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A Summary of Four Studies

Instructional Design Principles for CAI

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Enthusiasm over computers and their potential impact on special education can be documented without much difficulty (e.g. Budoff, Thormann, & Gras, 1984; Blaschke, 1985). Such enthusiasm is only part of a general eagerness by many to see computers widely used throughout elementary and secondary education. While most advocates are adept at detailing the technical capabilities of this medium (e.g. immediate feedback, automatic scoring, individualized instruction), little has been done in the way of systematic research into the use of computers—in particular, computer assisted instruction (CAI)—for the mildly handicapped. This report summarizes four studies we have recently conducted in this area. They are the beginnings of what we consider to be systematic research into CAI for the mildly handicapped.

The limited research on the instructional effectiveness of CAI for handicapped and non-handicapped populations is complicated and often contradictory. After a comprehensive search of the literature, Forman (1982) concluded that achievement was rarely enhanced by CAI, even though students exhibited positive attitudes toward such instruction. We are not surprised by this finding, as little available software used in special education settings makes use of even the most rudimentary principles of sound instructional design and effective teaching (cf. Stevens & Rosenshine, 1981; Engelmann & Carnine, 1982; Brophy & Good, 1984).

In 1984, we began a series of CAI studies that examined different instructional design principles that have been articulated by Engelmann and Carnine (1982) and others. These principles have been empirically demonstrated as effective techniques in non-computer studies (e.g. Carnine, 1980; Carnine, Kameenui & Woolfson, 1982; Darch, Carnine, & Gersten, 1984) and in our fifteen years of experience with Project Follow Through (cf. Stebbins et al., 1977). Through computer assisted instruction, we were able to isolate the effects of review cycles, size of teaching sets, explicit strategies, and correction procedures. We were able to do this in a variety of ways. Two of our studies compared popular commercial programs with software that we developed. In another, we examined the effect of one variable (a correction procedure) by modifying our version of the software. In the last study described in this report, we used our software as an adjunct to a written curriculum to teach specific problem solving skills.

All of the studies described below were conducted with mildly handicapped secondary students. Students were screened for appropriate skill levels. For example, all students in the math word problems study were competent in basic operations through division and knew how to solve addition and subtraction word problems. Students whose skills were above or below this were not used in the study; those who remained were randomly assigned to conditions. Finally, in order to precisely measure academic development, tests were created for the particular skills taught in each study. The rationale and relevant details of each measure are described along with each study.

Vocabulary Instruction: Size of Teaching Sets and Cycles of Review

Many researchers, operating under the premise that word knowledge correlates highly with reading comprehension (Anderson & Freebody, 1981; Pearson & Gallagher, 1983; Tierney & Cunningham, 1984), have attempted to improve comprehension skills by teaching vocabulary. Unfortunately, those programs which were most successful in teaching new vocabulary also required the most time to accomplish that task. For example, a study by Beck, Perfetti, and McKeown (1982) attempted to teach only 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 this required 2,250 minutes of instruc-

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Generalized Compliance Training – An Update –

By George Singer
Larry Irvin
Duane Lundervold
Oregon Research Institute

The purpose of this paper is to review developments in the use of generalized compliance training since the initial publication of Engelmann and Colvin's 1983 book, *Generalized Compliance Training*. The paper will review developments in four areas: (1) legal and ethical safeguards, (2) administrative accommodations, (3) modifications of the procedure, and (4) research needs.

Background

Generalized Compliance Training (GCT) is a Direct Instruction program for teaching severely handicapped learners to follow directions presented by different people, in various places, and with a wide range of materials. The procedure is one of several compliance training programs that have been field tested and published (e.g., Forehand and McMahon, 1980; Cataldo, 1982; Carr and Newsom, 1985). These programs aim to bring children's behavior under the control of instructions from important adults.

Most children learn to follow common directions both to initiate appropriate behavior and to cease inappropriate behavior in the preschool years (e.g., Lytton, 1980). When they do not learn to listen and follow verbal directions, they are at risk of becoming entrapped by a set of accelerating negative social interactions that have been characterized as coercion (Patterson, 1982). In coercive interactions, children and adults enter into escalating interchanges in which each tries to control the other's behavior with increasingly aversive actions. These kinds of coercive interactions appear to be a common characteristic of troubled parent-child relationships (Patterson, 1982; Biglan and Hops, 1985) and troubled relationships between special educators and handicapped students (Carr and Newsom, 1985).

Severely handicapped children appear to be at high risk for developing coercive social response patterns with parents and teachers. Most severely handicapped children are delayed in their development of receptive language. As an integral part of this delay they do not learn the normal social interaction rules that accompany the learning of receptive language. In addition, they generally have trouble learning discriminations and, in particular, learning language and social discriminations that may have subtle stimulus properties.

Direct observations of mothers and young severely handicapped children suggest that parents do not consistently consequate compliance with reinforcers and noncompliance with mild punishers as do successful parents of nonhandicapped and mildly handicapped children (Terdal, Jackson, & Garner, 1976). In addition, many severely handicapped students do not find the consequences that are commonly used in families and schools to be rewarding. In particular, some severely handicapped learners are not responsive to praise and attention as consequences for following directions.

Finally, many common tasks that are demanded of severely handicapped students represent difficult tasks. For example, an autistic student who normally attends to a task for no more than 30 seconds may be asked to watch TV or do a vocational task for five minutes. These tasks may appear to be undemanding from the parent's or teacher's perspective but may represent costly responses for the child.

Many children learn to get rid of such costly demands by using coercion. Compliance training procedures are generally aimed at undoing such learned patterns. Engelmann and Colvin (1983), unlike other authors of compliance training programs, took on the task of teaching severely handicapped children who had already become entrapped in coercive behavior patterns. Such children may be unfamiliar to most readers because they have traditionally been removed from community settings and placed in institutions (Hill and Bruininks, 1984). These individuals often are unresponsive to adults. They are engaged much of the time in self-directed behavior, such as stereotypic rocking or hand-flapping, and they may explode into extreme violence when demands are pressed

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Dear Editor:
Is there a new book by Wes Becker? If so, I'd appreciate publication information.

Thanks,
Marc Jacobs
195 Bennett Ave.
NY, NY 10040

Dear Marc:
Wes has a book in the final stages with SRA. Its title is *Applied Pyschology for Teachers: A Behavioral Cognitive Approach*. It is due out in early Spring. It covers classroom management, mastering learning models, design of instruction, cognitive motivational processes, group processes, development, interpretation and use of tests, and more.

Editor

In Memory of
IRIS POUTALA
Long-time supporter of Direct Instruction and the Association

In Memory of
DORIS ORR
Flint Follow Through Supervisor from the beginning

ADI EUGENE CONFERENCE 1986 AUG. 4-8

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Effective immediately there will be a change in ADI membership and subscription terms. Subscriptions will now run 4 quarters from the date of receipt instead of from September to August. This means if you join in March of 1986 your membership will expire in February of 1987.

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The Use of Corrective

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Appropriate special education programs have not historically been widely available to handicapped adolescents. Special education at the secondary level has been hindered by the subject-orientation of instruction, the fact that most existing assessment procedures, intervention practices, placement options arrangements, and teacher preparation programs were initiated for younger students, and the reality that handicapped adolescents often behave in ways that discourage educators from providing assistance (Epstein, 1982). However, after federal initiatives placed a priority on providing special services for "underserved" groups of students, special educators have increasingly acknowledged the need to develop programs and curricula uniquely designed for handicapped adolescents.

Programs for older handicapped students have frequently represented a mere extension of curricula implemented with exceptional students in the elementary schools (Mercer, 1983). Consequently these programs have often been characterized by a remedial curricular focus emphasizing basic skills instruction. In recent years the validity this model has come under the increased scrutiny of researchers and practitioners (see Alley & Deshler, 1979).

Perhaps the greatest impediment to the implementation of remedial programs for handicapped students in middle or secondary schools has been the relative paucity of curricula appropriate for use with this population. One notable exception is the *Corrective Reading Program* (CRP) (Engelmann, Becker, Hanner, & Johnson, 1980) based on the principles of Direct Instruction (Carnine, 1983) and specifically designed for older students who continue to experience difficulties in basic reading skills. The program has been used with upper elementary, middle school, and high school students identified as underachieving or mildly handicapped as well as with students who speak English as a second language (ESL).

CRP has not received the same degree of research attention as have those Direct Instruction programs geared for use with young children (e.g., DISTAR). Several studies, however, have reported evaluations of the program's effectiveness. These studies collectively indicate that implementation of the CRP can result in improved academic performance in elementary-aged ESL students (Gersten, Brockway, & Henares, 1983), junior high school underachievers (Campbell, 1983, cited in Becker, 1984) and maladjusted students (Thorne, 1978), and senior high school-aged disabled readers (Gregory, Hackney, & Gregory, 1982). In one of the few studies with a population specifically identified as handicapped, Lloyd and his colleagues investigated the effectiveness of CRP with learning disabled students in grades 4-6 (Lloyd, Cullinan, Heins, & Epstein, 1980; Lloyd, Epstein & Cullinan, 1981). They report that the LD students who received CRP evidenced significantly higher scores on measures of reading and language skills than those who did not.

The purpose of this study was to further investigate the effectiveness of CRP by analyzing its use with a population of learning disabled (LD) and educable mentally retarded (EMR) adolescents. In particular, the study focused on whether enrollment in CRP resulted in achievement gains of greater magnitude than had been accomplished during the prior year of schooling in other reading programs. This intra-subject comparison provided a measure of whether effective remediation could be accomplished by handicapped adolescents who had recently experienced minimal improvement in basic skills. In addition, the study evaluated whether handicapping condition interacted with the degree of success achieved by these students. This analysis would assist in determining the differential effectiveness of the program with adolescents with variant categorical labels.

Method

Subjects

Students selected for this study were LD and EMR students within a rural/suburban school division in central Virginia. All students were enrolled in middle or secondary special education programs at the time that the reading program was implemented. Eligibility guidelines used for placement in learning disabilities and mental retardation programs in this system were consistent with the standards of PL 94-142 as implemented by the Commonwealth of Virginia (Virginia Department of Education, 1980). Table 1 provides more specific data on the students participating in the study.

CRP was adopted by this school division for students in need of remedial assistance in both resource and self-contained classes. Each student participating in the program for whom sufficient data on achievement level, IQ, age, and grade level were available was included in the analysis (78 LD and 41 EMR students).

Curriculum

The *Corrective Reading Program: Decoding* series (Engelmann et al., 1978) was chosen because it embodied the principles of Direct Instruction. Specifically *CRP-Decoding*: provides a carefully sequenced hierarchy of continuous skills; monitors progress through criterion-referenced tests; provides lessons of about 45 minutes in which pupils make group and individual oral responses, as well as individual written responses; requires pupils to demonstrate and practice important learning discriminations; and, incorporates reinforcement of improvement through verbal feedback and earning of points.

Procedure

The *Corrective Reading Program* when used with middle and high school students in this division was the core instructional program rather than a supplementary material. Prior to program placement, sixth and seventh graders had typically been placed in a traditional basal program (most commonly Harcourt, Brace, Jovanovich) while eighth through twelfth grade students were in

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Reading (SRA) with Mildly Handicapped Students

eclectic programs which emphasized the use of high interest, low vocabulary materials.

In order to be eligible for the program, sixth and seventh graders had to be achieving at least three years below reading grade level, eighth graders at the fourth grade level or below, and ninth through twelfth graders at or below a fifth grade level. The program had been initially targeted for use with high school students, but was subsequently extended to middle school students because teachers had indicated that reading instructional programs at that level were inadequate.

Students were placed in either Level A or B of the Decoding Program based on the results of the Placement Tests. Students completing Level A continued to Level B. The majority of students who were initially placed in Level B spent the year completing that program, although a limited number did begin Level C. Small instructional groups ranging from four to eight students were formed on the basis of the placement testing.

CRP-Decoding was presented to teachers as one optional approach for teaching reading to middle and high school special education students. Full day in-service was provided on two occasions for all teachers who used the programs. The initial workshop was held prior to program implementation to give teachers an overview of the program and teaching techniques, as well as to provide information about placement testing, grouping, and scheduling. The second in-service was scheduled for the week before the fall term began and focused primarily on specific instructional techniques, lesson pacing, and other information needed for program implementation. Final decisions concerning placement in the program were made in the initial weeks of the school year although several teachers did elect to begin the program somewhat later in the year.

Table 1. Subject Characteristics

Groups	N	Mean Age*	Age Range	Grade Range	Mean IQ	IQ Range
LD Students	78	15-7	12 to 18-9	6-12	87.0	74-108
EMR Students	41	16-0	11-10 to 19-8	6-12	62.5	44-75

*Age was determined at the time of initiation of the intervention program.

Table 2. Reading Recognition and Comprehension Posttest Scores by year.

Groups	1981	1982	No CRP Gain	1983	CRP Gain
Reading Recognition					
LD	4.27	4.34	(.07)	5.07	(.73)
MR	3.12	3.33	(.21)	3.64	(.31)
Reading Comprehension					
LD	4.69	4.85	(.16)	5.49	(.64)
MR	3.27	3.37	(.10)	3.71	(.34)

Design

Students in the study were tested on the Peabody Individual Achievement Test, the standard measure used in this division as part of their annual evaluation, at the conclusion of three consecutive school years (1981-1983). Academic achievement gains between 1981 and 1982 reflected progress made under the prior reading curricula as discussed above, while difference scores between 1982 and 1983 reflected improvement made under the CRP. Academic gains were computed separately for Reading Recognition and Reading Comprehension with separate *t*-test statistics to compare the academic gains. For this analysis LD and MR subjects were combined to form a single treatment group. To address the question of differential effectiveness, an analysis of covariance was run using the initial achievement score (1981) as a covariate to determine if significant differences on the two post-test measures (1982, 1983) were present. Separate ANCOVA's were run for Reading Recognition and Reading Comprehension.

Results

Achievement test data obtained from the series of three administrations of the Reading Recognition and Reading Comprehension subtests of the PIAT served as the dependent variable. Scores were available as post-test measures for the years 1981-83. These data are presented in Table 2, separately for LD and MR groups.

Overall Program Effectiveness

The initial question of overall program effectiveness was addressed by comparing gains prior to the implementation of CRP (1981-1982 school year) with gains made during the experimental year (1982-1983 school year) for combined LD and MR groups. Under the traditional program, the academic gains in Reading Recognition (($\overline{X}$ = 0.109) and Reading Comprehension (($\overline{X}$ = 0.128) were minimal. In contrast, the academic gains during the CRP were substantial for both Reading Recognition (($\overline{X}$ = 0.570) and Reading Comprehension (($\overline{X}$ = 0.500). *t*-test analyses indicated a significant difference between gain scores in both Recognition (t = 2.75; p less than .007) and Comprehension (t = 2.36; p less than .02). These findings support the position that the CRP produced significantly greater gains than the reading programs previously used in these classrooms.

Differential Program Effectiveness

To address the question of differential program effectiveness for LD and MR students, separate ANCOVA's were run on the two reading measures using the initial test (1981 PIAT) scores as a covariate. No significant group differences were found for the 1982 posttest scores for either Reading Recognition or Comprehension, thus indicating the LD and MR groups responded in a similar manner to the previously-used reading programs. A significant group difference was found for the 1983 posttest scores on Reading Recognition (F (1,117) = 9.479; p less than .003), but not on Reading Comprehension. The significant difference indicated that the LD students improved more on Reading Recognition than the MR students.

Discussion

The data summarized above support the fact that CRP-Decoding had a significant impact on Reading Recognition skills of students and on Reading Comprehension. On both Recognition and Comprehension scores, gains for individual students ranged from essentially no positive change to several grade levels during the year then were enrolled in the program.

A key question explored in this study was the magnitude of reading gains achieved during the year in which CRP-Decoding served as the primary curriculum for subjects. The mean gains of approximately 5 to 6 months for both Recognition and Comprehension are less than those found in some prior research. However, it is significant that the previously reported research did not include the same type of students as the current study. For example, Gersten and associates (1983) were concerned with primary-level ESL students. Studies by Campbell (1983, cited in Becker, 1984) and Gregory et al. (1982) included older students that were not specifically identified as LD or MR. The findings reported herein are generally consistent with the results reported by Lloyd and colleagues (1980, 1981).

Several limitations in the present research need to be noted. First, the pool of students under study did show some fluctuation that was beyond the control of the researchers with some students transferring in and out of project schools and/or being declassified from special education. Second, although teachers were adequately trained in the use of CRP, a substantial amount of variance was noted both in the competency level of the instruction and achievement gains in students. It seems relatively safe to conclude that teacher competency was a confounding variable which could not be controlled for in this study.

Third, the use of PIAT scores as pre/post measures did not provide for the type of comprehensive evaluation that might be desirable. The risk remained that specific test scores for individual students could represent inflated and/or depressed estimates of actual achievement level. Anecdotally, teachers' judgments were that the post-test scores were conservative estimates of the magnitude of the gains students achieved.

The current study presents an optimistic perspective on the effectiveness of remediation with older students. The data caution special educators not to assume that basic skills instruction should be forsaken with adolescent handicapped learners. The positive attitudes of teachers who utilized the program reinforce the potential for the incorporation of highly structured, Direct Instruction programs, such as CRP, into the middle and secondary school curriculum.

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We Need More Contributions from the "Field"

Such as those in this issue by:

SHIRLEY SIMMS
ED POLLOWAY &
MIKE EPSTEIN, &
CHARLES AUTHUR.

Generalized Compliance Training

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upon them. Such children are few in number, but they place extreme demands upon their families and teachers, are often kept in extremely restrictive environments, and often do not benefit from public school special education programs. As such, they represent a major challenge to the field of special education and applied behavior analysis.

Many of the issues and concerns that have surrounded the use of generalized compliance training in the past five years have been directly related to characteristics of the population that has been served. Without exception, the service systems that have used the procedure are programs that have made an unusual committment to keep severely handicapped children who exhibit extreme behavior problems in community settings. Wherever this has been attempted, regardless of the behavior management programs that have been used, parents and educators are often involved in emotional and taxing circumstances, such as coping with self-injurous behavior or dealing with public misunderstanding of a treatment procedure. Thus, in part, generalized compliance training has been controversial because it has been used to treat a population of children that have been written off by most community services.

Like other direct instruction programs, Engelmann and Colvin's Generalized Compliance Training (GCT) is a complex instructional program based upon a careful analysis of the instructional universe that usually consists of verbal directions. At first these instructions are rudimentary such as "stand up," "sit down," "hold it," and "give it to me." Later in training the student may learn to follow complex instructions as part of a normal activity. Verbal directions are carefully taught using such common Direct Instruction procedures as rapidly paced massed practice, firming, and planned generalization. Because the program was developed for children who have learned to be extremely oppositional, it also uses an overcorrection procedure. In this component of the program, students who do not follow directions are required to *stand up* and *sit down* repeatedly upon command. If necessary, these movements are enforced by physically overpowering the learner while using loud verbal commands. Overcorrection has been widely used with severely handicapped students and has often, by itself, been an effective form of punishment (Foxx and Bachtel, 1983).

GCT has been controversial because it has been used with a difficult population and because it includes a dramatic punishment procedure. Overcorrection and other aversive procedures have come under attack by advocacy and professional organizations because such procedures are intrusive, i.e. they cause the learner physical and psychological discomfort or distress (TASH Newsletter, 1985). Opponents of aversive procedures fear that such methods are widely misused and, as a result, may subject severely handicapped persons to abuse. Educators who have used GCT have often stepped right into the middle of this controversy.

Legal and Ethical Safeguards

The use of GCT has proven to be controversial in a majority of the settings in which it has been implemented. In some cases, the controversy has surfaced in local newspapers; in others it has given rise to adminstrative investigations and reviews. One result of this controversy has been the development of legal and ethical safeguard mechanisms. In order to prevent accusations of abuse and actual misuse of the treatment, school districts and group home organizations have developed human rights review mechanisms (Irvin and Singer, 1985; Singer and Irvin, 1985). One school district has developed a Human Rights Review Committee (Singer and Irvin, 1985) that uses extensions of normal I.E.P. procedures to review the proposed use and implementation of any intrusive treatment with handicapped learners.

The Review Committee has been well received by parents and school personnel and has played an important role in assuring that there is knowledgeable public oversight regarding the use of generalized compliance training and other potentially intrusive treatments. The Committee is responsible for seeing that the school district has accomplished the following safeguards before implementing any intrusive treatments: (1) obtained full informed consent, (2) made a good faith effort to use less intrusive best practice procdures, (3) carefully documented the results of prior treatment efforts and, (4) proposed an intrusive treatment that is the least restrictive alternative. These review procedures are described in detail in a manual by the authors (Irvin and Singer, 1985).

Administrative Accommodations

GCT has proved to be challenging to implement both because of the nature of the population served and the precision required to implement the program properly. To our knowledge, it has been implemented successfully in three regional school districts, three group homes for severly handicapped children and young adults, a sheltered workshop program for severely handicapped adults, and in the private practice of three behavior therapists who work with families of handicapped children. At least 50 individuals have received appropriate GCT treatments from qualified professionals. It has been used both to train students who were extremely noncompliant and to decelerate other aberrant behaviors such as self-injurous aggression, tantruming, ingesting of dangerous substances, fire setting, running away, and breaking and tearing objects.

In each of these varied settings there have been several common administrative issues that have required attention: (1) the need for high staff-client ratios, (2) the need for highly trained personnel, (3) the need for careful on-going supervision of program implementation, and (4) the need for an excellent teaching environment as the context for compliance training. It is important to note that these concerns arise whenever this population is served adequately and whenever complex behavioral programming is used. During initial phases of compliance training, students in classrooms have required one-to-one aides. In group homes, a staff-to-client ratio of 4 to 6 has been needed. In several cases, however, this level of staffing has been faded after a period of from 1 to 3 years. In others, the intensive level of staffing has not been withdrawn because of the rapid emergence of behavior problems when intensive programming is faded. Unfortunately, we do not have enough data to predict ahead of time who will succeed with less intensive supervision and who will not.

The need for highly trained personnel derives from both the difficult nature of the presenting problem behaviors and the complexity of the treatment procedure. Successful programs have employed a program director or behavior specialist who is highly skilled and thus able to: (1) demonstrate the treatment procedure to others who will implement it, (2) identify instructional errors by program implementors, (3) give immediate feedback to those staff regarding their implementation efforts, (4) modify the program as needed, and (5) solve problems. The organizations described above have all instituted inservice training programs in GCT for their staff members. Training is ongoing, with frequent supervisory feedback.

Finally, the procedure requires a good teaching environment as a basic context for the training. Those elements of good instruction and good classroom practice that have been described repeatedly in the *ADI News* must be in place. They include high levels of engaged time, high levels of reinforcement, immediate and skilled correction procedures, appropriate pacing, variation of stimulus materials, careful selection and sequencing of exemplars, training for generalization, and regular review of materials.

Intensive behavioral services are expensive to provide. Programs that have not previously served this population have had to find ways to fund such intensive levels of service. Policy initiatives to address the needs of this population are sorely needed. At the present time, programs often have to patch together funding mechanisms to sustain intensive treatment.

Modifications fo the Procedures

Several implementors of the program have made modifications of it—primarily in regard to the use of overcorrection. Professional opinion and public concerns about child abuse have created a climate in which the use of any punishment procedure is highly controversial. In addition, there appear to be many students who, in fact, do not require the use of the aversive elements of GCT. Consequently, some educators have focused their work on the positive components of the program. They have used a variety of ways of addressing aberrant behavior including physically blocking it, manual restraint, short time out, and simple persistence with instruction in the face of aberrant behavior. In some cases these procedures have been sufficient. In these cases, GCT has been an unusually gentle program. However, in other cases—particularly with older and more violent students—these approaches have not been sufficient to obtain sustained suppression of problem behaviors. It has been necessary to add the more intrusive overcorrection component. For example, in one school program the staff found that manual restraint of an autistic young man when he tantrumed led to an increase in his violence and that additional emergency procedures used to prevent others from injury were ineffective. In this case the use of enforced "stand up" and "sit down" commands appeared to be less harmful than the continued failure of other less intrusive measures.

Research Needs

There are several compelling research issues raised by field experience with GCT. First, there is a need for further documentation of the program's effects. Treatment reports to date have been case histories and have lacked the kind of reliability and experimental control that is generally accepted as a standard in the applied behavior analytic literature. Such documentation would help to disseminate the procedure. Carefully designed studies of the treatment with direct observation measures would be a real contribution since our clinical experience has shown GCT to be effective where all else has failed to reduce extremely aberrant behaviors. Of particular interest in such studies would be untargeted collateral behaviors such as mean length of utterances, smiling, on-task behavior, and acquisition of new skills. We have observed repeatedly that when students learn to follow directions there is often a rapid emergence of other seemingly unrelated skills. For example, one autistic teenager who only used occasional two-word utterances began speaking in four-word utterances as soon as he learned to follow directions. Careful documentation of such effects is needed. It is possible that generalized compliance represents a general response class that is a core skill by virtue of the fact that it facilitates the learning and performance of many skills. There is a need to identify such core skills for severely handicapped learners because they often learn very slowly and lack many basic skills. As a result it is essential that educators select skills for instruction that will be as generative as possible.

Secondly, there are some very intriguing elements of the GCT program that, of themselves, are promising as treatment components and theoretically of great interest. In particular, GCT involves use of a "precorrection" procedure that is being widely used by teachers of severely handicapped students who must instruct their students in diverse community settings. The precorrection procedure involves the following components: (1) identification of stimulus conditions that reliably predict problem behaviors, (2) identification of the early parts of aberrant response chains, (3) presentation of rapidly paced commands in the presence of either *1* or *2*, and (4) reinforcement of compliance with these commands. For example, a teacher might assess the circumstances in which an autistic student tantrums and find that the student is most likely to become violent in a crowded room, less likely in the presence of several other

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The Non-Negotiable Part of School Discipline Plan

By Geoffrey Colvin, Ph.D.
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and Robert Lowe, Ph.D.
Principal, Casper, Wyoming

There is one component in a school discipline plan that cannot be excluded, parents have to be involved. If this is not carefully planned for, the involvement may take forms that are not desired. The following notes are some verbatim concerns that have reached a principal's office.

- "If your black playground lady disciplines my kid again I will tap dance on her head."
- "If you don't let Joe fight, I will hafta hit you."
- "Laurice admitted she wrote on the wall but she really did not do it because she does not know how to spell those bad words."
- "My son Cedric is well behaved at home and at Sunday School and never had any problems before he came to your school. His color must be a problem to you folks."
- "Please get another bus driver . . . this one only sees my Leroy doing awful things."
- "If you would start giving out better lunch food, maybe Cissy would quit throwing it around."

The following notes came from the principal's desk:

Mrs. Smith arrived at the office quite disturbed and spoiling for a fight. I told her I would visit with her as soon as the Behavior Consultant arrived. Mrs. Smith followed me into my office. When I asked her to wait outside the office she stated in a loud, threatening voice that my office was public property and that she would stay.

Tim lost his cool completely in the classroom and was sent to the office. His mother was called and arrived at the school in 30 minutes. She then visited with Tim and determined that he needed swats and then proceeded to apply a goodly number (10) with my paddle.

Ruth was sent in from the playground for fighting, making obscene gestures, cursing, defying authority and for being mouthy in general. Her father indicated that we must mean Irene because Ruth is the apple of his eye and she would never do anything like that.

While it is possible to deal with these parent concerns as they arise, we suggest it is much more fruitful and certainly less stressful to have a systematic plan for involving parents in a behavior management system.

Such a plan would be comprised of the following components:

1. Involvement at the development phase.
2. Communication of the proposed plan.
3. Communication of services available in the School District.
4. Development of a parent training system.
5. Management of parent behavior.
6. Management of the parent conference.

1. Involvement at the Development Phase

There are several advantages of trying to involve parents in developing or revising the school discipline plan:

a. If parents have the opportunity to participate in the development of the plan, then there is more likelihood that they will accept the plan.

b. By setting up a mechanism to require input from parents (and staff) we are communicating not only that their opinions are valued but that it is *necessary* to have a plan. In other words, the process helps to sell the idea of having a school discipline plan.

c. While all parents may have the opportunity to participate, we know that the response will probably be minimal. However, when a situation arises that particular parents are hostile about some consequences that are applied to their child, then we can respond that they had the chance to input and will have another chance when the plan is evaluated and revised. So until the plan is changed our policy dictates that we maintain the present plan.

d. Parents who have provided input into the plan can function as "allies" for us in dealing with hostile parents. This situation is particularly helpful where minorities are concerned.

2. Communication of the Proposed Plan

While it is important to invite parent input in the development of the plan and to respond appropriately to their input, it is critical to take several steps to disseminate the plan. The following steps are helpful:

a. Distribute copies of the plan to all parents. In addition we recommend that some kind of slip be designed to indicate that the parents have received a copy. References can be made in newsletters that the plan has been circulated to all parents and that if any parent has not received a copy then they should contact the school office immediately. Apart from ensuring that all parents have the chance to read the plan, this step helps to curtail statements like "I never knew that was a rule."

b. It is important to frame rules and consequences in a positive manner. For example, it is better to use terms like *expectations* versus rules. Expectations communicate the notion of acceptable behavior whereas to some parents (and students) rules may communicate a challenge or an authority threat.

c. Parents need to know at what point in the discipline plan they will be required to become involved. It is best to have a hierarchy of penalties and after a certain point in this hierarchy parents become involved. Clearly there are exceptions to every plan. However, our point is that if you do not have a plan then every situation will become an exception.

d. It is necessary to identify exceptions and to let parents know in advance what these exceptions are. One obvious exception is serious behavior. For example, if a student stole $100 from the cafeteria then parents would be notified immediately. It would be highly inappropriate to deal with this matter in the school without notifying the parents. At this level it is important to have parents understand that for serious behaviors or problems parents will be notified immediately. Other exceptions involve judgment calls. Some parents like to be informed whenever the child has problems, while other parents do not want to hear anything unless the behavior is serious.

e. Parents need to understand the important difference between a *behavior being non-negotiable* and *a consequence being negotiable*. It is our task to communicate to the parents that inappropriate behavior is not acceptable in the school and that consequences will be applied for inappropriate behavior. However, we also need to communicate that the consequences can be negotiated. It does not matter whether the child is kept in after school or denied recess or denied other privileges. What does matter is that some consequence is applied and that it is better to involve the parent in deciding the consequence for serious infractions.

3. Communication of Services in the School District

Most school districts have alternate programs for children who exhibit serious behavior or emotional problems over a long period of time. The typical model is that the student begins in the least restrictive environment, which is usually the home school. If behaviors still persist (given that the services in the

Continued on Page 15

Generalized Compliance Training Continued from Page 4

people, and unlikely to tantrum when alone with a trainer.

The teacher might also study the tantrums to find that the student reliably flaps his/her hands before beginning to tantrum. After the learner had been carefully taught to follow several directions, the teacher would begin to use the precorrection procedure. Before entering a crowded room, the teacher would give the student several simple directions to follow including a command for a response that is incompatible with tantruming such as "hands down, no noise." If the student were to begin to flap his hands while in the room, she would immediately provide rapidly paced commands to interrupt the tantrum chain. Our field experience shows this simple technique to be very useful. It is particularly helpful because it is portable—it can be used unobtrusively in community settings. Research is needed to validate the applicability and effects of the procedure. Our experience with precorrections also suggests the possibility of both self-control and staff-implemented maintenance procedures that could be extremely useful in applied settings.

Another area that needs to be carefully researched is how implementation of the last phase of a compliance training program is achieved successfully. This is the phase in which verbal commands for compliance are systematically made indiscriminable from other on-going verbal cues. In at least one site, highly skilled staff have managed to make compliance commands indiscriminable from normal social interactions so that autistic teenagers have learned to respond to cues such as "Hi, how are you?" in the same way as they respond to compliance commands. This process ought to be carefully documented; making compliance training and normal social interactions indiscriminable in diverse settings could be extremely useful as a training technique for a variety of purposes.

Finally, as mentioned earlier, alternatives are needed to the overcorrection component of GCT. In particular, other procedures are needed for working with older students and adults. Overcorrection is not recommended for this population because it is often difficult to physically enforce commands without risking injury to the subject or to the staff (Foxx and Bechtel, 1983). Acceptable and effective ways to work with violent adolescents and adults must be developed.

The application of Engelmann's instructional analysis approach to behavior problems holds great promise. The relative success of GCT as a treatment for a group of students who are unusually difficult to educate demonstrates this fact. We hope that relevant research and program development efforts will be sustained enough to realize that promise.

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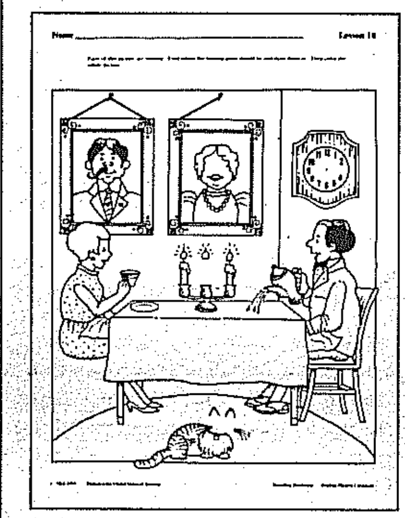

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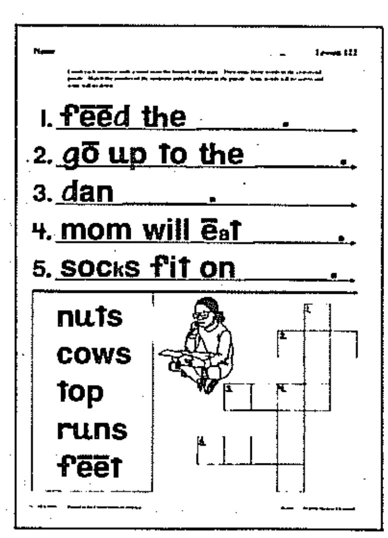

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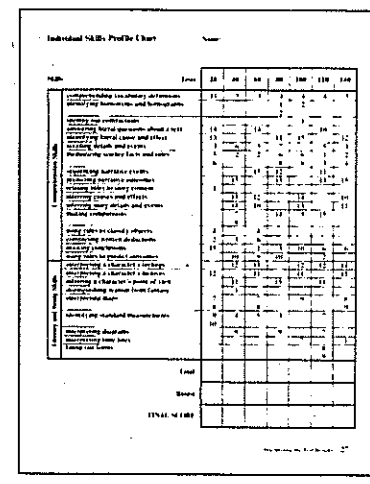

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Understanding Computer-Based Education

By Martin A. Siegel & Dennis M. Davis. Random House, 1986, 236 pages.

A book is stimulating if it does just that—stimulates and prompts you to think about issues that you would otherwise not think about. *Understanding Computer-Based Education* should be stimulating to anyone interested in instruction, whether or not the person is interested in computers. While computers represent a new technology, an old problem is encountered when they are used to teach: How to get the job done effectively and efficiently. There are many issues associated with computers as an approach to delivering instructional content.

The authors, Marty Siegel and Dennis Davis, take it from the beginning and lead you, a step at a time, through the issues. Their presentation is thoughtful and very nontechnical. You will not encounter bits and bites. Instead, you will see how the problems of computers in education are basically the same as the problems teachers face.

After all, the computer is supposed to do what the teacher would do in a traditional setting, deliver skills to students in a way that can be demonstrated through some sort of "test."

The book opens with a short social history of computers. The first computers emerged in the industrial revolution. They were machines that could perform routine operations more cheaply and more rapidly than humans. The Jaquard loom was an early prototype. It used a stiff punched card to guide the machine through a series of complicated steps in weaving; and lo, the punched card led to the Second Wave computers. These machines did operations that had been performed by clerks. As Siegel and Davis point out, "It is easy to see why Second Wave computers had to strive for big memory and big computing power. After all, in the early days of Second Wave computing, clerks could do the same kinds of data processing tasks that computers could do, and for less money, since computers were extraordinarily expensive to build, operate, and maintain. The computer's only advantage was that it could do more (big memory) faster than clerks (big processing power), and with fewer errors. The computer became practical between 1880 and 1890, when the US population had swelled so much through immigration that it would have taken an army of clerks more than ten years to complete the 1890 census. Enter the computer, large size, large memory, large rapid processing.

The Third Wave computers were conceived because of technological advances; however, their parents were clearly Second Wave machines, and they came into being with a heavy legacy from their parents. With transistors, silicon chips, and microcircuitry, they were magnificently powerful and inexpensive, and their creators looked not to the large industries that purchased the Second Wave machines, but to you and me, the mass market—a chicken in every pot, two cars in every garage and at least a couple of computers in every school. But the legacy of the parents directed the first steps of the Third Wave machines. The new hardware could operate only if it accommodated some kind of software. As Siegel and Davis explain, "Because the function of the computer can change depending on the program it is running, programs are called, 'soft.' Software is soft in the sense that it is changeable; hardware is hard because it is fixed or unchangeable. The computer must have a complex program because few, automatic, fixed functions are built into it. The problem with the early (and often current) programs is that the people responsible for the Third Wave machines were Second Wave people. The Second-Wave emphasis was on "programming" the machine, constructing the software and putting it into the computer so that it works. Kind of like building a car from junk parts, or rewiring your house. The Third-Wave users, however, were not computer programmers. Their interest in the computer was not to build the part of them that would make them do something useful, but to use them—like most people use cars. They are not particularly interested in the circuitry that makes the seat belt warning sound when the ignition turns on. They are simply interested in *using* the car to get from here to there. They view the car from a perspective totally different from that of the do-it-yourselfer or hobbiest. As Siegel and Davis point out, "In education, the computer revolution is centered not in the new machines but in new uses." In other words, people who use micros are software *users* not hardware programmers.

The questions this user asks are basic: "What do I want to teach? . . . What software delivers that instruction? . . . What computer runs that software?"

In their own quaint way, developers of Third Wave machines recognized that the needs of the new user were different and they came up with catch words (which are not entirely meaningless) to express how the software for the new user had to be different from that designed for Second-Wave consumers. The king of the catch words, "user friendly," means simply that the software is easy to use. More specifically, the program will interact in some version of English—possibly pidgeon English, but not the cryptic and involved codes that characterized Second-Wave programs. "Programs that are protected so that even if you do something dumb . . . you will not destroy the program or lose whatever data you entered, programs that keep you from getting stuck . . . programs that place clear directions for using them right on the screen (instead of the manual)."

As Siegel and Davis point out, "When you stop to think about it, however, the term (user friendly) is actually rather strange. Of all the easy-to-use things we purchase, only computers and software seem to be described by this term. Who ever heard . . . of a 'user-friendly' bicycle?" The term user friendly represents Third Wave computer people talking to themselves, reminding each other that there are new needs for the Third-Wave consumer, but not quite knowing how to express the idea. The people who designed and market the machines are computer experts—with a Second-Wave orientation. For them, the machine's potential is the important ticket. "As a result, we Third Wave users end up with a great little machine and nothing—or mostly bad and unfriendly software—to run it. And that, in turn, is why so many computers in our schools are standing idle. . . . It can be fun and exciting to learn some programming if you want to, and there is a place for teacher developed programs in education . . . But when it comes to the serious delivery of instruction, teachers can no more be expected to develop programs themselves than they can be expected to develop their own textbook series."

Which brings us to the question of "computer literacy." If you're a do-it-yourselfer, computer literacy consists of learning such ugly stuff as "BASIC programming." But as users of computers, not programmers we have different literacy needs. ". . . We need a range of courses with titles like, 'Using the Computer in Education.'" Even with very friendly programs there is a need for such literacy. Yet, as you probably know if you've had the questionable experience of taking a course on "computer literacy," we are still treated as mechanics, not intelligent users with very specific needs.

One very important notion that is not neatly expressed by the shop term "user friendly," is that if the computer is to serve the primary Third-Wave consumer the machine must be transparent. It must do its job in a way that doesn't call attention to itself.

What should we know about the internal operations of the computer? Well, you should know that they can't teach. "Computers do not teach; people teach. People build instruction into computer programs." The computer forms variations of four tasks: They accept *input*, they store information; they manipulate that information (calculate, compare, sort, possibly summarize); and they give you back the product of their manipulations as some output. Even though the computer is basically a dumb instrument, a program that intelligently harnesses these four "tasks" can make the computer behave a lot like a teacher. It can interact with the student—tell her if she made a mistake—it can keep score on her performance, and sort items that she missed so they will be repeated in the sequence of activities that she follows (but not necessarily in the sequence that another learner follows). The computer can also keep score on how well the learner performed and perform a bookkeeping-management function for the teacher. Although teachers can do some things better than computers, "computers can guarantee achievement given appropriately designed instruction . . . computers may also be regarded as better at sorting information. Unlike most teachers, they have total recall; however, they can draw only on information that has been specifically programmed into for the task at hand. They cannot reach into their 'life experience' for additional information and bring it to bear on instruction."

Instructionally oriented systems can be classified in various ways. The two primary classifications are based on the responses the learner produces and on the goals of interaction. Classifying systems according to learner responses leads to categories like drill, tutorials, instructional games, simulations, and "programming." A classification system that may have stronger implications for instruction is Taylor's system, which classifies activities according to the goal. The computer may be a tutor, a tutee, or a tool. Neither classification system does much for me. The nicest thing that happens in the chapter that explains these systems is the illustrations the authors present. Some of the examples are from PLATO programs developed by S. G. Smith, who has to be one of the cleverest instructional programmers around today. Smith not only knows his content; he knows how to translate it into "games," simulations, and very intelligent exercises. Other illusrations involving PLATO programs are also smart. For instance, in a bone-identification program, a marker shows a particular bone and the screen asks, "What bone is this?" If the student makes a mistake, typing in the wrong name, the following screen shows the bone the student mistakenly named and once more asks about the targeted bone.

Inevitably any discussion of computers in education must deal with questions of instructional philosophy. Just as there are those in education who try to fit a round peg into a square hole by "redefining" roundness, there are those in the computer-education forefront who identify problems that are quite real, interpolate theories or explanations that are perfectly irrelevant, and come up with solutions that are best left in rields near cattle barns. Siegel and Davis approach the philosophical with patience and understanding, in Chapters 5, 6 and 7. They begin with an easy-to-follow description of Logo, and how it attempts to teach "powerful concepts" through a program language that permits the learner to manipulate a triangle

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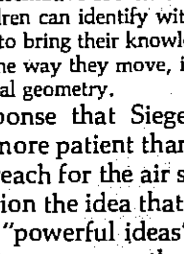
on the screen (called a *turtle*) through the use of a fairly simple computer language. The developer of Logo, Seymour Papert, suggests that through "discovery" in using the Logo program, students will engage in meaninfgul learning—meaningful in the Piagetian sense (which unfortunately has nothing to do with instructional meaningfulness). Papert identifies a real problem, "Imagine that children were forced to spend an hour a day drawing dance steps on squared paper and had to pass tests on these "dance facts" before they were allowed to dance physically . . ." Yes, some drill-and-practice programs are stupid. Some take a task that is basically one of creation or production and make it a "fact program." This problem is real. But now, the solution—the turtle, which is concrete, although it uses formal mathematical relationships and is purported to impart mathematical knowledge. Papert writes:

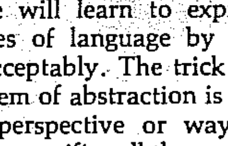
A turtle is at some place . . . but it also faces some direction . . . In this, the turtle is like a person . . . or an animal or a boat. And from these similarities come the turtle's special ability to serve as a first representative of formal mathematics for a child. Children can identify with the turtle and are thus able to bring their knowledge about their bodies, and the way they move, into the work of learning formal geometry.

The response that Siegel and Davis give is far more patient than mine would be (after I reach for the air sickness bag). They question the idea that students will learn such "powerful ideas" from learning to write programs that manipulate the turtle. (The idea of learning formal principles from playing with the turtle is about as compelling as the suggestion that one will learn to express formal properties of language by learning to speak acceptably. The trick in learning any system of abstraction is to learn the unique perspective or way of slicing reality that unifies all the applications of the abstraction. Stated differently, any kid who has ever filled a bucket with sand and watched it flow out through a hole in the bottom has witnessed an example of integral calculus, but very few people would espouse the scenario that by watching sand trickle from a holey bucket, someone would learn calculus.)

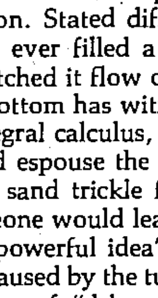
Another "powerful idea" that is supposed to be caused by the turtle program is the strategy of "debugging." Papert cites an example of a child who tried to draw a house using the Logo routines she had learned. The first house looked like this:



She partially debugged the illustrations and got this:



And with a final debugging, this:



Papert suggests that this debugging practice provides children with some concepts that can be generalized to show the larger issues. (This is another example of the sand and the bucket game.)

As Siegel and Davis put it: "The question is how to apply a concept like debugging to problems other than programming problems." How does it apply to the task of fixing up a written composition. Even if the student recognizes that both English and Logo are languages and that a bug in a Logo program can be remedied, where does the student go from here? "Debugging problems in computer programming usually are logical problems. . . . Problems in writing have many different origins. They could be logical, but they could be grammatical, stylistic, or conceptual. Papert points out that in using computer programs to generate sentences, a girl named Jenny made a discovery. "Now I know why we have nouns and verbs." (More sand from the bucket.)

Siegel and Davis respond to this anecdotal approach to instruction by pointing out that there is a difference between what one student happened to learn and what was taught. "Put it this way: Having found out about Jenny's discovery, can her English teacher confidently drop the study of nouns and verbs from the curriculum?" The authors point out that even though Papert's solutions are problematic, his identification of the problem is very reasonable. Nouns and verbs are not usually taught well in your typical "language class." What else is new. But the problem of undue formalism in the curricula does not imply the turtle.

Papert states, "In many schools today, the phrase 'computer-aided instruction' means making the computer teach the child. One might say the computer is being used to program the child. In my vision, the child programs the computer." Very quotable, but based on double meanings and a somewhat false dilemma. That would be like saying that children who learn to manipulate the turtle become experts at manipulation and can therefore be expected to grow into manipulative people. Or, as Siegel and Davis put it, "Logo teaches students to program computers. At the surface level, Logo thus presents no restrictions to the student . . . But programming languages are themselves restricted, artificial . . ." which means that Logo imposes the strongest kind of machine-like restraints on the student. A well designed "tutor" program "which interacts with students in English (not a programming language) imposes no such intrinsic mechanical restrictions on how students think about what they learn.

The thing that bothers me most about the plastic positions taken by people like Papert, who actually do an energetic job of warping reality to make it fit their assumptions about kids and learning, is their disregard for data or thinking. If debugging is a skill that is to be taught—whether it has any great application outside the field of computer programming—there are relatively efficient ways to teach it. For instance, we could construct a series of examples, like Jenny's first attempt at a house, display the programs, highlight the parts that are relevant to the mistakes and have students fix them up. We don't have to wait for motiviation, happenstance, and pure chance to lead to "discovery." We can anticipate that it is a skill that the students should have, and we design instruction that is capable of delivering it. So much for my editorial stance.

In dealing with the question of evaluating discovery, Siegel and Davis point out that two criteria are important: effectiveness and efficiency.

These criteria can be expressed by the answers to a series of questions: Did *all* the students learn the material? What exactly was it that students learned? If mastery performance shows great differences among children who went through the discovery experience, whose fault is it? (Should someone, like a teacher, have intervened and supported those who are less proficient at discovery?) What is legitimately discovered? "Bad instruction is inefficient because those who take it simply do not learn what they were supposed to learn. But of equal importance in classrooms, textbooks and instructions is the sort of ineffectiveness that is related to efficiency. If students in two different instructional programs learn the same thing, but one program takes significantly less time . . . it is better. If we had all the time . . . we needed, perhaps this would not be the case. But students have a lot to learn and no surplus of learning time."

The author's philosophical position is that computers should be used to individualize instruction, which means that the program routes students according to their pretest performance and their performance on various exercises. The uniform feature of the program for students of varying ability is that it will turn out students with the same minimum performance. The authors point out that it is not only an elusive task to design instruction according to the individuality of the learner; it is probably impossible, given the various possible dimensions on which we could show individual differences in preferences, styles, skills, and so on. If instruction is "individualized" so that the content is given and the procedures for accommodating the range of students who would enter the program, the goal is both manageable and potentially effective. Individualizing means that "each student must get every bit of instruction he or she needs to master content effectively and . . . no student gets one bit more instruction that he or she needs."

I may not disagree with the authors on this point, but I think the description of "he or she needs" should be made very clear. The need typically is much greater than that suggested by traditional programs that must have been inspired by hit-and-run drivers. These programs seem to assume that the game of instruction is to present new material at such a rapid rate that slower kids can't possibly learn it, and faster kids can learn it at the expense of developing great absorption strategies, but not thinking or critical-skill strategies. Part of any good program is lots and lots of overkill. The additional practice is needed for the slower kids and it really won't either turn off or hinder the higher performers. We don't want the student's grasp of important skills to be so precariously positioned, that the first time he or she sneezes, the skill flies out of their head. Siegel and Davis demonstrate a grasp of "intelligent" individualization in their list of specific things the program must do.

"1. In delivering instruction, we must devise some means for determining whether a student already knows the content taught in a lesson and, if he or she does, individualizing the lesson by permitting the student to skip it.

2. For students who do not already know the facts and/or skills the lesson teaches, and who thus enter instruction, we must:

   a. Teach them only the skills they do not know. Delivery is not fully individualized if the lesson is "all or nothing"—if students who enter it must take all the instruction, even though they make only a subset of possible errors in performing on the content.

   b. Give them immediate corrective feedback on their performance. Most instruction includes some form of feedback, usually delayed. For fully individualized delivery, students must get *immediate* feedback, and it must be specific to the learning errors they have made.

   c. Provide some efficient means for extended practice on the skills they have learned in the lesson. Again, most instructional programs include practice, but individualized delivery means that practice focuses on the specific skills with which a student is having difficulty."

Chapter 7 takes us through the specific techniques used by a good tutor program, showing us how the program permits accurate placement of students, immediate instructional feedback on performance; variation in lesson content (depending on student performance) distributed practice; and sequencing instructional activities (what Student M does after she completes this program). The treatment of these issues is clear and very sensible.

The final chapters in the book deal with specific issues associated with the instructional use of software. Chapter 8, educational software tools discusses some of the more subtle issues of software tools. Chapters 9 and 10 deal with very practical issues of using computers in the classroom and attacking the courseware problem. Chapter 11 presents possibilities, what could be. The closing paragraph suggests the ultimate possibility:

"When the time soon comes that it is possible to carry the entire contents of the Library of Congress around in a briefcase-sized computer, the problem we will face is not one of knowing how to build the data base we carry, but how to get at the information it contains in imaginative, efficient ways. As it increases our command of the knowledge and skills we need, this capacity to lead us into creative use of an awe-inspiring powerful new medium is surely the chief value and the best destiny of the computer as teacher."

My final note: As you can tell from my frequent editorial comments (otherwise known as opinions), I found the book both informative and carefully sequenced. I think it should be required reading for anyone in education who is looking at computers as a solution to global problems. Computers that deliver instruction, as Siegel and Davis point out through various examples, are driven not by hardware, but by the raw instructional details of the software. If those details are designed according to sound instructional principles, the program will deliver. If not, your computer has wasted both your time and that of your students.

Reviewed by Siegfried Engelmann

First Year Report on a Jr. High LD Class

By Charles Arthur—Teacher
Winchester, Massachusetts

Program Description and Test Score Interpretation

In September 1984 a special class was established at my Jr. High for students with learning difficulties. Tests were given at the beginning and end of the year in order to evaluate the progress that was made by the students during this first year. Only test scores for six students have been recorded because they are the students who completed a full year in the program. Three other students were in the class for a portion of the year. Testing was not completed for these three because of the partial year participation and because of attendance problems. Also, these three did not have the same serious academic problems as the first six.

For the six students, (4 boys and 2 girls) the special class provided instruction for 4 or 5 out of 7 classes a day. Four of the 6 students were considered 7th graders and 2 were 8th graders at the beginning of the year. Their ages ranged from 12-2 to 14-2. The daily classes included instruction in reading, language, math, independent reading in the content areas, and, for three of the students, a spelling/writing class. An instructional aide worked in the class for the last three-fourths of the year when 8 or 9 students were in the program.

The main purpose of the class was to provide intensive instruction to students who were at least two grade levels behind in academic skills due to a history of learning difficulties. The goal of the program was to help the students catch-up as much as possible to the average skills of their own grade level. In order to do this, each student would have to make more than a year's progress within the year.

The tests given, as one indication of this progress, were all norm-reference tests. These tests sample a progression of representative skills and provide standard average scores for various age level groupings and grade levels.

The students would be expected to improve at least one grade level in order to just keep up with the average progress. To catch up, they need to progress more than one grade level. All six students gained at least *two grade levels* in most areas. Thus, the progress made with these students, during this year, indicates that it is possible for students with a history of learning problems, who have fallen way behind each year, to begin to regain these losses.

Not all of the students were given exactly the same tests. Some first year difficulties prevented a complete uniform evaluation. For example, one of the 8th graders refused to take some oral tests at the beginning of the year, and the lack of time caused a few small omissions with other students. In spite of this, the testing was very similar for each student, and enough tests were given to provide adequate information (see Table 1).

The most interesting aspect of these scores has to do with the degree to which they correlate with the mastery of curriculum objectives. Curriculum objectives can measure skills more precisely, but are more difficult to relate to age or grade level groups. The Reading Comprehension/Written Language objectives and the Reading/Decoding objectives that these students worked on come from the *Corrective Reading Program* by Engelmann and others. This program has two tracks, one for decoding skills and the other for reading comprehension and written language skills. These programs, plus the corrective spelling and math programs from the same author comprised most of the curriculum for this class.

To summarize the curriculum levels achieved in the class, all six students mastered the Reading Comprehension/Written Language objectives of Comprehension B. Two students completed Level B Decoding skills, which represents a two year advance. Another completed this same level and about 15% of Level C Decoding Skills. Two students completed all of Level C Decoding Skills, and one completed 80% of this same level. Level C Decoding Skills also represents at least two grade levels.

In Math the progress in curriculum skills was more mixed. Three students completed long division, word problems with the basic four operations and about 75% of fraction and decimal computation skills. One student accomplished the same skills with the addition of closer to 90% of fraction, decimal and percentage skills; and two students accomplished about 95% of all of the skills, but did not start as low as beginning division skills at the beginning of the year.

The results shown in Table 1 give strong support to the effectiveness of Direct Instruction programs.

Table 1. Results for Six LD Children

A. Test of Language Development (TOLD—Intermediate)
(Mean = 100, standard deviation = 15, N = 6.)

Scale	Fall 1984	June 1985	Gain
Overall	83.4	103.2	19.8
Listening	91.6	101.4	9.8
Speaking	79.0	105.0	26.0
Semantics	82.6	91.4	8.8
Syntax	84.8	111.6	26.8

B. Test of Reading Comprehension (TORC).
Quotient score has a mean of 100 and a standard deviation of 10. Subscale scores have a mean of 10 and a standard deviation of 3
(N = 6).

Scale	Fall 1984	June 1985	Gain
Comprehension Quotient	83.5	98.8	15.3
Vocabulary*	7.5	8.0	.5
Syntax	7.3	9.8	2.5
Paragraph	7.8	9.7	1.9
Sequence	7.3	10.0	2.7

*Student D was given the Vocabulary Comprehension test orally in the Fall and through reading in June.

C. Test of Written Language (TOWL)
(Mean = 100, standard deviation = 15, N = 5)

Scale	Fall 1984	June 1985	Gain
Overall	81.6	95.4	13.8

D. Sequential Test of Educational Progress (STEP) grade equivalent scores.

Scale	Fall 1984	June 1985	Gain	N
Reading (silent)	4.17	6.77	2.60	6
Vocabulary	3.50	5.92	2.42	4
Written Language	3.44	5.90	2.46	5
Math Computation	3.63	6.17	2.54	3

E. Woodcock—Johnson Psycho-Educational Battery grade equivalent scores
(N = 4).

Scale	Fall 1984	June 1985	Gain
Reading Cluster	5.08*	7.00	1.92
Written Language	4.87	6.52	1.65

*One student was not pretested until late November.

F. Wide Range Achievement Test (WRAT) grade equivalent scores.

Scale	Fall 1984	June 1985	Gain	N
Word Recognition	5.15	6.88	1.73	6
Spelling	4.28	5.80	1.52	4
Math computation	4.30	6.33	2.03	3

tion or approximately 26 minutes per word. This amount of time is considerably more than that typically devoted exclusively to vocabulary instruction in the middle grades (Durkin, 1979; Roser & Juel, 1981). Computer assisted instruction, it would appear, offers the advantage of increasing instructional time on such a basic task without placing increased demands on a teacher's already limited time.

The purpose of this study was to compare two methods of computer assisted instruction (CAI) for teaching vocabulary to mildly handicapped adolescents. The study examined the effect of size of the daily teaching sets and provisions for daily and cumulative review on the acquisition and maintenance of word meaning. Two CAI vocabulary programs were used to present the same 50 words and definitions.

Two designs were used in this study—a time to mastery (Will there be a significant difference between times required to meet mastery criterion on the 50 words by students taught with the two different CAI programs?) and fixed design, in which all subjects were tested after the seventh session. We also looked at differences between pretest and posttest scores as well as maintenance of effects two weeks after students achieved mastery.

Method

Twenty-four students were randomly assigned to one of the two CAI programs. Students worked individually on their assigned program 20 minutes a day for 11 days. All of the words, which were the same for both programs, were considered important by two or more special education teachers. A final list composed of 25 verbs and 25 adjectives was used.

The CAI programs. One program used in the study, the Small Teaching Set program, tests students on words and then creates lessons with the words they cannot identify (Carnine, Rankin, & Granzin, 1984). After testing the students on new words, the program provides instruction on a "teaching set" of no more than three words which the student missed on the test. Each lesson also includes a "practice set" with a maximum of seven words. The student must meet a specific mastery criterion on each word before it is removed from the practice set. The program tests the student on new words and adds words the student does not know to the practice set. Once the student has mastered ten words, the program presents a cumulative review lesson on those words.

The other program, the Large Teaching Set program, teaches words in sets of 25 words (Davidson & Eckert, 1983). The student may choose to see the words in any of four types of formats: (1) a teaching display which shows the word, its definition, and one example sentence; (2) a multiple choice quiz format; (3) an exercise in which a definition is displayed and the student must spell the correct missing word to complete a sentence; and (4) an arcade-type game in which the student matches words to their definitions.

Measures. A 50 item, multiple choice test was developed for the study (.79 coefficient alpha). This test was administered to all subjects as a pretest, as a criterion reference test at the end of seven sessions, immediately after mastery (or at the end of the eleventh session), and two weeks after mastery. There were also two transfer measures. One was a 10 item objective test in which students defined words orally. The other test required students to answer comprehension questions that require knowing the meaning of words in several short passages.

Results

Eight of the 12 subjects (67%) in the Large Teaching Set program and 10 of the 12 subjects (83%) in the Small Teaching Set program met mastery criterion by the end of 11 sessions. The study was terminated after 11 sessions because the experimenter felt that the subjects who were still struggling to reach mastery were no longer benefiting from instruction. The mean number of sessions to mastery (for those who reached mastery) was 7.6 for those in the Small Teaching Set and 9.1 in the Large Teaching Set program. A *t*-test indicated this difference was significant (p less than .05). Hence, subjects in the Small Teaching Set program met mastery in significantly less time.

A 2 x 2 analysis of variance was performed on posttest and maintenance test scores, indicating no significant main effect for type of instruction. Results on the multiple choice test in the fixed-time design (i.e., the test administered to all students after seven sessions) indicates a slight, but nonsignificant difference in means favoring subjects in the Large Teaching Set program. Differences between scores on two transfer measures were also statistically nonsignificant.

Discussion

The unequivocal finding of the study was that the subjects taught with the Small Teaching Set program reached mastery criterion on the set of 50 words faster than subjects with the Large Teaching Set program. In addition, more students in the Small Teaching Set program reached mastery within 11 lessons. Given that the groups achieved equivalent levels of performance on the multiple-choice tests, their difference in acquisition rates becomes even more meaningful. Subjects taught with the Small Teaching Set program required less time to meet mastery criterion on the words, yet their posttest performance was equal to that of subjects in the other treatment who took longer reaching mastery. In addition, the shorter instructional time which the Smaller Teaching Set program subjects required did not negatively affect their retention of word meanings.

Math Word Problems: Explicit Strategies

Research into mathematical problem solving has been extensive. For example, Gorman (1968) identified 293 studies on word problems conducted between 1925 and 1965. In recent years, problem solving has been the subject of more research than any other topic in the mathematics curriculum (Lester, 1980). Yet the large number of studies has yielded little information for building effective interventions because of flaws in research design (Kilpatrick, 1978), vague descriptions of the experimental procedures (Silbert, Carnine, & Stein, 1981), and varying definitions of problem solving and the tasks to measure problem solving ability (Silver & Thompson, 1984). The success of further problem solving research depends on less on a continued analysis of the learner and his or her deficiencies and more on: (1) an analysis of the limits of instruction the students are currently receiving, and (2) development of strategies that will work with low achieving students.

We investigated math word problems in order to determine whether handicapped students could learn to solve multiplication and division math story problems if taught a strategy that focused on how to choose the correct operation. It was hypothesized that students who received explicit instruction on choosing the operation would solve more problems correctly than students who received instruction that did not specifically focus on the choice of operation and concentrated, instead, on a more general strategy of manipulating units.

Method

A pretest-posttest design with random assignment of subjects to treatment groups was used to examine the effectiveness of two procedures for teaching mildly handicapped students to solve math word problems through computer assisted instruction. Twenty-six subjects were randomly assigned to two groups. The first group used a Direct Instruction math story problems program and the second used a highly regarded commercial program. Each subject worked at a computer for 15 to 30 minutes a day for 11 days.

The CAI Programs. The Direct Instruction program, Analyzing Word Problems, (Carnine, Hall, & Hall, 1983) was based on principles of a theory of instruction articulated by Engelmann and Carnine (1982). The approach requires direct teaching of a clearly-specified step-by-step strategy. When a teacher is instructing the students, the teacher models each step in the process, heavily prompting the students as they continue to use the process, and then systematically fading the prompts until the students reach independence. When students made errors, the teacher again modeled or provided a prompt based on a previously taught rule. This style of strategy instruction was incorporated into the Analyzing Word Problems program. The program taught students how to solve multiplication and division word problems in a step-by-step fashion. When students erred, they were given a rule-based correction.

The Semantic Calculator (Sunburst Communications, 1983) was used as a contrast to the DI program. This program is based on the premise that the major difficulty in solving word problems comes from inappropriate manipulation of units (e.g., weeks, apples, dollars, etc.). If students could be taught to extract from the problem the quantities needed to solve the problem and the correct units for the answer, they would be able to solve the problem. In this program, students were guided through story problems by answering "How many?" and "What?" questions about word problems that were written on worksheets. Next, the students used the letters A and B to type in the operation that should be performed on the numbers (i.e., "A/B" to divide and "A x B" to multiply) and predicted the units in the answer. The computer then told the student what units were used to express the answer to the problem. If the student answer did not match that of the computer's, the student knew that he or she should go back and try again.

Measures. Both the pretest and posttest were 28-item tests comprised of 11 multiplication, 10 division, 2 addition, and 5 subtraction problems. All items were selected from three major arithmetic intermediate level textbooks and from the California Achievement Test. Sixty-eight percent of the problems on the test were like ones included in the instructional lessons; the remaining 32% were transfer problems.

Results

Results indicated no significant differences between performance of the Direct Instruction group and the Semantic Calculator group on the posttest and in the amount of time used to take the posttest. Interviews with students as they performed problems (i.e., choosing the correct operation and telling a reason for the choice) did yield a statistically significant difference between the groups favoring the Direct Instruction group, but the mean performance levels for both were not educationally significant.

Discussion

There are many possible reasons why there were no significant differences between groups. Eleven days at 25 minutes a day may have been too short of an intervention. With a longer treatment period, it would have been more certain that an unacceptable level of performance was attributable to other factors. Further, observations of student performance during the study indicated that many students typically ignored prompts on the screen that told them what to do next. Hence, through a failure to attend the students were missing opportunities to learn from their errors.

It is also conceivable that mildly handicapped students may need more teacher-directed instruction before using a computer for additional practice opportunities. The presentation of the problem solving strategy on the computer lacked the subtlety and flexibility that a teacher adds to instruction. Good teachers gather a considerable amount of information about how students are learning a new skill—particularly one as difficult as problem solving—and modify their teaching accordingly. Therefore, the most appropriate use of a computer for students such as these may be for guided practice (i.e., as a medium for reviewing material that is already familiar to the students).

Reasoning Skills: Correction Prodedures

Much of the recent literature on improving special education teaching practices has stressed the importance of providing academic feedback to students when they make errors (Carnine, 1980; Reith, Polsgrove & Semmel, 1981; Stevens & Rosenshine, 1981). Furthermore, a recent meta-analysis of the limited research on corrective feedback by Lysakowski and Walberg (1981) suggests that detailed corrective feedback is superior to merely telling students whether their answers are right or wrong. Just telling students they are wrong (called a "basic correction") does

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not help them solve the problem correctly. These authors suggest that students need to see an overt model of all the steps necessary for an appropriate response. By observing a model of all the steps necessary in obtaining a correct response, students receive detailed information on how to solve the problem. This procedural knowledge should be of use when they encounter similar types of problems. This type of correction will be referred to as an "elaborated correction."

The primary intent of this study was to examine whether remedial and mildly handicapped students who receive elaborated correction procedures would perform significantly better than students provided with basic corrections. We also examined any differences regarding acquisition time between students.

Method

Thirty-four students were randomly assigned to the Basic Correction or Elaborated Correction group. The Elaborated Correction group used an unaltered copy of the CAI program used in the study. The Basic Correction group used a modified version of the program. If a student in this group made an error, they were only given the correct answer. This was the only difference between the two conditions. In both conditions, students worked individually on a microcomputer. Students worked on their respective version of the program until they completed five lessons.

The CAI program. The Reasoning Skills program (Engelmann, Carnine & Collins, 1983) was designed to teach students two major objectives: (1) to draw conclusions from two statements of evidence, and (2) to determine whether a three-statement argument was logical or illogical. The program taught students about overlapping classes and non-overlapping classes. They learned that there are three possible key words (some, all, no); the same rule holds for all three. It also taught students relevant rules for constructing and analyzing arguments. The other major objective of the program was to teach students to identify unsound arguments. For logically unsound arguments, students were taught to specify one of three reasons why an argument was unsound.

Measures. The Test of Formal Logic (Collins, 1984) was the primary dependent measure in the study. The purpose of this test was to measure a student's ability to construct and analyze syllogistic arguments. Two alternative forms of the test were designed; Form A was used as the pretest and maintenance measure (given two weeks after treatment terminated) and Form B was used as the posttest measure (given immediately after the treatment). The internal consistency reliability (coefficient alpha) for Form A was .90 and for Form B .90. Parallel form reliability between Forms A and B was .84.

There was also a 15 item transfer test that evaluated subjects' abilities to generalize what they had learned on the computer to similar analytic tasks, but in prose paragraph form. The transfer test was devoted to the most difficult objective on the program—deciding whether arguments were sound, and, if not sound, giving a reason. This test was given to subjects on the day affer they completed training on the CAI program.

Results

A 2 x 3 analysis of variance (ANOVA) with one between subjects factor (Type of Correction) and one within subjects factor (Time of Test) was performed on the data. This analysis involved a planned comparison that looked at the post and maintenance tests only. The ANOVA indicated a significant difference favoring the Elaborated Corrections group (p less than .001). There was also a significant difference between the two groups on the transfer test, again favoring the Elaborated Correction group (p less than .05).

Data were collected on the time students took to complete each of the five lessons. The purpose of this analysis was to see whether students in the Elaborated Corrections group took more time to complete the lessons. A 2 x 5 analysis of variance (ANOVA) with repeated measures was performed on the time-per-lesson data and a nonsignificant difference between groups was found.

Discussion

This study was the first to explore experimentally the effectiveness of elaborated corrective feedback in teaching a complex cognitive skill to handicapped learners. The results indicate this is an effective instructional procedure.

The roughly equivalent time for the two groups to complete the five lessons seems anomalous at first. With more text to read in elaborated corrections, that treatment would seemingly take longer to complete the lessons. Completion times were not significantly greater for the elaborated corrections group, however. The extra time required to read the elaborated corrections may have been compensated for by faster acquisition of the material. In both versions of the program, the computer would return a student to items that were missed earlier in a lesson. If elaborated corrections resulted in fewer mistakes, students would spend less time returning to missed items. This interpretation suggests that taking more time early in a complex instructional sequence to offer elaborated corrections may, in fact, lead to savings in instructional time later in a program.

Both the basic and elaborated correction groups improved their reasoning skills as measured by the dependent variable. The groups demonstrated a mean score of 68-70% on the posttest (a dramatic gain from the mean scores of 26 to 34 percent on the pretest). The systematic design of instruction—particularly through a series of carefully controlled rules—may have contributed to this gain. Reasoning skills were acquired without any instruction from the teacher. Typically, CAI programs merely provide drill and practice exercises to supplement teacher instruction. Here the program was a true tutorial and did all the instructing.

Health Ways: Problem Solving Skills

Secondary students spend a considerable amount of their time completing application-oriented activities. These academic tasks often involve higher-order cognitive skills, and students are asked to make a variety of inferences about a subject area by prudently using facts, concepts, and strategies or problem solving skills. Some writers (Doob, 1972; Greenblat & Duke, 1975; Budoff, Thormann & Gras, 1984) have suggested that one way to enhance the higher-order skills of students is through educational simulations.

While much of the research has concluded that simulations are no more effective than conventional instruction, many of these studies have been plagued by fundamental weaknesses in research design (Fletcher, 1971; Pierfy, 1977). In the study below, we addressed many of these problems and created an instrument that reflected the problem solving skills actually taught in the simulation. Finally, we have addressed a curious feature of previous simulation research: the general reluctance to combine simulation instruction with conventional instruction.

In virtually all previous studies, simulations have been contrasted with conventional teaching methods. Only on a few occasions have simulations and conventional instruction been compared to conventional instruction alone. Nor is it clear in most of these studies what constitutes conventional instruction. One of our interests in studying simulations was to investigate how effective instructional practices could be used to enhance—rather than replace—secondary level instruction, not only in terms of their effect on basic fact and concept retention, but as they related to higher-order skills.

Method

Thirty students were randomly assigned to either the conventional or simulation condition. All students were instructed for 40 minutes per day for 12 days. The lesson consisted of two parts. The first part, called *structured teaching*, was identical for subjects in both student conditions. Instruction was conducted in a large group of 12 to 15 students for this part of each lesson.

At the end of the initial instruction, students separated into two groups—one which worked on application activities (the conventional group) and the other with the computer simulation (the simulation group). The conventional group worked in the resource room under the supervision of the resource room teacher, who presented these students with a variety of application or review activites.

Simulation students, on the other hand, were taught in a computer lab, each student working individually at a microcomputer. The 12-day course of instruction for these students was broken into three phases: initial modeling (3 days), guided practice on three simulation games (2 days), and independent practice with individual feedback from the instructor (7 days).

The CAI program. Health Ways is a commercial software program developed by Carnine, Lang, and Wong for the Apple II and IBM PCjr computers. The *Health Ways Supplementary Curriculum*, an accompanying written curriculum developed by Woodward and Gurney, extended information presented in *Health Ways* and the original *Health Ways* teachers' guide. Material was taken directly from two widely used junior high school health textbooks. All of the information was rewritten to control for vocabulary and amount of new information. Clippings from newspapers, news magazines, journal articles, and health pamphlets were also used in this supplementary curriculum. The reading level of the curriculum is approximately sixth grade.

Measures. Students were assessed one day, two days, and two weeks following the instruction. On the first day, student's acquisition of basic facts and concepts about health taught in the curriculum was measured by the Health Ways Nutrition and Disease Test. The first 20 questions of this test were solely from the written curriculum. The remaining 10 were questions over material that appears in both the written curriculum and the *Health Ways* simulation. Internal consistency reliability (coefficient alpha) of this measure is .84. On the second day, the students were given the Health Ways Diagnosis Test, an individually administered test measuring prioritizing skills. This test was a set of three written profiles and measured health related problem solving skills (i.e., the student's ability to detect important health problems facing an individual, identify and change related health habits, and control stress as it increased due to the health changes). The Health Ways Diagnosis Test has a test-retest reliability of .81. Two weeks after the instruction the students were again given the Health Ways Nutrition and Disease Test. This served as a retention measure.

Results

The data were analyzed in two parts. Major analyses involved a comparison of scores on the two measures for the handicapped students. Because the Health Ways Nutrition and Disease Test was used in both the posttest and maintenance (retention) phases, a 2 x 2 analysis of variance (ANOVA) was used. Secondary analyses involved comparing the performance of the handicapped students in the experiment was also compared to that of a random selection on non-handicapped peers who were in health classes.

Subscales analyses. The 30 item test was broken into two subscales: (1) items reinforced by the *Health Ways* simulation, and (2) items taught in the curriculum and not reinforced by the simulation. Separate 2 x 2 ANOVAs with repeated measures were performed on each subscale. The effect on items reinforced by *Health Ways* was significant (p less than .01). For those items not reinforced the comparison was not significant (p less than .06). This indicates that the simulation was an effective vehicle for reviewing material that had already been taught in the written curriculum.

T-tests performed on the Diagnosis Test demonstrate a significant difference between the two groups (p less than .001) in problem solving skills. Simulation students were better able to diagnose health problems, prioritize them as to their effects on an individual's longevity, and prescribe appropriate remedies.

In a supplemental analysis, a one-way analysis of variance (ANOVA) was used to compare the test performance of the conventional and simulation groups with students from regular health classes who did not particiapte in the study. The purpose of this quasi-experimental

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Using DI to Teach Self-Monitoring Skills

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Teachers, researchers and other educators are becoming increasingly concerned about the fact that teaching new behaviors does not commonly result in their generalized use outside of the teaching setting (Carr, 1981; Koegel, Rincover & Egel, 1982; Mowrer, 1971; Sommers, 1962; Stokes & Baer, 1977). One avenue of research that seems especially promising for remediating this problem focuses on the use of self-monitoring procedures to increase generalized use of a behavior across both settings and time (O'Leary & Dubey, 1979; Rosenbaum & Drabman, 1979). Paralleling this research, have been major developments in the Direct Instruction Model for teaching a wide variety of populations (cf. Becker, in press; Becker & Carnine, 1980; Engelmann & Colvin, 1983; Rose & Horner, 1982). The purpose of this article is to discuss the generality of the Direct Instruction Model for teaching severely handicapped children to monitor their own behavior in nontreatment settings (cf., Anderson-Inman, Paine, & Deutchman, 1985), to promote a widespread generalized use of target behaviors. That is, instead of using Direct Instruction to teach the target behavior directly, the use of Direct Instruction also can be utilized to teach self-monitoring in order to broaden the number of settings where the target behaviors will occur and to increase the maintenance of these behaviors over time. First, this article will discuss several principles and procedures for teaching self-monitoring activities in the classroom, and then will give examples of some self-monitoring programs that have been effective with severely handicapped students in the public schools. These programs are a direct outgrowth of our previously published work on self-monitoring with speech impaired children (Koegel & Koegel, 1984; and Koegel, Koegel, & Ingham, 1986), but now reflect an extension of the procedures for use with severely handicapped students.

The general principles of teaching self-monitoring activities through Direct Instruction follow.

A. Definitions:
1. Specify the characteristics of the training and generalization settings.
2. Observe the client's behavior and operationally define the inappropriate and appropriate (target) behaviors.
3. Determine a behavioral unit small enough for the client to attain immediate reinforcement.
4. Define functional reinforcers.
5. Define a gradual stepwise increase in the behavioral unit until it achieves the ultimate behavioral objective.

B. Training the Self-Monitoring Behavior in One Setting:
6. Prompt the client to engage in and identify both sets of appropriate and inappropriate behaviors.
7. Teach the client to record (on a counter or piece of paper) occurrences of the first behavioral unit of the target behavior.
8. Provide larger units of reinforcers for accurate monitoring of appropriate behaviors(s) than for monitoring inappropriate behavior(s). For example, provide 2 points for validly self-monitoring appropriate behavior, and one point for validly self-monitoring inappropriate behavior.
9. Set a criterion level in the clinic that is high enough so that the client will be able to readily and successfully perform the behavior in the natural environment during the subsequent treatment steps.

C. Self-Monitoring in Natural Settings:
10. If no appropriate behaviors occur in the natural environment, then determine a method for prompting their occurrence.
11. Define a reinforcement schedule, whereby reinforcers can be earned when the client turns in the self-recordings of the occurrences of the target behavior.
12. Determine a method of validating the client's self-monitoring in non-training settings.

The above steps are divided into three areas. The purpose of the first area, preparation, is to define the instructional universe. In the case of many target behaviors, such as the ones we will discuss below, the instructional universe is so large that we ultimately want the target behavior to occur in all settings. Therefore, the use of self-monitoring as a mediating event is especially useful since it ultimately serves to promote the occurrence of the target behavior in all of the clients' settings. The purpose of the second area listed above, pre-training, is to teach one instance of the self-monitoring behavior. Finally, the purpose of the last area, self-monitoring in natural environments, is to sample the range of other instances when the behavior will be required. The following examples illustrate the application of the above principles in public school programs for multiply handicapped students.

The first example concerned a 12-yr. old moderately autistic boy who was also legally blind and legally deaf, but was assisted with hearing aids and glasses. He attended a special education class in the public schools. Among his many deviant behaviors, the problem of hygiene stood out because it interfered with his access to many educational settings and activities. The special education staff had met with his parents on numerous occasions to discuss this problem, but unfortunately his parents found it difficult to collaborate in remediating the hygiene problems. Both parents left for work very early in the morning (prior to his waking) and were unable to supervise him. As a result, his poor hygiene was so severe that on some days his teachers were unable to work with him because of interfering odors and appearance. The problem had existed for several years without improvement, and it required remediation in a home environment without adult supervision. Therefore, the Special Education staff

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comparison was to extend the posttest analysis to students of a comparable age group who were also receiving health instruction. Again, scores from each section of the Health Ways Nutrition and Disease Test and the Health Ways Diagnosis Test were analyzed.

Total score on the Diagnosis Test showed significant differences between the groups (p less than .001). A Tukey post-hoc comparison indicated significant differences between the handicapped simulation students and those in the regular classroom (p less than .01) as well as a significant difference between the regular classroom students and the mildly handicapped students in the conventional group (p less than .01).

A significant difference also appeared between the groups on the reinforced subscale of the Nutrition and Disease Test (p less than .01). Tukey post-hoc comparison showed a significant difference between the mildly handicapped simulation group and the two other groups (p less than .05), favoring the handicapped students taught by *Health Ways*, but no difference on items not reinforced.

Discussion

The results of this study support the use of computer simulations in teaching material not easily taught by traditional means. Further, a structured approach in simulations, one where outcomes are specified and controlled, does produce significant educational results.

We infer from the results that the explicit strategy instruction used to teach the simulation students about *Health Ways* was a successful bridge to "less" direct instruction activities. Further, the superior performance by those in the simulation group over non-handicapped students from regular health classes shows that explicit strategies instruction is successful in teaching unstructured academic tasks that involve higher level knowledge structures or strategies. The two non-handicapped students who had the highest scores on the Diagnosis Test articulated a prioritizing strategy comparable to that given by several of the handicapped students. Thus, many of the handicapped students in the simulation group showed a conscious awareness of the strategies that they were using, as did the two non-handicapped students, who may have achieved their awareness in a more intuitive manner.

Conclusion

The results of these four studies indicate that properly designed CAI can be effective as an instructional medium. These findings are consistent with our non-computer research that we have conducted over the last 15 years. Using sophisticated, empirically-based design principles can make a considerable difference in the effectiveness of any instructional program. Yet another outcome of these studies is that they begin to identify—with much greater clarity—the role of the teacher and his/her instruction independently from the computer. This perspective deviates from original questions about computer assisted instruction (e.g., Is CAI more effective or efficient than conventional instruction?). It forces us to look closely at the intersection of the teacher, the academic task, and the stage of instruction.

The Vocabulary Instruction study, for example, demonstrates that a skill requiring considerable practice can be adequately taught on a computer. Such a task is time consuming for a teacher and can be handled effectively by a teacher. Furthermore, there is very little variation as it moves from one stage of instruction to the next (i.e., from introduction and teacher modeling, to guided practice, and independent practice). Note, however, that the task, as it was defined in the study, was one of memorizing vocabulary words. We did not teach nor assume that students would necessarily learn how to use the words expressively or detect their meaning from context. This would have required a different analysis.

The Reasoning Skills program, a teacher independent tutorial, was successful at teaching a more complicated academic task: logical inferences. It might be argued that the particular academic skills taught in this program were more discrete than, say, math word problems or the subtle problem solving skills addressed in the Health Ways study. If this observation is correct, then computer assisted instruction—carefully developed with instructional design principles and field tested—can be an effective, "stand alone" form of instruction.

Math Word Problems, on the other hand, do not share the same task complexity as the syllogisms. In this study, we found that the best way to teach skills such as math word problems, notoriously difficult for mildly handicapped students, may be through teacher directed instruction first, with the computer used for guided practice. This conclusion is tentative, and we will conduct another study after we revise our strategy.

Finally, the Health Ways study strongly suggests that facts and concepts, which were preskills to the problem solving activities, can be efficiently taught in group instruction without computers. The computer can be an effective tool after the preskills have been introduced and explicit strategies for using the simulation have been taught by the teacher. In this sense, a complex task like problem solving can be effectively taught in the guided and independent practice phases of instruction. Thus, the best use of computer assisted instruction requires a careful look at the academic task, the stage of instruction, and the appropriate role of the teacher.

(For References, write Wes Becker, ADI News.)

Self-Monitoring Continued from Page 13

decided to utilize Direct Instruction to teach the client to use a self-monitoring program to evaluate and monitor his own hygiene under the relevant stimulus conditions where the problems were occurring. The entire treatment program was implemented by an undergraduate student from the University of California at Santa Barbara who had successfully completed classes in behavior modification and autism. She was directly supervised by the school district's speech and language specialist (LKK).

The first step of the treatment program was to specify the characteristics of the training and generalization settings. Hygiene, the problematic behavior in this first example, required remediation under relatively narrow stimulus conditions. Specifically, the client did not clean or groom himself in the mornings when he was at home or at his grandmother's house. The training environment was a treatment room at the client's public school that contained a small sink and a mirror, as well as a table and chairs.

The next step (step 2) was to observe the client and define his inappropriate behaviors in the target (generalization) settings. In this particular client's case poor hygiene was defined as any of the following behaviors occurring after the child awakened, and before he left for school in the morning:

1. dirty face (actual dirt on fact)
2. dirty glasses (spots and film on glasses)
3. dirty shirt—client wears the same unwashed shirt daily
4. dirty pants—client wears the same unwashed pants daily
5. dirty socks—client wears the same unwashed socks daily
6. bad breath and dirty teeth—client does not properly clean teeth
7. odors—client does not properly take a shower or wear deodorant

It was also necessary to determine the appropriate behaviors which should substitute for the inappropriate behaviors. In order to keep the initial behavioral unit small (step 3), we decided to work on one behavior at a time, until the entire list of problems had been remedied (step 5). The first behavior, clean face, was selected because it could be easily observed and trained in the school setting. The child selected his own reinforcer which was earning points to go to the beach with the clinician after school (step 4). At this point, the preparation for teaching the general behavior of self-monitoring of hygiene skills that would need to occur while the client was in the unsupervised morning settings was complete.

Next we were ready to train a single instance of the target behavior, self-monitoring a clean face, in the treatment room at school. This began by teaching him the discrimination between a clean vs. a dirty face in the clinic (step 6 above). The clinician spent several days at school having the client look in the mirror and tell her if his face was clean or dirty and then having him wash his face then look in the mirror again and tell her if it was clean or dirty. Following each correct (clean) response the clinician had the child self-monitor the behavior by putting a check or plus in a small notebook which he carried with him (step 7). The check indicated that he had a clean face and correctly monitored his behavior and therefore he received a point. If the client's face was not clean and he recorded a check in his book or if his face was clean but he did not record a check, he would receive no points and would be verbally told why he would not receive a point. If his face was not clean and he did not record a point he would be verbally reinforced for accurate monitoring but would receive no point (step 8).

Once the client had reached a high level of success in the training environment (step 9), the client could begin self-monitoring his behavior in the natural settings. First, because the self-monitoring had not occurred in the home setting (although he was demonstrating a high level of success at school) the clinician accompanied the client to his home after school and prompted the client to perform the discrimination and monitoring process there (step 10). He was instructed to engage in the target behavior every morning after waking (i.e., wash face, look in mirror, evaluate and record if his face was clean). The points were continued as in the school setting. That is, if the client had a clean face and recorded a plus, he earned a point toward his beach trip (step 11). In order to verify the validity of his self-monitoring, the client was checked for a clean face and accurate monitoring each morning when he arrived at school on the bus (step 12). If his face was clean (and recorded as being clean) *and* the teacher agreed that it was clean, she verbally reinforced him (e.g., "good job washing your face, it looks very clean"), and rewarded him with a point (step 11).

When the client reached a high level of success with the first behavior (i.e., four consecutive correct days) a second target behavior was added. Then, earning a point was contingent upon correct performance of both behaviors and so on until all of the target behaviors were successfully learned. Self-monitoring of the second and subsequent target behaviors only required training in the school environment, without prompting in other settings. That is, generalization of the appropriate hygiene behavior began to occur in all of the target settings (school, home, and grandmother's house) without further intervention.

The above example illustrates the application of Direct Instruction to teach self-monitoring under relatively restricted stimulus conditions (home, grandmother's house, and school). The next example illustrates how such procedures can be expanded into much broader settings. This example concerned an 8-yr. old boy who suffered a stroke that resulted in brain damage, especially in the areas of language and reading. He was placed in a special education class in the public schools and was mainstreamed for math (which was relatively unimpaired), physical education, and art. During a parent conference his mainstream teacher stated that he had made absolutely no progress as a result of his extreme level of disruptive behavior. Several of his other teachers also discussed his behavior problems. Because so many different settings were involved, it was decided that the speech and language specialist would use Direct Instruction to teach the child a self-monitoring activity in an attempt to improve his behavior across all of his varied settings. First, in defining the training and generalization settings (step 1) it was decided that training would be done in a single setting (the speech/language specialist's room). Then, in addition to self-monitoring his own behavior in the speech/language specialist's room, self-monitoring also would be expected to occur in his special education classroom, his mainstream classroom, and in an office with the school psychologist during counseling. Beyond these particular school environments, we also wanted his behavior to generalize to virtually an infinite possibility of other settings where disruptive behavior would be considered inappropriate. At the staff meeting, the following list was compiled of his inappropriate behaviors in the educational settings listed above (step 2):

1. burping
2. out of seat
2. perseverant tattling on other children
2. falling out of chair
2. verbally refusing to do school work
2. knocking papers off desk
2. talking out loud at inappropriate times
2. making loud noises

The Speech-Language specialist met with the client and it was determined that after approximately each 10 minutes (step 3) he would earn points to exchange for "smelly stickers" and small "transformer" toys (step 4).

After the above preparation, training of the use of self-monitoring in a single instance (the clinician's office) could occur. The clinician read him the list of inappropriate behaviors which had been previously defined and then demonstrated the corresponding appropriate behaviors for each problem area. This consisted of demonstrating the correct way to follow directions, going quickly and quietly to his seat, and working quietly. Next, he had to practice both the inappropriate and appropriate behaviors (step 6) and was taught to mark a happy face on his data sheet (see Figure 1) if he exhibited appropriate behavior, and a sad face if he exhibited inappropriate behavior (step 7). The point system was then explained to him (step 8): (1) if he accurately monitored, he would be given a point; (2) if he accurately monitored and demonstrated good behavior he would earn 2 points; (3) if he did not monitor, or was not accurate in his monitoring, he would receive no points. In the training setting, the client practiced his target behavior using the point system beginning with a short time period (10 minutes). The time period was gradually increased until the child demonstrated no inappropriate behaviors throughout the entire (½ hr.) speech/language period for several consecutive sessions. It was previously agreed upon that a half hour period was long enough that it would not disrupt the class when the client approached the teacher for the verification of his recordings, and short enough that he would be able to successfully perform the behavior in a sampling of his natural environments (step 9).

Then the client was told to monitor his behavior in his various classrooms throughout the day. In the client's natural environment, since it was important to maintain continuity of treatment across all of his environments (cf. Dunlap, Koegel, & Koegel, 1984), this program was coordinated among all of the people who interacted with the client (i.e., special education teacher, mainstream teacher, speech-language specialist and school psychologist). The client carried a single notebook with him and all of his teachers utilized the same point system.

All points were exchanged for reinforcers toys by the speech and language specialist (step 11).

For validity checks, the teacher independently recorded the same type of data the child was recording (i.e., a happy or sad face) on a separate piece of paper (step 12). Then the teacher transferred her data to the client's data sheet which he carried with him at all times. In order to be assured that the child maintained the accurate discrimination of the correct vs. incorrect behavior, the teacher briefly stated the reason for her recording after each validity check.

After the child was performing a high level of correct responses, the lines between the boxes on his data sheets were whited out so that he was required to ex-

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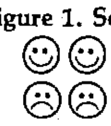
Figure 1. Self-Monitoring Record Sheet



= 1 point + bonus point (2 points)

= 1 point

Monday	8:15-9:35	9:35-10:00	10:15-10:55	10:55-11:15	12:05-12:25	12:25-1:10	1:10-1:30	1:30-1:50	1:50-3:00	Other	Dail Tota
Child's Name											
Teacher											
points											

Tuesday	8:15-9:35	9:35-10:00	10:15-10:55	10:55-11:15	12:05-12:25	12:25-1:10	1:10-1:30	1:30-1:50	1:50-3:00	Other	Dail Tota
Child's Name											
Teacher											
points											

WEEKLY TOTAL ____________

home school are appropriately utilized) then the student moves to a more restricted program such as a special class or a special school. If these alternate programs exist, then it is critical to provide this information to all parents rather than wait until their child is a candidate for a special program. If this information is not communicated, then it is likely that some parents will assume that their child will remain in the home school as his or her right under any circumstances. We suggest that this information be included in the discipline plan with a brief description of the alternate programs; or at least, have the information readily available should a particular student be likely to need an alternate program. In this communication it is better to stress the positive aspects of these programs, namely, that some students need more assistance or more structure than what can be provided in the home school; or stress that these alternate programs are designed for special needs rather than for punishment.

4. Development of a Parent Training System

Most of us accept that there are very few children who can function adequately at school when their home situation is in disarray. An effective school discipline plan needs to provide some systematic assistance to parents in the area of managing behavior. Some parents will say that they were never trained to be parents, others will say that school people are the experts who should tell us what to do while others will assert that what happens at school is school business and what happens at home is no business of the school. In any event, we recommend that a systematic plan be developed to assist parents in managing behavior.

The plan could consist of:

a. Communication of simple rules or techniques to help prevent behavior problems. The techniques could be listed in a booklet form or presented to parents in a workshop. The workshop approach, while ideal, does not usually bring in many parents unless considerable groundwork is undertaken (unfortunately the parents who generally come to these workshops are the ones who least need the information). The workshop could cover strategies to show parents how to:

- Display affection, approval, interest and love.
- Present themselves as good role models.
- Establish limits.
- Build self-esteem.
- Establish positive and negative consequences.
- Ensure family "space."
- Protect safety.
- Allow opportunities for success and failure under controlled conditions.
- Require responsibility and accountability for actions.
- Ensure family communication.

b. Utilization of district or community resources for the more dysfunctional families (family therapy, counseling, effective parenting, etc.)

5. Managing Parent Behavior

You can expect a wide range of responses from parents when you have to deal with the subject of discipline problems with their child. However, there are certain categories of parent behavior that can be identified. Once these categories are identified and recognized it is easier to deal with the parents and to respond to their concerns. The following categories of parent behavior are relatively common:

a. *Denial.* Some parents will not accept that their child is capable of behaving in the alleged manner. The denial is manifest in several ways such as wanting to blame someone else, trying to justify the behavior, establishing a sad story to explain why the child may have acted in such a way without full knowledge. With this kind of behavior it is best to fully document the child's infraction and to involve as many witnesses as possible. These parents will argue and it is usually pointless to argue back. Generally it is better to let the "data" do the talking and to maintain the position that the child needs help. In addition, it is helpful to make a distinction between explaining a behavior and excusing a behavior.

b. *Confrontation.* Some parents will take it personally when their child is in trouble. Their first response will be to attack the school and become personal. They will display anger towards the teacher or the supervising person and they will attack the principal. Their basic strategy is to shift the discussion from what the child did and try to force the principal (or teacher) to become defensive. It is best not to defend, rather to stay closely to what the child did. In addition, it is really important to stay calm. This is easier said than done when the parent's behavior has become escalated and abusive. If the parent becomes abusive we recommend that you shift the discussion to the parent's rights—tell them they can put their concern in writing or take their case to the superintendent. Giving choices to someone who is trying to corner you in a hostile manner is a powerful strategy for de-escalating the person and for shifting the focus of the discussion.

c. *Dysfunctional parents.* These parents may be involved with substance abuse, child abuse or in general, cannot function adequately as parents. While we would like to be able to change their behavior we realistically know that not much will be accomplished with either the parent or the child. Our most optimistic outcome in these situations is the hope that the child can learn to live in two worlds. Keep the rules at school and function on different rules or values at home. Clearly, if the situation is bad enough, we should refer the case to appropriate agencies and try to encourage the parents to seek help.

d. *Split homes.* Another difficult situation is the troubled child whose parents are separated or divorced. In many of these situations the parents are divided on how the child's problems should be handled. In some cases the agenda is not the child's problems, but the conflict between the two parents. It is imperative to know who has legal custody and to work with that parent. The other parent could be informed of what is being done, but would not necessarily have input or control (given there is conflict between the parents on the procedures for management of the child's behavior). The matter is more complex where joint custody is involved. In this situation it is best to work with the parent who has custody at the time the infraction occurred. The other parent would be informed, but would not necessarily be involved in the decisions.

e. *Tacit approval.* In this situation the parent is basically displaying approval of the child's behavior through comments such as : "I was like that as a child," "My whole family has a stubborn streak in them," "I have always told my son to stand up for his rights," etc. In these cases, it is best to keep close to the position that the behavior is not acceptable in the school. The issue is one of values and the best we can do is to say that these behaviors are not permitted by the school regulations. The stance is to present information that is not really negotiable.

f. *Cooperative parents.* A major problem in the school situation is that we spend a greater part of our time with troubled students. Consequently, it is very important that we make efforts to make adequate contact with students who keep the rules and behave appropriately. Similarly, we can spend most of our parent contacts with "troubled parents." In like manner, it is important to make contact with cooperative parents and to acknowledge their behavior.

6. Managing the Parent Conference

Some situations may just require a visit between the parent and the principal. Other situations may require a formal parent conference comprised of parents, principal, and involved staff members. There are a number of strategies that may prove useful in managing the parent conference:

a. Be sure to have adequate documentation on hand before the meeting is called.
b. Make certain that all involved people are at the meeting. Problems will arise if second/third hand information has to be used.
c. Maintain a focus on the child's behavior, what the child did and what action should be taken. Redirect discussion to this focus when other issues come up, such as, whose fault it was, what happened to the other students, etc.
d. Stay with what you know about the child. Do not get into other areas unless you have facts, such as attendance, grades slipping, etc.
e. Appoint someone to take adequate notes of the meeting.
f. Be ready to negotiate on the kind of consequence that will be administered, but do not negotiate on whether or not there will be a consequence.
g. Be prepared to establish meeting rules if the meeting starts to get out of hand, such as a number of people talking anxiously at once, or if the parent and an individual teacher start arguing. Simply direct all discussion through the principal.
h. Identify what will be done if the child's behavior occurs again.
i. Try to remain calm. Assume that the parent is upset and that if we can be effective in calming the parent then we are likely to provide help for the child.
j. Avoid platitudes such as "You can be sure we have the best interest of your child at heart," or "Schools are for children and everything will be done to ensure that your child will receive the best education possible." Parents would wonder why we need to make these statements, and if they feel their child is not being treated fairly, then these platitudes will come across as lies. Basically, our actions will communicate whether or not we have the best interests of the child at heart.
k. Be prepared to stop the meeting if hostilities get out of hand such as personal abuse, foul language, etc. In these situations either adjourn the meeting and ask everyone to put their concerns in writing or take charge of the meeting and establish clear rules of behavior. If it is anticipated that the meeting may get out of hand, it is useful to begin the meeting by informing participants that we hope the meeting can be productive and that people can talk. However, if things get out of hand then the meeting will have to be stopped and other avenues be used to address the problem.

Summary

We will be spending time with parents on the matter of school discipline whether we plan for it or not. We recommend that the parents be involved at all stages of the planning: design of the plan, implementation of the plan and revision of the plan. There is far more chance that the child's needs will be met if the plan is carefully communicated to the parents. However, even though parents are systematically involved in the plan and careful measures are taken to communicate the plan, some parents will still be difficult to work with. The behavior of these parents can often be categorized and specific techniques can be utilized to make the situation less stressful and more productive. In general, working with parents in the area of school discipline is basically a percentage game and our task is to try to maximize the percentage of success through developing a system that systematically involves the parent.

Self-Monitoring

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hibit appropriate behavior for longer time periods to earn points (steps 5, 8, and 11). Eventually he worked up to a whole day, and by the end of the school year he was required to demonstrate appropriate behavior for an entire week before he could earn his reward. Finally, his parents were trained to utilize the techniques in order to extend the procedures to improve his behavior at home. At present it appears that this sampling of natural environments was broad enough, so that his appropriate behaviors appear to be occurring and maintaining across all the environments the client is currently encountering.

(For References, write Wes Becker, ADI News.)

DISTAR and CTBS Results

By Shirley Sills
Oldham County, Kentucky

In the late Spring of 1980, the Oldham County Kentucky Chapter 1 Staff, both certified and classified, were introduced to a Direct Instruction program produced commercially as DISTAR. The total staff were impressed with the concepts presented in this program and requested additional inservice in the area of reading. The National Diffusion Network afforded inservice through the Dayton pilot project. Our local Board of Education entered into a participation agreement with the Dayton Direct Instruction Project and the National Diffusion project. As a result, representatives from the Dayton project were assigned to the Oldham County Board of Education for purposes of providing inservice and instructional support.

The program was offered for one year in the Chapter 1 remedial program. At the end of the year, the regular elementary teachers became very interested in the program because they began to see improved reading behavior of their students. They requested the same opportunities to use the program in their regular classrooms. With the assistance of the principal, we developed a program for low students in the regular first, second, and third grade. The Oldham County Board of Education was approached and the program approved. The staff was then trained in the DISTAR procedures.

The DISTAR program has been used for the lowest achieving students at Crestwood since 1982. Each year the staff at Crestwood, along with the Principal, Mr. Jacovino, petitions the board for continuation of this project.

The success and the results of the Crestwood project prompted the teachers at LaGrange to investigate the program, take inservice, and also request a project approval for their first graders. This was completed for the 1983-84 school year. They are now requesting the project for First and Second grade for the 1985-86 school year.

Direct Instruction, as presented in the DISTAR program incorporates most of the teaching concepts that research has identified as *EFFECTIVE*: Scripts, Group Instruction, Signals, Reinforcement, Training and Supervision. The following paragraphs expand on each of the effective teaching activities.

The use of *detailed lessons-scripts* may be initially thought to restrict teachers' initiative. However, the advantages of scripts in providing quality control in a delivery system outweigh any criticism. Scripts permit efficient learning if followed because the selection of sequence and examples are controlled. Most teachers simply do not have time to find appropriate words and examples or to sequence skills in an efficient manner. When teachers phrase their own questions, they often choose terms unknown to lower-performing children or they may insert unnecessary verbiage. Often, major skills are omitted.

Another advantage of scripts is their potential for teaching teachers about effective classroom instruction. Teachers can learn effective presentation strategies through repeated examples. Teachers often begin using *Direct-Instruction techniques in subjects where scripts are not available*. A positive advantage is also apparent during training and supervision. The precise skills needed to teach a particular skill or lesson can be specified when designing training programs. Supervisory staff can quickly determine what is happening and compare that information with what should be occurring. In this setting, the supervisor is better equipped to provide direct, practical demonstrations or suggestions to the teacher or aide. Standardization of the teaching program also makes it easier to monitor the progress of the children with criterion-referenced tests, since the on-going testing procedures indicate skill levels and concepts.

The use of rapid-paced, teacher-directed, *small-group instruction* has often been criticized as pushing or placing too much stress on young children. The data on affective outcomes, however, do not support this conclusion. The use of *small groups* has many advantages. It is more efficient than one-to-one instruction and provides better teacher-direction, supervision, and individualization than large-group instruction. It also emphasizes oral communication skills, which children from non-English and economically disadvantaged backgrounds often need. Finally, small-group instruction provides a setting in which the repetitious practice necessary for some important skills is made more fun by transforming drill into a challenging game. Children enjoy the rapid pacing when circumstances allow them to be successful.

Prepared scripts direct teachers on how and when to use signals to cue a group to respond together. For example, in sounding out a word, a finger is used to point to the letter being sounded out. The children say the sound as long as the teacher touches it. The teacher moves his or her finger from sound to sound as they are to be said and lifts the finger away at the end of the word. To coordinate counting-to-a-number, a foot tap or finger snap might be used as the signal. Often the signal simply involves dropping the hand which was raised to alert the children to "get ready" when a question was asked. Much training is required to learn how to use signals in a natural and clear manner.

Some educators have criticized choral response. They have suggested that it fosters an authoritarian role for the teacher. This logic would imply that using signals to direct such groups as choirs or orchestras also promotes submissiveness or authoritarian models. Our children's behavior in our classrooms does not support this interpretation. On the contrary, the evidence tends to suggest that without signals some children merely imitate a "leader" in the group rather than learn the task directly. The use of signals obviates this problem.

The use of signals, finally, has also been criticized as fostering rote learning. The persons drawing such conclusions, however, often overlook the long-term benefits of carefully sequenced teaching examples. The data on cognitive outcomes do not support the criticism of rote learning.

Some educators believe that children should learn for intrinsic rewards. When this does not happen, however, teachers need to know how to use methods that will lead to learning for its own sake. The model encourages the use of positive *reinforcement* as a means of strengthening motivation and making learning a positive activity. When children do not respond to games, praise, attention, or success, stronger reinforcers may be necessary. Point systems leading to special rewards are sometimes needed early in a program and are faded out when no longer needed. Principles and procedures which provide the basis for teacher training in this area are available for the beginning teacher. (See Becker, Engelmann, & Thomas *Teaching 1 Classroom Management*, SRA, 1975.)

A primary focus of *training* in this model, therefore, is developing the skills required to teach small groups. To get the most out of each child, teachers also learn procedures for grouping the children and for changing groups.

Children can succeed in school when teaching methods are appropriate and when these methods incorporate effective teaching techniques. What are the critical elements of these methods? The seven components of the Direct Instruction Model outlined earlier concentrate on changing administrator and supervisor behavior, teacher behavior, and academic programs. Each program involves the building-level administrator in their children's progress, and provides supervisors with the technical skills needed to help teachers foster learning. In view of these findings, a product-oriented management program and an enhanced teacher-support system appear to be requirements for improved teacher-directed teaching.

Recent research that relates to teacher behavior, and student achievement in reading and math, supports the use of specified behavioral goals in Direct Instruction Model. Research has found that when more time is devoted to teaching a subject area and when the teaching procedures are effective, student achievement is enhanced. By definition, this is "direct instruction". It involves teacher-directed oral activities in small groups centered on specific teacher questions, a high rate of student response, and adequate teacher feedback to students.

Programs that did poorly on achievement measures did not allocate as much time to teaching reading and math. A simple, logical conclusion follows: the learning of reading and math does not occur unless instructional time is provided, and the students are engaged during that time.

The Oldham County Kentucky Spring, 1985 CTBS test results produced some significant scores. The Direct Instruction program has been in operation at shcool #2 since 1982. The students who began that program are now going into the Fourth grade. The dramatic reduction of Crestwood students, through the Fourth grade, who fell below the 49th percentile in both reading and math are provided in Tables A and B. Since math scores show a similar reduction of students below the 49th percentile, it is possible that the successful teaching techniques learned in reading are being modeled and carried into the regular math program.

The results of the one year program at School 4 have not yet emerged. The program requires refinement in presentation and effective teaching techniques. In addition the students have not had an opportunity to catch up after being introduced to this base of knowledge during the one year that the teachers have been using the directed scripts.

In a recent article published by the United States Office of Education, the conclusions of the Commission on Reading were given. Effective teaching was characterized by a *simple* introduction to phonics during the First and Second grades. Providing students with an opportunity to *read aloud* was another strategy advocated by the commission as was the opportunity to read silently. Teacher's handling of errors and their correction when done positively and with dignity were stressed as effective and necessary for learning. The Commission criticized excessive workbook activities and excessive homework assignments and stressed writing activities. Writing supports and strengthens reading abilities.

Our DISTAR program incorporates all of these concepts and activities evaluated as effective. The percentage of students who fell below the 49th percentile at our Crestwood site is extremely low compared to other elementary campuses. Crestwood's population, as a single factor, does not account for this reduced percentage of students below the 49th percentile. Crestwood in its student and residential make-up has been most often identified with School 4, while School 3 has consistently reported higher achievement test scores. Although we cannot factor out all variables, we must attribute some of the results to our DISTAR program and the effective teaching techniques represented by the program.

Table A. 1985 CTBS Percentages of Students Scoring Below 49th Percentile
Reading

	School 1	School 2*	School 3	School 4	School 5
2nd Grade	16.44	9.22	21.1	29.73	34.57
3rd Grade	30.43	17.92	21.59	25.32	12.50
4th Grade	30.34	14.29	13.41	33.33	24.32
5th Grade	14.94	21.55	9.59	36.78	23.78

*Crestwood Elementary

Table B. 1985 CTBS Percentages of Students Scoring Below 49th Percentile
Math

	School 1	School 2*	School 3	School 4	School 5
2nd Grade	15.07	10.81	13.3	33.33	33.33
3rd Grade	16.30	7.55	10.00	12.66	12.50
4th Grade	31.46	5.19	18.29	15.94	24.32
5th Grade	17.24	19.83	6.85	32.18	30.51

*Crestwood Elementary