exposed to some of the

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Table 1: Stanford-Binet Gains by Group

<table>
<thead>
<tr>
<th>Experimental Group</th>
<th>Pretest MA</th>
<th>Posttest MA</th>
<th>Gain in months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student 1</td>
<td>4-10</td>
<td>10-01</td>
<td>6-10</td>
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<td>Student 2</td>
<td>4-10</td>
<td>9-44</td>
<td>5-04</td>
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<td>Student 3</td>
<td>4-5</td>
<td>10-07</td>
<td>5-12</td>
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<tr>
<td>Student 4</td>
<td>4-8</td>
<td>9-60</td>
<td>5-20</td>
</tr>
<tr>
<td>Student 5</td>
<td>4-2</td>
<td>9-52</td>
<td>5-00</td>
</tr>
<tr>
<td>Student 6</td>
<td>4-8</td>
<td>9-94</td>
<td>5-06</td>
</tr>
<tr>
<td>Mean</td>
<td>4-7.3</td>
<td>9-78</td>
<td>5-10.6</td>
</tr>
<tr>
<td>Comparison Group</td>
<td>4-7</td>
<td>10-09</td>
<td>6-10</td>
</tr>
<tr>
<td>Student 7</td>
<td>4-6</td>
<td>10-05</td>
<td>6-00</td>
</tr>
<tr>
<td>Student 8</td>
<td>4-8</td>
<td>9-55</td>
<td>5-08</td>
</tr>
<tr>
<td>Student 9</td>
<td>4-7</td>
<td>9-32</td>
<td>5-00</td>
</tr>
<tr>
<td>Student 10</td>
<td>4-10</td>
<td>9-10</td>
<td>5-00</td>
</tr>
<tr>
<td>Mean</td>
<td>4-8.4</td>
<td>9-10</td>
<td>5-09</td>
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Table 2: Reynell Developmental Scales Gains by Group

<table>
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<tr>
<td>Student 1</td>
<td>4-0</td>
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<tr>
<td>Student 2</td>
<td>4-5</td>
<td>6-25</td>
<td>2-25</td>
</tr>
<tr>
<td>Student 3</td>
<td>4-0</td>
<td>5-13</td>
<td>1-13</td>
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<tr>
<td>Student 4</td>
<td>4-6</td>
<td>6-25</td>
<td>2-25</td>
</tr>
<tr>
<td>Student 5</td>
<td>3-8</td>
<td>5-23</td>
<td>2-23</td>
</tr>
<tr>
<td>Student 6</td>
<td>4-3</td>
<td>6-15</td>
<td>2-15</td>
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<tr>
<td>Mean</td>
<td>4-1-8</td>
<td>5-11-9</td>
<td>2-22</td>
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Table 3: Peabody Picture Vocabulary Test Gains by Group

<table>
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<th>Experimental Group</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Gain in months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student 1</td>
<td>3-3</td>
<td>8-78</td>
<td>5-05</td>
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<tr>
<td>Student 2</td>
<td>3-6</td>
<td>8-78</td>
<td>5-05</td>
</tr>
<tr>
<td>Mean</td>
<td>3-5.7</td>
<td>8-78</td>
<td>5-05</td>
</tr>
</tbody>
</table>

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DIRECT INSTRUCTION NEWS, SPRING, 1987 3
South African Preschool-
Continued from Page 3
"Americanization" through the media (television). Sensitive teaching also helped overcome the problem. However, the teacher, in such circumstances, did have to deviate from the strictly laid-down verbal instructions in the presentation books and explain to children the alternate word normally used (e.g., written = spinner; waggis = can).

The results showed that pupils in the experimental group demonstrated a significantly higher number of verbal concepts than the comparison group and the very aprecius that were taught generalized to significant improvement on the Stanford-Binet Intelligence Scale. It was found that pupils in the experimental group could classify and categorize objects up to the 7-year level. These findings concur with those of Maggs and Morath (1976), quoted by Maggs (1980).

During the Pretorskting, it was found that Child 5 in the experimental group had a developmental-lag in her language ability ranging from speech defects to a total speech disability.

She proved distractible and had a short attention span. In spite of this, she was decid-
ed to include her in the study.

Results demonstrated that this pupil made very encouraging gains in all areas tested. On the Reynell Language Developmental Scale, comprehension gains were 23 months and expressive language gains were 31 months. It was also found that her language speech improved markedly.

It was substantiated by the child's mother.

On the Stanford-Binet Intelligence Scale, gains in IQ points were 12 points and in Mental Age 20 months. Gains on the Peabody Picture Vocabulary Test were 27 months in vocabulary age. Although initially the teacher indicated that the presence of this pupil skewed the group, it was found that within approximately two months the pupil was able to keep pace. According to the teacher and from observations by the researcher, her attention and concentration span improved markedly.

One has to be cautious in the interpretation of the progress made by Child 5 in view of the fact that the comparison group did not include a child with similar language problems. It does, however, suggest that it would be worthwhile to investigate the effects of DISFAR Language I on children with language disorders.

It must be mentioned that the researcher experienced certain drawbacks in the implementation of the study. Firstly, there was a change in teachers at the school a month after the study began. Then, there was an interruption in the program for 2 weeks before the new teacher could be trained in the use of procedures involved.

Thirdly, it was found that on occasions when the teacher was absent, the program could not be implemented, since there was the practical problem of management of the rest of the pupils.

Conclusion

As with other research groups mentioned, DISFAR instruction has once again achieved positive and encouraging results. The results of this present study suggested that it would be worthwhile testing and following up the implementation of the DISFAR Language program in other preschools in South Africa.

References


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<th>Quantity</th>
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<td>Distar Language I Classroom Kit</td>
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<td>7-7445</td>
<td>Additional Teacher's Guide</td>
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<td>Take-Home Workbook 1 (pkg of 5)</td>
<td>14.85</td>
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<td>5-5749</td>
<td>Take-Home Workbook 3 (pkg of 5)</td>
<td>14.85</td>
</tr>
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*Prices subject to change. Please call for current pricing.*

Examples from Teacher Presentation Book D

SRA
students. The questionnaires also indicated, however, a low level of implementation of the DISTAR system. No information was provided on the comparability of experimental (N = 14) and comparison (N = 24) students at the start of the study. The authors (Moodie & Hoen, 1972) emphasized that their study had severe limitations and offered strong subjective support for DISTAR.

One of Lewis (1983) experiments investigated the effect of DI for 12 and 12-year-olds reading disorders. Students who were taught with traditional remedial programs and other model programs scored higher than DI students on posttests of word attack skills and reading comprehension. The respective ESs were -.47 and -.52. However, DI students averaged gains of 4.6 months in spelling, compared to 2.4 months and 3.0 months for the two comparison groups. Adequate information was not available for the calculation of the spelling effect size. None of the measures in Lewis' (1982) study produced statistically significant differences.

Reading and Mathematics

The DI studies that investigated academic outcomes have been divided according to specific skill areas. The study-weighted mean ESs for measures of reading and mathematics achievement are listed in Table 5. The mean ESs in reading of .33 is consistent with the mean ESs for DI, both overall and in achievement measures. A further subdivision of reading measures (into comprehension, word attack, and total reading measures) does not support the arguments of these educators who contend that DI teaches basic academic skills of a lower-order cognitive level (such as word attack skills) at the expense of higher-level skills (such as comprehension). The study-weighted mean ES for DI on word attack measures across 10 studies was .64 (SD .72, median .55, range -.47 to 1.67). The correlation of the study-weighted mean ES for DI on total reading measures was .55 (SD .88, median .54, range -.35 to 1.97).

Table 3. Individual Study Effect Sizes for DI

<table>
<thead>
<tr>
<th>Study</th>
<th>Overall ES</th>
<th>Academic ES</th>
<th>Proportion of Significant Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bramble (1983)</td>
<td>+1.61</td>
<td>+1.61</td>
<td>1.00</td>
</tr>
<tr>
<td>Campbell (1983)</td>
<td>+1.08</td>
<td>+1.12</td>
<td>.83</td>
</tr>
<tr>
<td>Darch &amp; Karczewski (1985)</td>
<td>+1.59</td>
<td>+1.59</td>
<td>1.00</td>
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<td>Ginsen (1985)</td>
<td>+1.57</td>
<td>+1.76</td>
<td>.33</td>
</tr>
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<td>Gregory et al. (1983)</td>
<td>+1.66</td>
<td>+1.71</td>
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<td>Haring &amp; Knag (1975)</td>
<td>+1.05</td>
<td>+1.05</td>
<td>1.00</td>
</tr>
<tr>
<td>Harsh (1979)</td>
<td>+1.71</td>
<td>+1.77</td>
<td>.25</td>
</tr>
<tr>
<td>Kelly et al. (1983)</td>
<td>+1.39</td>
<td>+1.39</td>
<td>.60</td>
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<tr>
<td>Leis &amp; Proger (1974)</td>
<td>+1.40</td>
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<tr>
<td>Lewis Study 1 (1982)</td>
<td>+1.16</td>
<td>+1.16</td>
<td>.00</td>
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<td>Lewis Study 2 (1982)</td>
<td>+1.40</td>
<td>+1.40</td>
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<td>Lloyd et al. (1982)</td>
<td>+1.84</td>
<td>+1.85</td>
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<tr>
<td>Maggs (no date)</td>
<td>--</td>
<td>--</td>
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<td>Maggs &amp; Mauro (1976)</td>
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<td>.00</td>
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<td>+1.30</td>
<td>--</td>
<td>.71</td>
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<td>Richardson et al. (1978)</td>
<td>+1.10</td>
<td>+1.10</td>
<td>.25</td>
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<tr>
<td>Stein &amp; Goldman (1980)</td>
<td>+1.75</td>
<td>+1.75</td>
<td>1.00</td>
</tr>
<tr>
<td>Stephens &amp; Hudson (1980)</td>
<td>+1.94</td>
<td>+1.94</td>
<td>1.00</td>
</tr>
<tr>
<td>Sambrook &amp; Braunig (1977)</td>
<td>+1.54</td>
<td>+1.54</td>
<td>.50</td>
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<td>C. Walker (1980)</td>
<td>+1.39</td>
<td>+1.04</td>
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<tr>
<td>H. Walker et al. (1983)*</td>
<td>+1.29</td>
<td>--</td>
<td>.10</td>
</tr>
<tr>
<td>H. Walker et al. (1983)**</td>
<td>+1.09</td>
<td>--</td>
<td>.44</td>
</tr>
<tr>
<td>Wahlman (1984)</td>
<td>+1.33</td>
<td>+1.33</td>
<td>.50</td>
</tr>
<tr>
<td>Woodward (1985)</td>
<td>+1.02</td>
<td>+1.22</td>
<td>.56</td>
</tr>
</tbody>
</table>

* refers to Walker, McConnell, & Clark  ** refers to Walker, McConnell, Walker, Clute, Todis, Cotten, & Rankin

Table 4. Individual Study Effect Sizes for DI

<table>
<thead>
<tr>
<th>Study</th>
<th>Overall ES</th>
<th>Academic ES</th>
<th>Proportion of Significant Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>+0.84</td>
<td>+0.81</td>
<td>.33</td>
</tr>
<tr>
<td>Median</td>
<td>+0.80</td>
<td>+0.77</td>
<td>.50</td>
</tr>
<tr>
<td>SD</td>
<td>.64</td>
<td>.67</td>
<td>.40</td>
</tr>
<tr>
<td>(N)</td>
<td>(24)</td>
<td>(19)</td>
<td>(25)</td>
</tr>
</tbody>
</table>

Table 5. Study-Weighted DI Effect Sizes in Reading and Mathematics

<table>
<thead>
<tr>
<th>Measures</th>
<th>Reading</th>
<th>Math</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ES</td>
<td>+0.85</td>
<td>+0.50</td>
</tr>
<tr>
<td>Median</td>
<td>+0.80</td>
<td>+0.38</td>
</tr>
<tr>
<td>SD</td>
<td>.78</td>
<td>.71</td>
</tr>
<tr>
<td>(N)</td>
<td>(13)</td>
<td>(4)</td>
</tr>
</tbody>
</table>

responding mean for measures of reading comprehension across eight studies was .54 (SD .65, median .44, range -.33 to 1.59). Using a difference of .33 standard deviation units as the criteria for an educationally significant difference (Horn, Tallmadge, & Wood, 1975), there is no important difference between ESs for DI in the "low level" word attack skills and the "high level" reading comprehension skills. The study-weighted mean ES of .59 for math was lower than the corresponding mean for reading. However, not as much confidence can be placed in a mean ES resulting from only four studies, especially considering that prior research has shown that math achievement is often more marked when measured than reading achievement for economically disadvantaged DI students (Gerson & Carmine, 1984).

Intelligence, Readiness

Effects of DI on measures of intellectual ability and readiness skills are indicated in Table 6. Typically, standardized measures of intelligence are not the most responsive measures in educational intervention. However, since the earliest research on the DI model in the mid-sixties with "at risk" nonhandicapped preschoolers (Engelman, 1968), DI has produced appreciable gains in IQ. All studies that measured IQ in this meta-analysis (Leis & Proger, 1974; Lloyd, Cullinan, Hanes, & Epstein, 1968; Maggs, et al.; Maggs & Monarch, 1976; Proger & Leis, 1976) made use of the DISTAR Language curriculum, which was quite similar to that used in the preschool studies. Apparently, the same curriculum and approach that were beneficial for young students who are at risk for developing learning handicaps are also effective with older students with demonstrable learning handicaps. It seems that the label of a "learning disabled" is less than the level of sophistication (or naive) that the one or the other brings to a task. DISTAR Language presents basic language concepts in a controlled, systematic manner, and teaches some of the language abilities (e.g., analogy, deduction) measured by most intelligence tests.

In this meta-analysis, measures of academic preskills, basic concept learning, language development, psycholinguistic abilities, and Piagetian cognitive development were pooled together and called "readiness" measures, since these skills are the ones that are stressed by most prekindergarten and kindergarten programs. Except for learning basic language concepts (e.g., understanding, singal/plural, past tense/present tense), Direct Instruction programs usually skip over so-called readiness activities in favor of academic skills. In early childhood research with children from economically deprived areas, Direct Instruction has had a definite positive impact on substantive academic skills; yet its effect is negligible on the rudimentary skills (e.g., naming letters, matching shapes) that most children seem to pick up, regardless of their academic program (Weinstein, 1984). In this meta-analysis, however, six studies (Campbell, 1985; Continued on Page 8

Table 6. Study-Weighted DI Effect Sizes in Intelligence and Readiness

<table>
<thead>
<tr>
<th>Measures</th>
<th>Intellectual Ability</th>
<th>Overall Readiness</th>
<th>Concept Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>+1.32</td>
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<td>+2.74</td>
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<tr>
<td>Median</td>
<td>+1.13</td>
<td>+0.89</td>
<td>+2.74</td>
</tr>
<tr>
<td>SD</td>
<td>.83</td>
<td>.83</td>
<td>.44</td>
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<td>(N)</td>
<td>(5)</td>
<td>(5)</td>
<td>(7)</td>
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</table>

DIRECT INSTRUCTION NEWS, SPRING, 1987 7
Table 7: Weighted Effect Sizes for Different Forms of Measures

<table>
<thead>
<tr>
<th>Form of Measure</th>
<th>Criterion-Referred</th>
<th>Norm-Referenced</th>
<th>Other</th>
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<tbody>
<tr>
<td>Mean</td>
<td>+1.57</td>
<td>+0.77</td>
<td>+0.70</td>
</tr>
<tr>
<td>Median</td>
<td>+1.13</td>
<td>+0.71</td>
<td>+0.71</td>
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<tr>
<td>SD</td>
<td>94</td>
<td>72</td>
<td>50</td>
</tr>
<tr>
<td>N</td>
<td>(17)</td>
<td>(16)</td>
<td>(16)</td>
</tr>
</tbody>
</table>
Correlates of Gains in Algebra for Low Performing High School Students

by Russell Gersten*, Meredith Gall, Daniel Grace, Dianne Erickson, Steve Stieber - University of Oregon and

Effects of Teacher Behavior on High and Low-Ability Students in Algebra

Daniel Grace*, Russell Gersten, Meredith Gall - University of Oregon

Editors Note: This paper contains more complex statistical analysis than we usually include in the DI NEWS. However, the findings should be clear enough that any reader could skip the more complex procedures and attend to the results and conclusions.

Most research on effective mathematics instruction has involved the study of elementary schools. Few studies have investigated patterns of effective mathematics instruction at the high school level. Of these studies, only one (Oakes, 1982) sought to identify patterns of effective instruction for low-performing high school students.

The study described in this paper focuses on the effects of effective instructional procedures for the high school students of below-average ability. The purpose of this study was to determine whether variations in teacher behavior are significantly related to the achievement of low-achieving students enrolled in algebra classes.

Many states now require a minimum of three years of high school math for graduation. The more stringent graduation requirements will apply to students of all ability levels, meaning that low-ability students will be taking more and more complex mathematics courses in secondary school. Yet, little research knowledge is available to guide the mathematics instruction of low-achieving high school students in courses such as basic or elementary algebra.

As the study progressed, we realized that within this group of "below average ability" algebra students, there was an extreme amount of variability. That is, secondary analyzers were performed using an epitome-trait formulation (ATT) model. The primary purpose of the ATT analysis was to determine whether the three instructional variables were associated with achievement growth for these extremely low-performing students.

Method

Subjects and Setting

Basic Algebra classes are typically comprised of students who achieved below grade level in junior high school math courses; eight grade teachers say that these students lacked the skills to manage the one-year elementary algebra course successfully in the ninth grade. Basic Algebra is a two-year sequence course. Much of the first year is essentially a pre-algebra course, but also includes a few of the beginning units of the standard introductory algebra sequence. The second-year Basic Algebra, therefore, is designed to cover most of the Elementary Algebra course in a slower pace.

The data analyzed was from随机 classes for high school students at the University of Oregon. The classes were randomly selected from the mathematics department's offerings. The data for each class included information on student achievement, instructional practices, and teacher behavior.

The data collected covered the entire school year, and included three time points: the beginning of the year, the middle of the year, and the end of the year. The data included information on student achievement, instructional practices, and teacher behavior.

Results

Correlates of Achievement

The primary analysis included correlations between each instructional practice and the mean residualized achievement growth for each class. These correlations were intended to assist instructional practices related to enhanced achievement.

The aptitude-treatment interaction analysis

In the ATT analysis, the student was the unit of analysis and the variables included in the use of instructional practices could be analyzed for differential effects on student learning using different skills. A multiple regression model was used for the total sample of 334 students for each of the instructional variables following Pedhazl’s (1977) procedures. First the part correlation was entered, next the score for the instructional variable, and finally an interaction term. Each was tested for significance.

Consistency of Teacher Effects Across Sections

Sixteen of the thirty-one teachers in the sample also taught one or more sections of Basic Algebra. Though we did not observe the other sections, students in the other section were also tested; mean residualized growth scores for these non-observed classes were calculated. If the teaching behaviors and student achievement growth were identical in the observed classes and typical of a particular teacher, then similar trends in instruction and hence, student achievement growth, would be expected in that teacher's non-observed class.

The result was: correlation coefficient was reasonable high, r = 0.40. Of special interest is the contrast that groups analyses of the groups presented below is the consistency of mean residualized growth scores among the five teachers whose classes made the lowest achievement growth. Three of these five teachers had both their observed and non-observed sections placed in the lowest quartile. Of the four observed classes for which achievement growth was measured, ten of the eleven classes with the lowest achievement growth were taught by just four of the thirty teachers.

A Typical Lesson

Total occurrences for each low-inference practice variable for each fifty-minute lesson were computed. A mean score for each of these variables (expressed in minutes of bar of minutes) over the three lessons for the 31 classes was calculated for each class. These results are shown in Table 1. These data provide a sense of how Basic Algebra teachers typically structure and teach their lessons. Mean scores for each of the moderate-inference variables also were calculated.

Continued on Page 11

DIRECT INSTRUCTION NEWS, SPRING, 1987
The Association for Direct Instruction Announces the 13th Annual
Eugene Direct Instruction
Training and Information Conference
August 3-7, 1987
Eugene Hilton Hotel & Conference Center
Eugene, Oregon

The Association for Direct Instruction is pleased to announce the 13th Annual Eugene Direct Instruction Training and Information Conference. The conference will be held at the Eugene Hilton Hotel and Conference Center, in downtown Eugene. We hope that you will be able to make the Conference the highlight of your summer and join with other professionals from around the country in furthering your skills and knowledge of instructional technologies. There is a full range of sessions designed for teachers, aides, supervisors, and administrators whose goal is to promote educational excellence in all facets of education. Previous participants will find new course offerings in a number of areas of interest.

After a day of work, participants will enjoy evenings in Eugene. Next door to the Hilton is the Hult Center for the Performing Arts, a world class performance hall. Within blocks of the conference site there are scores of restaurants catering to a variety of tastes. Eugene's setting will make the conference a rewarding professional experience as well as a relaxing vacation for you and your family. To help renew old friendships or make new acquaintances, a picnic has been planned for Monday afternoon. On Tuesday and Wednesday evening there will be a social hour where trainers will be available to answer questions and provide an opportunity for making new contacts.

There are 39 sessions offered during the 5-day conference. Participants may attend up to 4. Sessions are either training or informational sessions. The focus of training sessions is on specific teaching behaviors. Task practice is involved in each of these sessions. The goal of informational sessions is to provide the kind of detailed information needed to implement successful techniques or understand the topic.

A Teaching the Beginning Reader
A Reading Mastery III-VI
A Corrective Reading, Decoding
A Advanced & Corrective Arithmetic
A Basic Reading Programs: Selecting, Transitioning to & Adapting
A Teacher Training: Teaching Others to Teach DI Programs
A Solutions to Classroom Management in Grades K-6
A Diagnosis, Corrections & Firing Procedures
A Overview of Direct Instruction Research & Theory
A Instructional Techniques for Severely Handicapped Learners
A Issues in Implementation of a Direct Instruction Curriculum

B Teaching the Beginning Reader
B Reading Mastery III & IV
B Corrective Reading, Comprehension
B DISTAR Arithmetic I & II
B Effective Spelling Instruction
B Reading Mastery II and Fast Cycle I & II
B Teaching Beginning Language Skills
B Overview of Direct Instruction Programs
B Solutions to Secondary Classroom Management
B Managing Classroom Behavior of Severely Handicapped Learners

B Training Administrators in a Supervisory Model
B Teaching Academic Survival Skills
C Reading Mastery V & VI
C Overview of Effective Spelling Instruction
C Teaching Facts and Fact Systems in the Content Areas
C Teaching Expressive Writing Skills
C Managing Chronic Behavior Disorders and Serious Emotional Disturbances
C Classroom Technology and Direct Instruction

D Videodisc Instruction in Math
D Direct Instruction Supplemental & Transitional Activities
D Computer Courseware: A Direct Instruction Perspective
D Design of Instruction for Severely Handicapped Learners
D Overview of Direct Instruction Research

E A Direct Instruction Approach to Secondary Science Instruction
E Teach Your Child to Read in 100 Easy Lessons
E Overview of Aspects of Supervision & Monitoring of DI Programs
E DI Research on Severely Handicapped Learners
E Overview of Direct Instruction Theory

Presenters:

<table>
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<tr>
<th>AM</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>C/E</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>C/D</td>
<td>Ends at 1:00 PM</td>
</tr>
<tr>
<td>Evening Events</td>
<td>Team Meet the trainers Meet the trainers Annual ADR Meeting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Early Registration
Sunday 6:00 pm to 7:30 pm
Registration
Monday 8:00 am to 9:00 am
Opening Session
Monday 9:00 am to 9:30 am
Daily Sessions begin at 8:30
Lunch Daily from 11:30 am to 1:00 pm
Teacher Behavior and H.S. Algebra Gains - Continued from Page 9

d for each class over the three lessons, as shown in Table 2. These data help clarify what happens during a lesson.

Lecture-demonstration recitation. In some classes, lessons began with a few minutes spent reviewing homework problems. Teachers asked students to provide answers or students indicated problems that require reworking or explanation. It was also common, however, for classes to begin with a few minutes of non-academic discussion or announcements made by the teachers.

Approximately 25 minutes was devoted to the lecture-demonstration phase. For about 14 minutes, teachers explained concepts and demonstrated procedures for solving equations or worked through problems in the textbook. This included review of selected homework problems. By and large, the teachers in the study tended to present the material in a low-key, almost routine manner, with reasonable clarity, but without communicating any special enthusiasm.

Seven of the 25 minutes of this lecture-demonstration phase involved substantive interaction between teacher and students. On the average, teachers directly called on four to six students of the 25 to answer questions. About half the teacher's questions were targeted to specific students and half were asked to the class at large.

Occasionally teachers asked their students if they understood a procedure or concept before providing further explanation or assigning worksheet problems. We observed that students seldom responded to such questions. However, students asked questions and initiated comments about the material for approximately 9% of the lesson.

Guided Practice. Rarely did Basic Algebra teachers use guided practice to check students' understanding before students practice independently. (The mean was 8.42%.) Only seven of the 31 teachers were observed to employ guided practice for more than one minute. Sixteen teachers never utilized this strategy during observed lessons.

Homework. All teachers assigned seatwork (the other major phase of the lesson), averaging approximately 15 minutes. Teachers monitored seatwork for about 11 of the 15 minutes. Not infrequently, teachers sat at their desks, attending to paperwork outlining individual students, occasionally looking around the room. This behavior appeared to remove them from effective contact with the class.

The rate of off-task behaviors tended to increase when the seatwork phase was lengthy. Usually seatwork was the final activity of the lesson, and it was common for students to conclude work early with the next agreement, or at least without the expressed disapproval of many teachers.

Classroom Climate. Basic Algebra teachers seldom praised students and rarely criticized them. In none of the observed lessons, teachers were three times more likely to use a short comment to remind students about expectations for academic or social behavior than they were to praise or criticize them. Overall, the climate paralleled what Goodlad and others had found in their observations of lower track high school classes - a somewhat business-like, almost perfunctory atmosphere prevailed. The one exception to this would be described in the qualitative case study section, below.

In response to the teacher questionnaire, teachers indicated that they assign approximately 30 minutes of homework daily. Eighty-three percent of the teachers did they collected homework assignments most of the time, but only 11 teachers (37%) indicated that they graded assignments.

Table 1. Mean Number of Minutes Spent on Selected Instructional Practices in a Fifty-Minute Lesson (N = 31 Classes)

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture-Demonstration Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher academic verbal behavior</td>
<td>17.0</td>
<td>6.7</td>
</tr>
<tr>
<td>Teacher makes linking statement</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Teacher gives directions</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Teacher questions (product or process)</td>
<td>2.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Teacher questions (checking for understanding)</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Total teacher questions</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>All students have opportunity to answer</td>
<td>1.4</td>
<td>0.9</td>
</tr>
<tr>
<td>One student has opportunity to answer</td>
<td>1.5</td>
<td>1.6</td>
</tr>
<tr>
<td>Students ask questions</td>
<td>0.8</td>
<td>0.5</td>
</tr>
<tr>
<td>Students initiate comments</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Guided Practice</td>
<td>0.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Total Lecture Demonstration</td>
<td>24.5</td>
<td></td>
</tr>
<tr>
<td>Seatwork Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher monitors seatwork</td>
<td>11.0</td>
<td>7.5</td>
</tr>
<tr>
<td>Teacher does not monitor seatwork</td>
<td>3.9</td>
<td>2.7</td>
</tr>
<tr>
<td>Total Seatwork</td>
<td>14.9</td>
<td></td>
</tr>
<tr>
<td>Classroom Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transitions, interruptions &amp; non-academic verbal behavior</td>
<td>7.4</td>
<td>3.4</td>
</tr>
<tr>
<td>Teacher Feedback Contributing to Classroom Climate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher praises</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Teacher criticizes</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Teacher uses management statements</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Percentage of students off-task*</td>
<td>13%</td>
<td>7%</td>
</tr>
</tbody>
</table>

*Based on a time sampling count of students off-task

Eugene Conference Registration Form

Please fill out the registration form completely and mail to ADI.

Make checks payable (U.S. funds only) to Association for Direct Instruction

Remember space is limited, early registration is recommended. Use an address where you will receive mail up until the conference.

Name
Street
City
State
Zip
Have you had previous experience with Direct Instruction? Yes No
Have you attended the Eugene Conference previously? Yes No
What year(s)?

I would like to register for the following list: on "A", on "B", and either one "C" or one "D" and one "E" session:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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</thead>
<tbody>
<tr>
<td>either</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;A&quot;</td>
<td>&quot;B&quot;</td>
<td>&quot;C&quot;</td>
<td>&quot;D&quot;</td>
</tr>
</tbody>
</table>

or D & E

I am an Association for Direct Instruction member: Yes No
I will attend the picnic: Yes No

I would like to attend the "Meet the Trainers" event on ___ Tuesday and/or ___ Wednesday.

I have enclosed $2.50 for each evening.

I am interested in staying at the Hilton. Please send me a reservation envelope: Yes No

I am interested in staying at the Valley River Inn. Please send me a reservation envelope: Yes No

Please send college credit information: Yes No

Please return this form with your check or District Purchase Order to: Association for Direct Instruction, P.O. Box 10252, Eugene, Oregon 97440

For further information: Date _____ Fee _____ Check _____ For _____ by _____

DIRECTIONS INSTRUCTION NEWS, SPRING, 1987 11

Students checked their own homework assignments in half the classes, a process usually carried out at the beginning of the lesson, and typically involved some teacher feedback to students. Teachers reported that approximately one-third of all Basic Algebra students usually did not complete homework assignments.

Results: Correlations Between Instructional Practices and Achievement

Separate correlations were conducted between each instructional practice variable (e.g., "minutes in controlled practice") and the dependent variable (realized mean class gain scores on achievement). The class was the unit of analysis. Significant correlations - as well as those approaching significance - are presented in Table 3.

Lecture-Demonstration

Achievement appears to be significantly enhanced when teachers asked questions at a high rate. Achievement was enhanced when teachers asked questions in a fashion so that all students had an opportunity to respond, rather than posing a question to one individual student. The total amount of teacher academic verbal behavior (i.e., lecturing, working out problems, Continued on Page 12
Teacher Behavior and H.S. Algebra Gains- Continued from Page 11

less on the blackboard) also correlated to some extent with achievement growth; r = .25, p = .08. These findings seem to parallel the findings of Good and Grouws' (1977)—the more time teachers interact with students on academic matters, the higher the achievement level. In addition, extending the amount of lecture—demonstration time (and consequently shortening the seatwork time) seems to correlate, to some extent, with achievement.

Seatwork

The amount of time teachers spend circulating is negatively associated with student achievement growth. This is not consistent with findings of previous research (Evertson, et al., 1980; Good et al., 1983, 1981, 1975). The moderately strong negative correlation between student achievement and the amount of time teachers circulate and assist students during seatwork suggests that the monitoring procedures, as implemented by teachers in this study, were not effective.

Classroom Management

A related finding concerns the level of noise during seatwork. Not surprisingly, quieter classes appear to be more effective learning environments. The significant negative correlation between noise during seatwork and student achievement growth and the percentage of students who are off-task is a logical conclusion. Students who are engaged in the academic process need to be engaged and to practice skills without distraction if they are to exhibit achievement growth.

The significant negative relationship between students' achievement growth and the number of students late for class may also be a symptom of ineffective classroom management.

Results:

Contrasted Groups Analysis

Differences in instructional practices between the five teachers, where students made the greatest achievement growth (effective teachers) and the five teachers whose students made the least achievement growth, (ineffective teachers) were tested for statistical significance. A t-test was performed for the differences between mean scores on each instructional variable. It was expected that this analysis might help clarify and enhance the correlational analysis. These results are presented in Table 4.

Table 3. Relationship between Selected Instructional Practice Variables and Student Residualized Achievement Growth (N = 31 Classes)

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture-Demonstration Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher academic verbal behavior</td>
<td>.41</td>
<td>.01</td>
</tr>
<tr>
<td>Teacher questions (product or process)</td>
<td>.17</td>
<td>.13</td>
</tr>
<tr>
<td>All students have opportunity to answer</td>
<td>.25</td>
<td>.01</td>
</tr>
<tr>
<td>Seatwork Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher circulates among students</td>
<td>.30</td>
<td>.03</td>
</tr>
<tr>
<td>Teacher assists students</td>
<td>.27</td>
<td>.07</td>
</tr>
<tr>
<td>Classroom Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion of students on task</td>
<td>.47</td>
<td>.004</td>
</tr>
<tr>
<td>Noise level during seatwork</td>
<td>.39</td>
<td>.01</td>
</tr>
<tr>
<td>Number of students entering late</td>
<td>.49</td>
<td>.003</td>
</tr>
</tbody>
</table>

Table 4. Differences between the Means of Selected Instructional Practice for Teachers with the Highest Student Achievement Gains (N = 5) and Teachers with the Least Student Achievement Gains (N = 5)

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Teachers with High Achievement Gains</th>
<th>Teachers with Low Achievement Gains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement Residualized Gains on Cooperative Algebra Test</td>
<td>2.57</td>
<td>1.16</td>
</tr>
<tr>
<td>Active Teaching Phase (Low-Inference Variables)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher questions (product or process) (in minutes)</td>
<td>3.0</td>
<td>2.5</td>
</tr>
<tr>
<td>All students have opportunity to answer (in minutes)</td>
<td>1.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Seatwork Phase (Moderate-Inference Variables)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher circulates among students</td>
<td>2.33</td>
<td>2.06</td>
</tr>
<tr>
<td>Classroom Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of students off-task</td>
<td>8.0</td>
<td>21.0</td>
</tr>
<tr>
<td>Noise Level during seatwork</td>
<td>2.2</td>
<td>4.0</td>
</tr>
<tr>
<td>Number of students entering late</td>
<td>2.4</td>
<td>4.6</td>
</tr>
</tbody>
</table>

The Association for Direct Instruction Announces

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July 8-10, 1987

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Variables Which Had A Considerable Effect on Extremely Low Achieving Students

Analysis using the class as the unit of analysis yielded surprising significant negative correlations between seatwork and student achievement growth. The attitude—treatment interaction analysis, however, revealed a significant differential effect for these teacher behaviors on achievement.

For "Teacher Assists Students during Seatwork," the interaction was significant; F(1,530) = 4.22, p = .04. For "Teacher Circulates During Seatwork," the interaction approached significance; F(1,530) = 3.11, p = .07. In each case, the effect was positive for the low ability students and negative for the high ability students.

Finally, as an adjunct to the AIT analysis using hierarchical multiple regression, we computed Pearson correlations between instructional practice variables and residual...
Teacher Behavior and H.S. Algebra Gains—Continued

ized growth scores for the two "extreme groups" of students—those beginning the course with pretest scores of 9 and below, and those entering the course with scores of 21 and above. Tests were conducted to ascertain those variables for which the correlations were significantly different. This provides the results.

The most striking finding was that the achievement growth of low-skilled students appeared to be positively influenced by teacher circumscribing and assisting during seatwork. It appeared that students with a low entry level of achievement benefited more from teacher assistance during seatwork than they did from working independently. When this teacher-student interaction occurred it tended to have a detrimental effect on the achievement of students with relatively high levels of skill. Teachers provided them with extra instruction on the individual basis which proves beneficial. However, when teachers assisted in this way, students of higher achievement skill levels who should be able to practice independently during seatwork to reinforce their learning, were not achieving as well as their skill-statement suggested they should.

Discussion

There were few differences in the findings of this study. They demonstrated that most of the aspects of effective mathematics instruction delineated by Good and Grouws (1977) and Etter et al. (1985) are equally important in teaching algebra to below-average ability students.

The pattern of teachers explaining and demonstrating material clearly, and asking many questions which provide all students with opportunities to respond consistently related to superior student achievement gains as measured by students' scores on the Cooperative Mathematics Algebra Test. It appears that the more interactive the teacher, the more he or she is effective. Effective teachers provided significantly more time for asking questions and twice as much time creating opportunities for all students to respond as did ineffective teachers.

The continued group analysis revealed that effective teachers direct questions to individual students twice as often as ineffective teachers (1.8 minutes vs. .9 minutes). Although the effect is not significantly large, it seems reasonable to assume that when handled by a skilled teacher, such questions would help keep students involved, and would be helpful in assisting student learning during a lesson.

Unlike many other teachers observed, Ms. Frank holds students accountable for their work and reinforces her expectations for good performance. This teacher asks each student to answer a question from the homework assignment, and obviously expected an answer:

T: "If I call on you, you need to be ready!
Jamie, number six."
S: "I don't have my homework."
T: "Do it now!"
S: "I don't have a book."
T: "Borrow someone's, quickly!"
At this point the teacher walked while the student found the problem. Then, Jamie answered it correctly. On another occasion, when a student had not done the assignment, and the teacher returned to question her three times until she had satisfactorily answered the question.

In two additional observations of this teacher's lesson, the following data on directing questions to individuals were collected:

Day 1:
- Number of students in class: 32
- Number of questions: 32
- Number of students called on: 26 (81%)

Day 2:
- Number of students in class: 30
- Number of questions: 34
- Number of students called on: 23 (77%)

These direct questions, and occasional challenges to students did not appear to be intimidating. The teacher consistently used a combination of brief praise ("Good!") encouragement ("These are hard ones. Be careful!") humor, and mild, non-technical statements to remind students of her behavioral expectations. When public questions were asked, students responded by raising their hands, frequently calling out, and occasionally by answering in unison.

In summary, this teacher's questioning strategies ensured that all students were actively involved, and enabled her to provide feedback—including praise—and to persist in questioning those students who were not prepared for the lesson or who had difficulty with the material. In her room, the students were consistently accountable. They worked much harder and received constant feedback on their work.

Monitoring of Seatwork

The major findings of the aptitude-treatment interaction (ATT) analysis were that the interaction effects found for the variables, "amount of time teacher circulates among students" and "amount of time teacher assists students" during seatwork. These variables were positively correlated with achievement growth for low-skilled students and negatively correlated for average and high-skilled students (see Table 6). Interestingly, correlations between achievement growth for low-skilled students and student achievement growth in this study were negatively correlated as Everson et al. (1980) found in eighth-grade math classes.

Also, this present study and others (e.g., Everson, 1982) found the number of minutes of seatwork to be positively correlated with off-task student behaviors, so it is clear that teachers may need to not only limit the amount of time given to seatwork, but also need to supervise students during independent practice. Yet, for the total sample of students, a negative correlation was found for the amount of time teachers circulated and the number of time teachers assisted students individually.

This correlation was significant even when we statistically controlled for the total number of minutes allocated to seatwork (using a partial correlation). The ATT analysis suggests, however, that these teacher behaviors may actually be detrimental to the achievement growth of high-skilled and average students, and helpful only to low-skilled students.

What may have been occurring (which was not objectively measured in this study) was that teachers needed to have lengthy contacts during seatwork with individual students who could not manage the work independently. Everson et al. (1980) and Continued on Page 15

Table 5. Significant Differences between Correlations of Instructional Practice Variable with Reinitialized Achievement Growth for Low-Skill Students (Pretest Scores < 10) and High Skill Students (Pretest Scores > 20) in Basic Algebra

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Low-Skill Students (N = 36)</th>
<th>High-Skill Students (N = 62)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seatwork Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of time teacher circulates among students</td>
<td>.42*</td>
<td>.11</td>
</tr>
<tr>
<td>Number of students teacher assists</td>
<td>.25</td>
<td>.14</td>
</tr>
<tr>
<td>Acyclic Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When teacher asks a question, only one student has opportunity to answer</td>
<td>.23</td>
<td>.1</td>
</tr>
</tbody>
</table>

*p < .05
Generalization with Precision in Community Settings

by Richard W. Albin and Alice E. Block*
University of Oregon

Currently, a primary goal of instruction is to teach generalization or to help children reach the goal of living a productive life in the ‘real world.’ One very important feature of the ‘real world’ is its constantly varying conditions. For example, interactions among students, or with teachers, may be influenced by traffic lights or by stop signs, or may be unconstrained; they may include one-way or two-way streets with different types of traffic lights on each; and traffic may be heavy or light and move at low, moderate, or high speed. Other activities and skills: shopping for groceries and personal items, cooking, riding the local bus system, using the telephone, working in a clinical job, busing tables in a cafeteria, working on a groundskeeping crew -- present a multitude of changing performance conditions and response requirements. Quite simply, correct responding does not occur in a range of conditions if they are to have an impact on the lives of persons with disabilities. This need for performance across a range of conditions creates a special problem for teachers and trainers. It is not practical to make sure that all of the conditions in which performance is required. Therefore, generalization (i.e., responding in situations not included in training) becomes critical to success in the community. Planning for generalization and instruction of procedures that consistently produce generalization are important considerations.

Developing an instructional technology for generalization has become a major objective for both researchers and practitioners. However, the analysis of performance needs underlying these efforts too often fails to fully recognize the degree of sophistication in responding demanded by many community settings. Functional generalization in applied settings requires at least two features: (a) responding across the full range of appropriate, nonreinforced conditions that the learner will encounter, and (b) generalization that occurs in situations in which responding is inappropriate (Homer, Bellamy, & Colvin, 1984). Generalization with a precision that meets the demands of the community. Responding in only a limited subset of appropriate conditions, or indiscriminate reinforcement of responses in both appropriate and inappropriate conditions, is not acceptable.

A couple examples illustrate this. A student's Delta Prime item tosses items, but also snags items at convenience stores or "morn and pop" type stores. Training occurs at the convenience store next to her high school. She is expected to do this next at the other store from the same national chain shows that generalization does not occur and that the teacher precisely notes the objective. Enthusiasm is tempered, however, when the student’s parents report that she recently refused to purchase items from any of the small markets around her home with substantial assistance. A good community activity has been learned, but the reality is that this one skill is not going to generalize to the real-world situations.

This activity is a subset of the topic covered in this article. Richard W. Albin, who is one of the leading researchers in the area of generalization, highlighted the importance of teaching functional activities in community settings. His work has been influential in shaping the field of special education and has contributed to the development of practical strategies for ensuring that students with disabilities can participate fully in society. Through his research, Albin has emphasized the need for generalization training that prepares students to respond appropriately in a variety of real-world situations.
Teacher Behavior and H.S. Algebra Gains-Continued

Sullings (1975) found that lengthy contacts negatively correlated with achievement. While engaged in these tutoring contacts, teachers were essentially no more effective for those students who felt they had only a few students benefited and other stu-
ents, who may have had additional opportunities and encouragement, stayed for extra time, received
little or no attention from the teacher.

Perhaps the way that circulating and assisting during after-school periods for the H.S. teachers generally render these practices ineffective.
Effective use of circulating and assisting during after-school periods was demonstrated, however, by the teacher in the qualitative case study. In these two additional observations of this teacher, the following data on her circulating and assisting behaviors.

Day 1: Student numbers of students contacted
1. Number of students in class
3. Number of student contacts
4. Total number of contacts
5. Number of students contacted by teacher
6. Total number of contacts
7. Number of students contacted by teacher or teaching assistant
8. Total number of contacts
9. Number of students contacted by teacher or teaching assistant
10. Total number of contacts
11. Number of students contacted by teacher or teaching assistant
12. Total number of contacts
13. Number of students contacted by teacher or teaching assistant
14. Total number of contacts
15. Number of students contacted by teacher or teaching assistant
16. Total number of contacts
17. Number of students contacted by teacher or teaching assistant
18. Total number of contacts

This teacher clearly saw the need for providing close supervision to many students while they practiced new skills. Unlike many Basic Algebra teachers, she typically monitored to the end of the lesson period. (Many others circulate for 5 to 10 minutes then sit at their desks and only assist students who came up to the situation and the locations.


desks).

Some students with very low entering skills experience severe problems managing the level of work despite instruction. For example, if they have no knowledge of
decimals, they may become lost in a lesson involving decimals with small amounts of
extra assistance during after-school periods. If provided excessively by the teacher, this extra assistance could result in reduced small classroom under which such student.

This problem suggests that either counseling from someone other than the teacher (e.g., a peer tutor, an aide, may be necessary, or that such students may be inappropriate in placed in Basic Algebra.

Other Findings from the ATI Study: Teacher-Student Verbal Interactions

Findings for two teacher-student interaction variables-teacher questions that invite all students to respond (r = .24, NS) and teacher quasi-student's performance between students to respond (r = -25, p < .09) suggest that these teacher-directed questions were not helpful to low-skilled students. In contrast to this pattern, the students' independent positive correlations between low-skilled student achievement and low-several student questions asking students (r = .20, p < .08).

It may be that in classes where teachers are more receptive to student contributions, low-skilled students feel more confident about asking and receiving help at their level. The classroom climate may tend to be more relaxed and consequently less threatening to low-skilled students.

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Teaching Complex Content to Secondary LD Students - Using Mastery
by Douglas Carnine • University of Oregon

A major obstacle to mainstreaming is the long-standing belief that learning disabled students and their peers. Various interventions have been offered to help overcome these differences. Curricular-based interventions (Pollack, 1996), Direct Instruction curriculum design (Englemann & Carnine, 1982), technology (Leibler & Smolin, 1995), and peer tutoring (Bloom, 1994), tutoring (Scruggs & Allday, 1986), learning strategies (Deshler, Schumaker, & Lenz, 1984), and so forth. Since presenting these interventions singly has been found to improve student learning, combining several of these interventions would probably produce even greater effects. Such comprehensive interventions might well be essential for cognitively complex topics such as fractions, chemistry, reasoning skills, etc. This review covers research on interventions that have combined Direct Instruction curriculum design strategies to provide instruction in complex topics.

The interventions focused on secondary students who were experiencing increasing demands to learn complex material, exemplified by new high school graduation requirements, particularly for mathematics. Secondary science textbooks are not designed to meet the needs of learning disabled students. These textbooks look more like reference books than instructional programs. Many biology texts have increased in size by over 300 pages during the past several years. According to Mary Budd Rowe of the University of Florida, an average high school science text requires students to master 3000 terms and symbols or an average of 2 per minute of class.

A required course, such as earth science, deals with the solid earth, oceans, atmosphere, and the oceans, and generally includes geology and geophysics, meteorology, oceanography, and climatology. This extremely large collection of material provides a great challenge even to the earth science teacher, let alone the student. At least one textbook is worth mentioning. Each of these earth science topics is covered independently, with its collection of facts and nomenclature, as if there was no connection among the topics. Explanations of the ways in which the earth, atmosphere, and oceans work are usually presented in a disjointed way that leaves students with a jumbled collection of unrelated ideas and facts.

We have attempted to remediate these and other problems for secondary learning disabled students by integrating instructional design, technology and mastery learning procedures into a comprehensive intervention.

Instructional Design
One of the primary principles of instructional design set forth by Englemann & Carnine (1982) is to show how seemingly unrelated phenomena can be unified through a common set of rules. Learning a small set of related rules that then makes sense of dozens of facts is *many of the research studies cited in this section were supported by grants C08001095 and C080004000 from the USDE by equipment provided by IBM. The author wishes to acknowledge the contributions made by Richard Rome, Brenda Kelly, Linda Carnine, and Noff.

Figure 1

<table>
<thead>
<tr>
<th>Component Concepts and Relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buoyancy</td>
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</tbody>
</table>

II Operations Composed of Component Concepts

<table>
<thead>
<tr>
<th>Solid Earth</th>
<th>Convection</th>
<th>Core convection</th>
<th>Plate tectonics</th>
<th>Earthquakes</th>
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<tbody>
<tr>
<td>mantle</td>
<td>convection</td>
<td>convection</td>
<td>tectonics</td>
<td>volcanoes</td>
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<tr>
<td>plate tectonics</td>
<td>convection</td>
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<td>convection</td>
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<td>volcanoes</td>
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III Applications of Operations

<table>
<thead>
<tr>
<th>Atmosphere</th>
<th>Ocean</th>
<th>Local convection</th>
<th>regional convection</th>
<th>Earthquakes</th>
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<td>coastal</td>
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<td>convection</td>
<td>volcanoes</td>
</tr>
<tr>
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<td>local</td>
<td>convection</td>
<td>convection</td>
<td>volcanoes</td>
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Table 1. Summary of Studies and Instructional Design Principles

<table>
<thead>
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<th>Technology</th>
<th>Study</th>
<th>Instruction</th>
<th>Mastery Learning Principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>Video</td>
<td>Teach unifying rules</td>
<td>a. Oral responses</td>
</tr>
<tr>
<td>Fractions</td>
<td>Video</td>
<td>Present a full range of examples for a concept</td>
<td>b. Work check with remediation</td>
</tr>
<tr>
<td>Health Promotion</td>
<td>Computer</td>
<td>Teach knowledge skills, then explicit problem solving strategies</td>
<td>c. Homework</td>
</tr>
<tr>
<td>Resolving Skills</td>
<td>Computer</td>
<td>Teach step-by-step procedures for rule governed contexts</td>
<td>d. Daily quiz with remediation</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>Computer</td>
<td>Relate student errors in earlier taught rules</td>
<td>e. Weekly test with remediations</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Inexpensive</td>
<td>Give students continuous immediate feedback</td>
<td>f. Constructed review</td>
</tr>
</tbody>
</table>

Figure 1

The technology component of the Earth Science Course is the laser videodisc. One side of a videodisc contains up to 54,000 individual high-resolution video frames. The frames can be shown in rapid succession to create motion sequences or displayed singly for any period of time. Moreover, by pressing a few keys on a remote control pad (very similar to the remote control for a TV), the teacher can move anywhere on the disc in just a second or two. Automatic stops built into the disc allow still-frame exercises to appear and stay on the screen following an

downward moving ocean crust forms deep trenches in the ocean along the edge of the continents. Earthquakes and volcanoes form along subduction zones, as the ocean crust slides against the continental crust, moves down, and melts. If zones where earthquakes, volcanoes, and mountain chains occur are mapped on the earth's surface, we get an idea of where the major convection currents in the mantle are moving up or down. Thus, convection, specifically the process of mantle convection, helps explain many, seemingly diverse phenomena such as the occurrence of mountains, volcanoes, earthquakes, mid-ocean ridges, ocean trenches, and fault systems. Once the process of convection is understood, these major topics of earth science are easily and logically presented. Convection can also account for many of the phenomena found in the ocean and atmosphere—the global heat pattern and the wind patterns of the earth, as well as the dynamics of fronts and clouds, and ocean currents and the temperature structure of the world's oceans.

Technology
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Learning, Technology & DI Theory

explanation or demonstration. The way these features are orchestrated can be illustrated with an example: The teacher is presenting a videotaped lesson from Earth Science on a large monitor to an entire class of students. She diagnoses students as having difficulty with the concept of buoyancy, so she enters the address for the segment of the disc that explains buoyancy. Within seconds, the students are reviewing buoyancy with a dynamic video presentation. At the end of the demonstration, the disc stops automatically, displaying an application exercise. With the remote control device, the teacher is able to move around the room to see when students have had enough time to complete the exercise. The teacher then uses the remote control to advance the player to the next frame, which shows the answers.

Thus, videoconferencing technology allows an interactive format usually not possible with conventional audio visual materials. The videoconferencing technology also dynamically presents experiments and demonstrations that are difficult or expensive to conduct in classroom settings. Visual and auditory demonstrations are associated with nearly every concept that is presented, rendering them, visually, audibly, and percussively. Visual, graphics, sound effects, brisk pacing, highlights and other techniques also help maintain students’ attention.

Mastery Learning

Earth Science has a specific system for helping teachers diagnose and remedy student difficulties. This system is embedded in six steps that are utilized with all concepts introduced in the program:

1. During the initial explanation of a concept, the teacher on the videoconferencing asks questions which students answer orally.

2. Immediately following the initial explanation students are asked to answer a series of problems. This practice serves as an informal test. If more than 20% of the students miss it, the teacher plans an explanation from the disc. This pattern of demonstration followed by practice is repeated for each concept presented in a lesson.

3. Students do homework without supervision.

4. The next lesson begins with a quiz covering the one or two major concepts introduced in the previous lesson. The screen gives the disc address for a remedial lesson if needed.

5. Every fifth lesson is a test. Again, teachers diagnose student errors and select remedials from the disc based on student performance.

6. After being taught, a concept is reviewed every five lessons.

The instructional design, videoconferencing technology, and six-step mastery learning procedure make it easier for the teacher to present material if she is unable to visually- compelling manner. Courses like Earth Science are particularly helpful to less confident students, particularly students who have been presented in a clear fashion from which students will learn. Moreover, the course provides an in-class, daily model of effective teaching practices. The reader of this paper describes a series of research studies that incorporate a variety of instructional design principles, technologies, and problem-solving procedures. (See Table 1 for a summary.) Most of these studies asked specific instructional questions, using randomized assignment to treatment groups of learning disabled students and, in some studies, remedial students as well.

Research Studies

Chemistry

The components of the Interactive Introduction to Chemistry course from the Core Concepts series (Systems Impact, Inc., in press) were very similar to those of the Earth Science course—unifying principles were taught to an entire class via a tape version of the videoconferencing course with the same six-step mastery learning procedure. In the study (Carnine, Kolly, Noell, & Hayden, 1986), the subjects were students who had not yet passed a science class, which was a high school graduation requirement. Of the 16 students who participated, five were learning disabled and 11 were remedial. Five students were in the 9th grade, five were in the 11th grade, and one student was in 12th grade. Students were taught with the chemistry program for four weeks, for 15 to 40 minutes per day. At the end of the four weeks, the students were given a post test. The test was also given to unreinforced placements, second year chemistry students at the same high school. (The mean percentile score on the math section of the Stanford Achievement Test was 17 for the experimental students and 95 for the advanced placement students.)

To ensure that the test was not biased toward the content of the Core Concepts course, two high school chemistry teachers from another high school in a different district examined the test. After carefully reviewing each item, four questions were rejected. Each teacher felt the remaining questions were fair measures of beginning chemistry, the kind of item that they would expect beginning chemistry students to know. (The experimental students had an average pretest score of 17.3 percent and an average posttest score of 76.9 percent. Advanced placement students scored an average of 82 percent on the posttest. The advanced placement students did not score significantly better than the experimental students who had received instruction with the Core Concepts Chemistry course.)

Fractions

Mastering Fractions (Systems Impact, 1985) is another videoconferencing course from the Core Concepts in Math and Science videoconferencing series, with the same six-step mastery learning procedure. Earlier research (Kolly, Carnine, Genten, & Genten, in press) compared Mastering Fractions with a widely-used math basal. Instructional design principles in Mastering Fractions were reduced the number of remedial placements. Students were taught the material by home exercise, stress management, dricking, snapping, life styles, etc. through test material and lectures. They then learned problem-solving strategies for health promotion via a computer simulation. The mastery learning procedure was required to successfully apply the strategy to simpler character profiles before more complex ones were introduced. The problem-solving strategy required students to prioritize and change desirable health habits, check stress level, and maintain health habit changes over time. The careful teaching of relevant content, combined with instruction on explicit problem-solving strategies, resulted in over two-thirds of the 15 learning disabled students becoming proficient in health promotion analysis. Only two out of 15 nonhandicapped seniors in a health class achieved this same level of problem-solving so- phistication.

Reasoning Skills

Carnine, Carnine, and Genten (in press) conducted research on a computer assisted instruction program that taught individual remedial and learning disabled students to draw syllogistic conclusions and critique arguments. The mastery learning procedure consisted of each missed item being presented again later in the lesson, until the student answered it correctly. Students followed step by step procedures for constructing arguments and for critiquing arguments. The specific instructional design principle targeted for investigation was the use of process feedback, which related student errors to previously taught rules. Process feedback lead to higher scores on the posttest and a transfer test, without resulting in students taking significantly more time to complete the program.

In a later study (Carnine & Carnine, 1986), the performance of four groups of students was compared: Learning disabled high school students, general education high school students, college students in an introductory logic class, and college pre-service education students. The results appear in Table 2. On the construction- argument subtask, learning disabled students were quite proficient, comparable to their general education peers and the logic students. The college pre-service education students scored significantly lower than the other three groups. On the critiquing-argument subtask (Part B), the logic students scored significantly higher than the other three groups. Overall, the learning disabled students scored comparably to two of the three other groups, indicating a lack of any performance deficits.

Vocabulary

Johnson, Genten, and Carnine (in press) compared two computer assisted instruction (CAI) programs that taught the meaning of 30 words that were identified as high utility words by three high school special education teachers. Twenty-four learning disabled high school students were randomly assigned to learn the 30 words from one of the two programs.
Teaching Complex Content - Continued from Page 17

The experimental CAI program incorporated several instructional design principles: (1) test students to identify the words requiring instruction so that instruction can be focused; (2) teach the words one at a time, with practice after each word; and (3) use previously introduced words; (2) maintain a teaching set of seven unknown words—a large set to capture students' variability in the words they need to retain, but not so large as to overwhelm the students; (2) when a student responds correctly twice to a word on two consecutive lessons, move that word to a review pool and add another unfamiliar word to the teaching set.

The mastery learning procedure used in the program was to progressively review learned words. After a student learned ten unfamiliar words, those words were presented in a recall test. If the student missed any of these words, they were moved back into that student's teaching set.

Eighty-three per cent of the students who learned the 50 words versus 67% in the comparison group, who learned from a CAI program material, read more words, with the mean score on a test of the 50 words being 86% for the learning disabled students and 81% for their general education peers.

Efficiency

The previous studies illustrate a variety of technologies, instructional design principles, and mastery learning procedures that contribute to the effectiveness of instructional programs. Efficient CAI is another important program attribute.

Consider vocabulary instruction. Beck, Perfetti, and McKeown (1982) taught 104 words in 75 thirty-minute lessons. At the end of the study, students knew an average of 85 words that they did not know prior to the program, but took 2,250 minutes of instruction or approximately 26 minutes per word. This amount of time is considerably more than that typically devoted to vocabulary instruction in secondary schools.

If technology can free the teacher from drill-and-practice instruction, a significant efficiency could be realized. The computer-assisted program in the Johnstown experiment presented 180 words in 30 words, but a teacher was not required to instruct. Similarly, the reasoning skills program did not require a teacher. Although the computer simulated and videodisc courses required a teacher, the technology still made the instruction much more efficient. For example, a teacher presented the content of the Mastery Fractions program on overheads rather than lecturing and the overhead slides were produced by Merrow Sherwood & Bransford, 1986). The students learned as much from the overhead presentation as did students (randomly assigned) who learned from the videodisc course. However, the teacher who used the overheads required a half-hour to complete and change overheads each day.

Other research that we have conducted has focused more exclusively on technology as a means of increasing efficiency. The technology was a low-cost networking system on the computer, which is too expensive to provide in many schools. One of our recent research projects (Grenier & Carini, 1987) suggests that low-cost networking might be an answer to the expense problem.

Table 2. Means for Parts I and II and Total Score (with Standard Deviations) for Learning Disabled Students, General Education Peers, College Logic Students, and College Preservice Education Students.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number</th>
<th>Construct Argument Mean</th>
<th>Critique Argument Mean</th>
<th>Total Test Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Disabled</td>
<td>23</td>
<td>11.09</td>
<td>7.96</td>
<td>19.00</td>
<td>4.11</td>
</tr>
<tr>
<td>General Education</td>
<td>53</td>
<td>10.94</td>
<td>6.42</td>
<td>17.36</td>
<td>3.74</td>
</tr>
<tr>
<td>College Logic</td>
<td>30</td>
<td>11.33</td>
<td>8.73</td>
<td>20.07</td>
<td>3.10</td>
</tr>
<tr>
<td>Teacher Preservice</td>
<td>41</td>
<td>8.15</td>
<td>7.29</td>
<td>15.44</td>
<td>5.11</td>
</tr>
</tbody>
</table>

References


Kelly, B., Carini, D., Grenier, R., & Grenier, B. (in press). The effectiveness of video instruction in teaching fractions to learning handicapped and normal high school students. Journal of Special Education Technology.


DI Meta-Analysis

Continued from Page 15


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Corrections-
Separation of Similar Responses and Similar Stimuli
by Douglas Carnine
University of Oregon

In previous work, Carnine (1976) showed that separating two highly similar sounds (e and i) in a matching sequence resulted in more correct responding by first graders and more rapid sound acquisition by preschoolers than was obtained from a matching sequence where the similar sounds were contiguous. The present study extends the application of this principle to correction sequences. It should be noted that stimuli can be similar both in their visual form and in the acoustical properties of their responses. Study 1 dealt with similarity in terms of the acoustical properties of sounds. Study 2 looks at the same issue based on visual similarity.

Study 1
First, the sound e was introduced with a drawing of an ice cream cone. Then four progressively-expanding training sets were presented:
- e, ice cream cone, and m.
- e, m, and u.
- e, m, u, and s.
- e, m, u, s, and i.

The stimuli were presented on sheets of paper with 15 on a page. All stimuli within a set appeared an equal number of times in random order, except that letters most similar to e (u and i) never immediately preceded or followed e.

Twenty preschoolers aged 2 1/2 to 7 who could answer simple questions, but who did not know the sounds, were included in the study. They were all given pretraining to ensure that they could visually discriminate the letters. The preschoolers were made aware of the current sound according to age and one member of each pair was randomly assigned to each experimental group. They were also grouped into older (over four) and younger (four years old) groups so that the experimental effects could be examined for age effects. The experimental conditions varied in the correction procedure when an error was made on the sound e. The similar-sounds group often received a correction sequence consisting of e and either u or i. In general, the correction sequence consisted of e and the letter the child mistook it for. If the child said "fill" for e, the correction sequence was e and f. Table 1 lists the correction sequences used for each type of error. Trials in the correction sequences were counted in the measures of trials to criterion.

In the distractor-sound group, the teacher corrected by modeling the correct response for e (u) and then presented the next letter in the training set. Since the letter e was never contiguous with a u and i in the four training sets, children in this group did not encounter juxtaposed examples of the highly similar vowel sounds (e, u, i).

All training sessions lasted 10 minutes. Difficulty in saying sounds was minimized by giving practice in saying new sounds before they appeared in a training set. The child had to say a new sound correctly 3 times before training proceeded. In each training session, children continued until they reached a criterion of eight consecutive correct responses to the new letter plus five consecutive correct responses to each of the familiar letters in the set. Each child received as many as 10-minute training sessions as needed to reach criterion on each of the four sets. A posttest was given one week after criterion was reached.

Results
Table 2 gives the numbers of trials to criterion for each group. The interaction term was significant (p < .01), indicating that younger children receiving the similar-sound correction required more trials than younger children in the distractor-sound correction.

Table 3 presents the data by training set. The means for the training sets with e and i were 77.6, 54.0, 66.6, and 10.8. The means for the training sets with e and s were 26.5, 32.7, 36.3, and 37.2. Thus, with each exception (10.8), training sets with phonemes more similar to e (i, and s) are associated with more trials to criterion. The follow-up posttest a week later did not show significant differences. Apparently, requiring all children to reach the same criterion washed out the group differences found on trials to criterion.

Conclusion
The similar-sound correction was less effective than the distractor-sound correction, especially for younger children. This finding is consistent with Carnine's (1976) finding that separating the introduction of highly similar sounds as far as possible leads to faster learning of the act of sounds.

Study 2
In this study, 16 preschoolers who passed an object-identification screening test were assigned to similar and dissimilar correction groups, as in Study 1. They were also divided into younger and older groups. The training procedures and sequences were the same as in Study 1, except that geometric designs were used as the training stimuli rather than letters. These designs were very similar, differing only in the position of the dot. These corresponded to the similar phonemes e, u, and i. One of the three similar forms was designated the target stimulus and then par

Table 1. Correction sequences following errors on e for each stimulus set and for each possible error.

Table 2. Average number of trials to criterion on e for younger and older subjects and for Similar and Dissimilar correction sequences.

Table 3. Average number of trials to criterion on e in the four training sets for the Similar and Dissimilar correction sequence.

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Table 4. Average number of trials to criterion for the target stimuli for younger and older subjects and for Similar and Dissimilar correction sequence.

<table>
<thead>
<tr>
<th>Correction Sequence</th>
<th>Younger</th>
<th>Older</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>316.5</td>
<td>103.5</td>
<td>210.0</td>
</tr>
<tr>
<td>Dissimilar</td>
<td>79.8</td>
<td>60.5</td>
<td>70.0</td>
</tr>
<tr>
<td>Mean</td>
<td>198.2</td>
<td>82.9</td>
<td></td>
</tr>
</tbody>
</table>

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