Non-Profit Organization
U.S. Postage Paid
Permit No. 122 – Eugene, OR

ADI NEWS

Volume 6, Number 2 | Association for Direct Instruction, P.O. Box 10252, Eugene, Oregon 97440 | Winter, 1987

Coaching Athletes

by Wes Becker

Some very exciting developments are taking place in the application of behavioral methods to coaching. A major summary of this work is provided in Martin and Hrycaiko (1983) who illustrate applications to football, golf, swimming, tennis, little league coaching, hockey, gymnastics, volleyball, basketball, karate, and cross country ski racing. In addition, they cover changing the coach's behavior, life-fitness programs, self-management, and mental preparation of the athlete using systematic relaxation training, imagery, and other cognitive-behavioral therapy procedures. In this article, I will summarize some of the ideas and research findings presented by Martin and Hrycaiko.

Steps for Effective Behavioral Coaching

According to Martin and Hrycaiko (1983), to be effective a behavioral coach needs to do the following:

1. *Specify performance objectives.* What do you expect of your athletes? (Sounds like the first step in effective planning for teaching, doesn't it?) For a competitive sport this might consist of requirements for practice and requirements for competition.

Expected behaviors at practice:
- Attend each session.
- Listen to instructions.
- Practice techniques as instructed.
- Apply good technique in endurance training.
- Keep your practice going (without stopping a lot).
- Practice as if in competition.
- Practice relaxation and imagery techniques (for use prior to competition.)

Expected behaviors at competition:
- Use relaxation and imagery to prepare.
- Work to show performance improvement.
- Support the team.
- Show good sportsmanship (shake hands with losers or winners, keep control, show respect for others, etc.)

In the area of skill training it is necessary to get more specific about exactly what is good execution and what is not. Game statistics do not tell you who has mastered what skills. You need to get specific enough to say whether any component of a complex behavior is adequate or not. Martin and Hyrcaiko illustrate this point with five pictures showing each phase of the backstroke. For each picture, there is a set of 2 to 5 actions to be checked. With a chart based on the checklist, the coach can rate a sequence of strokes during training and provide feedback to the swimmer. Koop and Martin (1983) evaluated the use of error analyses of this sort in coaching beginning swimmers in the three basic strokes. They found reductions in error rates from near 100% during baseline to under 10% with error feedback during the experimental condition.

2. *Learn to maintain as well as develop behavior.* Just because a coach gets some new behavior going, that does not mean that it will keep going on its own. Many coaches blame the kids for "dumb plays" because they think the kids had already learned it. One can do it right once without mastering it, however. Coaches are too quick to criticize when they should be teaching and using procedures to maintain behavior.

3. *Have athletes work against their personal best.* Having winning as a goal isn't always the best way to go. Athletes can't always control who will win, but they can work to improve their performances. By setting multiple goals and keeping data on them while working toward them, more successes will be experienced and athletes will have stronger motivation to practice.

4. *Base procedures on those demonstrated to be effective.* The effective coach doesn't fly by the seat of his or her pants. She or he uses the science of behavior and data on performance of team members to make decisions. For example, use clear instructions to get better stimulus control over the athlete's behavior. Don't just tell the backfield defense on a football team to "Watch the quarterback." Tell them what to watch. "Watch where he is looking. Watch for an arm cock. He has to look where he is going to throw and he can't throw until his arm is cocked." Explicit instructions that can be used to guide an athlete's behavior are important to effective coaching.

5. *Monitor your own performance as a coach.* Videotape your training session and review it. Develop a checklist to remind you of the critical things you need to do to train, motivate, and monitor the team. Are you giving positive feedback for improvement? Etc. Continued on Page 12

Coaching Teachers

by Ann Glang and Russell Gersten

The growing body of research on inservice training provides information regarding effective approaches to training teachers in new skills. Perhaps the most consistent finding is that a training program consisting of *lecture only* is not sufficient (Lawrence, 1974; Willis & Gueldenpfenning, 1981). The majority of training programs that attempt to train teachers in new skills employ one or more of the following components: (a) *Lecturing* on new procedures and providing a rationale; (b) *modeling* of new techniques, and (c) *roleplaying* new techniques and providing feedback. For example, some training programs have used lecture and practice (Beck & Roblee, 1982), some lecture and demonstration (Brand, 1977), and some lecture, demonstration, and practice (Symington, 1979). Each of these authors (like many others) reported that teachers who participated in the training programs demonstrated acquisition of new skills in the training setting.

In reality, the critical ingredients for a successful training program may have more to do with what happens once teachers are in the classroom than what the initial training procedures involve. Unless teachers receive some *follow-up training* once they are in the classroom they are unlikely to use the new skills they have learned (Fullan, 1983).

Some Research Findings on Coaching

In an extensive review of the teacher training literature, Joyce and Showers (1980) hypothesized that for teachers to actually use the skills they have learned, they must be coached by consultants, peers, or supervisors. Coaching involves in-classroom assistance in implementation of new skills and strategies. Coaches make on-going observations throughout the course of an inservice training program.

Joyce and Showers (1982) describe the coach's responsibilities as: (a) giving technical feedback, (b) analyzing when to apply a model and evaluating what its effects are, (c) adapting the model tostudent needs, and (d) providing companion-ship and support in implementing new strategies. Since their initial article on the potential benefits of coaching, Joyce and Showers, have studied the effects of coaching on teacher's ability to implement newly learned skills. (See also Baker, 1983; Copeland, 1977; Fitzpatrick, 1985; Sparks; 1983b.)

Showers (1983) trained 17 junior high teachers in three different teaching models (Joyce & Weil, 1980). All teachers received 21 hours of training that included four components: theory presentation, demonstrations of new strategies, practice with peers in a role play situation, and feedback. Following the initial training, teachers were randomly assigned to the coached or uncoached condition. Uncoached teachers were encouraged to implement the new strategies and were observed regularly. Coached teachers were observed by an outside consultant once a week for five weeks. Following each observation, the consultant and teacher met for a conference and discussed plans for future lessons.

The experimenters computed transfer of training scores for all teachers based on their skill with the strategies and the appropriateness with which they used the new models of teaching. Results showed that coached teachers' performance in the classroom (i.e., transfer of training scores) was signficantly better than teachers in the uncoached condition. After initial training, uncoached teachers tended to discontinue use of the new strategies and return to previous teaching methods. (See Table 1.)

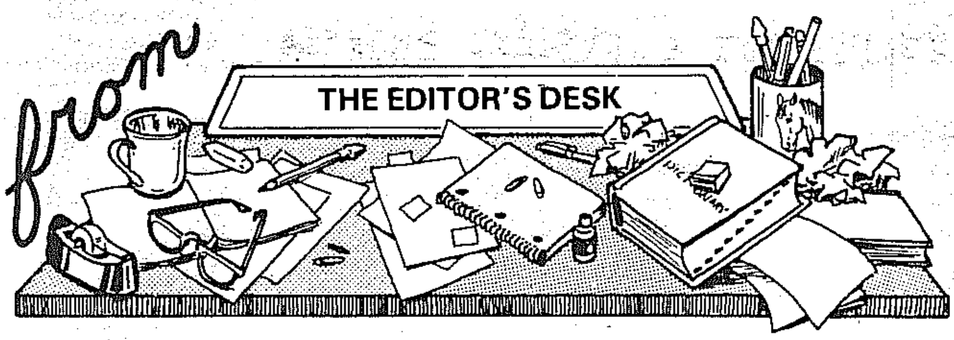
Table 1. Transfer Scores for Coached and Uncoached Teachers (Showers, 1983)

	Coached	Uncoached
Mean	11.67	5.75
Standard Deviation	4.21	4.23

Other authors have reported this same finding: Teachers who are not given in-classroom assistance frequently fail to implement new strategies (Dodd, 1985; Fullan, 1982).

Baker (1983) followed the teachers who participated in the Showers (1983) study to investigate whether teachers retained their skills and continued to use them in the classroom. Six to nine months following training, teachers were asked to demonstrate lessons in which they used one of the models they had learned in their earlier training (the teachers did not use the models as part of their normal teaching). The findings indicated that coached teachers surpassed uncoached teachers on measures of skill retention and transfer of training. (See Table 2.)

Continued on Page 4



Ed. Note Shirlee Lehnis, whose letter follows, was the ADI Teacher of the Year as recognized in our last issue. We were unable to include her picture in the last issue, so a letter from her and her picture is included now.

Dear Editor,

The picture I promised you is enclosed. Also, here are some other facts about me that might interest your readers.

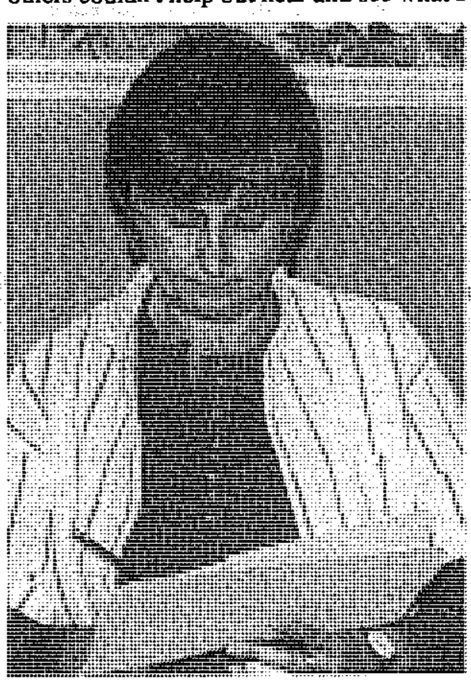
I began taking classes in DI the Summer of 1982. I came to Eugene that August and returned to Olympia and asked (begged) my special education director, Kirby Cleveland, to order reading, math, spelling, and language DI materials. He did and I had a wonderful, exhausting two years teaching DI "all day." I lost my voice three times that first year.

When I wasn't teaching it, I was proselytizing. I kept an "open door" all year and others couldn't help but hear and see what I was doing. One of those people was my friend Carolyn Ray (fourth grade teacher). She had been moaning and groaning about Ginn and her low-performing group, so I suggested that she and I go to Eugene on August, 1984 and see if *Reading Mastery* might not be a good alternative. We went, she did, and our principal (Pete Kerl) ordered the materials, and she began using *Reading Mastery III* with the low group. We did a mini-research project on that group and by the end of the year, they showed *3 times* the growth in reading as the had the previous year with Ginn.

I also turned over my proselytizing to Carolyn. I figured she had more credibility with regular class teachers. She took up right where I left off.

At any rate, word started getting around about Carolyn and Liva Conrad (sixth grade teacehr at Mountain View) and things have mushroomed from there.

We now have three pilot buildings and interested folks in all of our elementary schools. Liva and I are serving as teacher-consultants in our buildings and Mary Stein is helping out at Olympic View! We're off and running!



Shirlee Lehnis

Plan now to attend the 13th Annual Eugene Direct Instruction Conference, August 3-7, 1987- Details in the next D.I. NEWS

The **Direct Instruction News** is published Fall, Winter, Spring and Summer, and is distributed by mail to members of the Association for Direct Instruction. Readers are invited to submit articles for publication relating to DI. Send contributions to: The Association for Direct Instruction, P.O. Box 10252, Eugene, Oregon 97440. Copyrighted by ADI, 1986.

Editors . . . . . . Wes Becker
. . . . . . John Woodward
Associate Editors for Research . . . . . . Ed Kameenui
. . . . . . Russell Gersten
. . . . . . Craig Darch
. . . . . . Robert H. Horner

Departments
Teacher-to-Teacher . . . . . .
Administrator's Briefing . . . . . .
Dear Ziggy . . . . . . Ziggy Engelmann
Analyses of Curricula . . . . . . Linda Meyer
Software Evaluation . . . . . . Douglas Carnine
Microcomputers and DI . . . . . . Samuel K. Miller
Art Director . . . . . . Susan Jerde
Layout . . . . . . Wes Becker
. . . . . . Springfield News
Photography . . . . . . Arden Munkres
Typesetting . . . . . . Bryan Wickman
. . . . . . MacIntosh
Printing . . . . . . Springfield News

Doctoral Studies at Northern Illinois University

by Alan Repp
Maria Collins
Northern Illinois University

The faculty of Special Education at Northern Illinois University offers a doctoral program degree which empasizes the technology of teaching and behavioral research. Coursework is divided into three sections. The first is a core consisting of single-subject and groups research courses, issues in special education and the psychology of special education. The second section allows the student to choose areas of emphasis. For those students interested in behaviorally-related studies, these courses might include a generic course in the technology of teaching, effective instruction with the mildly handicapped, managing maladaptive behavior, stimulus control and generalization, and current research and teaching practices in special education.

In addition, students apply what they have learned in the classroom through field experiences and practica in teaching and research. The third section consists of the dissertation and its defense. Becuase our students do so much research before the dissertation, most students find this phase only an extension of their prior work rather than a separate and new stage in their educational pursuits.

In addition to the coursework, the program emphasizes the preparation of our doctoral students to teach at universities, to conduct research, and to train teachers in various settings. The average student in the behavioral portion of our program graduates with several papers published or in press, about 10 presentations at national conferences, and experience in teaching methods courses at the university level. Because we have a reputation for attracting conscientious and dedicated students and because of these program experiences, all students have been placed at facilities of their choice at or before graduation.

Students graduate from our program with a large number of specific skills to prepare them for a wide range of career possibilities in the field of special education. We will breifly list skills students gain in the areas of research and administration. In the area of research, students learn to conduct behavioral assessments, to evaluate interventions, and to evaluate teaching techniques. Administration skills include an analysis and comparison of various teaching methods, including general-case programming, precision teaching, and Direct Instruction, management by objectives, contingency management, and staff training and reinforcement.

Students have been supported either as instructors or as participants in one of our doctoral training grants. These grants have been behaviorally based, have emphasized research and effective instruction, and have supported students at $10,000 per year, plus tuition and fees.

If you would like further information about the program, please contact Dr. Alan Repp, Learning, Development and Special Education, Northern Illinois University, Dekalb, IL. 60115 (phone: 815-753-8464).

Replication of CLASS Program in Costa Rica

by Hill M. Walker.
University of Oregon

Gerardo Fonseca Retana
University of Costa Rica

Russell Gersten
University of Oregon

The functions of replication are to: (a) establish the reliability of previous findings, and (b) to determine the generality of these findings under differing conditions (Hersen & Barlow, 1976). The present report examines a cross-cultural replication of the *CLASS* program (Contingencies for Learning Academic and Social Skills) for acting out pupils within Costa Rica. *CLASS* (Hops, Beickel & Walker, 1976) is a comprehensive behavior management package consisting of the following components: (a) a response-cost point system, (b) adult praise, (c) group and individual contingencies, (d) school and home rewards, and (e) behavioral contracting procedures. The *CLASS* program is designed to remediate the disruptive, oppositional behavior patterns of acting out pupils in K-4 school settings. The program has been implemented successfully for pupils in the full elementary age range and is applied to the behavior of acting out pupils in a cooperative arrangement between a program consultant (counselor, school psychologist, resource specialist, principal, teacher aide, etc.) and the pupil's homeroom or primary teacher. *CLASS* is applied to all school settings (classroom, lunchroom, hallways, playground) in which the target pupil's behavior is considered to be problematic.

This study was designed to answer three questions in relation to the *CLASS* program:

1. Can the *CLASS* program be feasibly implemented in Costa Rican schools?
2. Does implementation of the *CLASS* program, according to its usage guidelines, lead to a quantifiable increase in the appropriate behavior levels of disruptive Costa Rican pupils who meet the program's eligibility criteria?
3. Do consumer satisfaction measures, completed by program participants, socially validate the *CLASS* program's effectiveness and utility with Costa Rican schools?

Method

Study Design

An experimental/control group design was used to investigate questions one and two posed by the study; social validation methodology was used to generate data to answer question three. Subjects were randomly assigned to experimental and control groups by pairs.

Program Consultants

A total of 10 *CLASS* program consultants were trained by the senior and second author during a one-week period in Costa Rica. The program consultants trained were graduate and undergraduate special education students at the University of Costa Rica who were enrolled in a practicum class focusing on child behavior disorders in the school setting. Some of them had previous teaching experience with handicapped children. The remainder either had minimal or no teaching experience. The instructor of the practicum course (a colleague of the second author) offered her students, with their consent, to participate in this study. All these students received three days of intensive inservice training in the *CLASS* program, conducted by the authors, but only those who volunteered to participate in the study ($N = 10$) actually implemented the *CLASS* program.

Subjects

Twenty acting out pupils enrolled in Costa Rican elementary schools participated in the study as either experimental or control subjects. Subjects were enrolled in regular classroom settings and were referred by teachers because of their disruptive, noncompliant behavior. The subjects consisted of 17 males and 3 females who ranged in age from 8 to 12 years and were enrolled in grades 2 through 6.

A dual selection criterion was used to identify eligible children. This criterion involved *teacher ratings* and *direct classroom observations* using the *CLASS* consultant observation code. Pupil behavioral levels on these measures for program eligibility were identical to those used in U.S. applications of the *CLASS* program.

Program consultants recruited and received referrals of disruptive pupils and from a number of San Jose elementary schools. Referring teachers were asked to complete a rating scale of disruptive behaviors and to allow direct observations of the referred child.

Program consultants were each required to identify two children who qualified for the program, i.e., met minimum, behavioral eligibility requirements. These pupils were then randomly assigned to either an experimental or control group.

Inservice Training Procedures

The *CLASS* program materials, i.e., the Consultant Manual, Teacher Manual, and Program Materials Packet, were all translated into Spanish by the second author. Workshop activities were conducted in English and Spanish and focused on mastery of the *CLASS* program materials. Special attention was given to participants' achieving both *conceptual* and *behavioral* mastery of key program components that directly affect implementation quality (e.g., use of the red/green point card, monitoring teacher performance, and so forth). A majority of the available training time was devoted to the *CLASS* Consultant Manual, which provides detailed information on program tasks and implementation procedures. Actual training activities involved: (a) providing brief overviews of each program task; (b) consultants' reading of relevant sections of the *CLASS* manual; (c) role playing and behavioral demonstration of program tasks; (d) providing feedback on performance; (e) consultant viewing and discussion of videotaped examples of correct and incorrect program applications; and (f) question/answer and discussion sessions.

Training required 3 full days. Approximately 2 1/2 days were devoted to *CLASS* program mastery and one-half day to logistical arrangements relating to the replication study.

The instructor of the practicum course participated in the training sessions and served as a *Local Program Coordinator* (LPC) during program implementation following the workshop training. Her program-related duties as Local Program Coordinator were:

1. To serve as a resource to student consultants in technical matters concerning *CLASS* Program implementation.
2. To monitor consultant performance during *CLASS* Program implementation.
3. To directly supervise consultants during implementation and provide feedback on their performance.
4. To hold weekly group meetings with consultants to share information about the program.
5. To work with consultants and schools in solving logistical problems relating to delivering program procedures.
6. To make a Likert scale rating of each consultant's fidelity of implementation.

The consultants' *CLASS* program responsibilities were to present the *CLASS* program to school personnel, to identify two acting out children who qualified for the program, to apply the *CLASS* program to one of the two qualifying children, and finally, to implement the program according to the application guidelines and steps contained in the *CLASS* Consultant Manual. Consultant trainees were trained in all these tasks during the workshop sessions. In addition, detailed instructions for accomplishing them are contained in the consultant manual supplied to each trainee and the LPC.

Following completion of training, the authors returned to the U.S. and the LPC and consultant trainees began the task of program application. Telephone contact and written correspondence were maintained between the LPC and authors throughout the implementation period.

Dependent Measures

The primary dependent measure in this study was the proportion of observed time subjects spent engaged in appropriate classroom behavior as recorded by the *CLASS* Consultant Observation Code. A copy of this code usage guidelines/instructions are contained in the *CLASS* Consultant Manual (Hops, Beickel, & Walker, 1976).

This is an interval observation code that requires the observer to code the child's behavior as either (+) appropriate or (-) in appropriate during successive 10-second intervals.

A secondary dependent measure in this study was a consumer satisfaction instrument that assessed program consultants' perceptions of the *CLASS* program's utility and effectiveness. This instrument was developed by the authors of *CLASS* (Hops, Beickel, & Walker, 1976) and used to socially validate the program during its field testing (Wolf, 1978). The *CLASS* Consultant Evaluation Form provides a detailed assessment of the *CLASS* program manual and its major program components.

Behavioral Observations

Twelve observers were trained by the authors. Observers were members of an undergraduate class in mental retardation at the University of Costa Rica and received practicum credit for their efforts. Observations were recorded during seatwork instructional periods. Two 30-minute observations were recorded for each subject before and after interventions. Appropriate behaviors were defined as: (a) listens carefully to teacher instructions; (b) raises hand for assistance and for permission to talk with others; (c) does what the teacher says; (d) works on and attends to assigned task(s); (e) follows teacher's directions for assignments; and (f) remains in seat (during instructional activities). The target child had to be engaged in one or more of these appropriate behaviors for the entire 10-second interval for a (+) to be coded. If not, a (-) was entered for that interval. Observers used either a stopwatch or a watch with a sweep hand to estimate the occurrence of 10-second intervals. The percentage of appropriate behavior was calculated by dividing the number of (+) intervals by the total number of intervals observed and multiplying the result by 100.

Observational data were recorded by trained observers prior to intervention and after intervention was terminated. Observers were not informed of the experimental or control status of the pupils.

An observer coordinator helped schedule observations, keep track of data, and assist as needed.

Videotape training. Observers were first trained to an 80% accuracy standard with the senior author's coding of a videotape. Once all observers were able to consistently achieve the 80% accuracy standard, a series of 20-minute coding sessions was conducted in which pairs of observers were instructed to compare their simultaneous recordings of identical intervals on the videotape. Table 1 contains the average interobserver agreements with standard deviations and ranges for each 20-minute coding session. Percentage agreement was determined by counting the number of intervals in which both observers made identical entries, divided by the total number of intervals observed. Across the six sessions, the overall interobserver agreement percentage averaged 84.99%.

Table 1. Observer Training Reliabilities (percent agreements) Using Videotaped Models of Classroom Behavior

Sessions	Mean	Standard Deveation
1	89.92	8.54
2	75.38	12.65
3	96.15	7.67
4	82.30	12.35
5	83.84	8.69
6	85.38	8.77

In vivo coding of live models. In this training segment, the authors alternated in role playing appropriate child behavior in a simulated seatwork situation. Four 20-minute sessions were conducted in which observers compared their ratings with the authors' and with each other. Table 2 contains average interobserver agreements between pairs of observers across the four sessions in which the authors modeled child behavior. The overall mean for these four sessions was 94.99 percent. The level of agree-

Continued on Page 4

ment was consistently higher for coding of live models.

Results

Means and standard deviations for the percentage of appropriate behavior are presented in Table 3. Separate *t*-tests were performed for experimental and control group differences on the pretest and posttest data. The *t*-test was significant only at posttest. All 10 subjects in the experimental showed gain in appropriate behavior. In constrast, only 4 of the control subjects showed a gain from pretest to posttest.

Table 2. Observer Training Reliabilities (percent agreements) Using In Vivo (Live) Models of Classroom Behavior

Sessions	Mean	Standard Deveation
1	94.16	7.92
2	98.33	5.77
3	95.00	5.22
4	92.50	8.66

prepared to implement the *CLASS* program?; (2) Do you think you implemented the program correctly?; and (3) How satisfied were you with the results you obtained? Average ratings for those three questions were, respectively, question (1) Mean = 5.88; S.D. = .35; question (2) Mean = 5.88; S.D. = .35; and question (3) Mean = 6.75; S.D. = .46. These ratings indicate very positive responses to each.

In Section Three, respondents clearly perceived the *CLASS* program as highly effective in remediating child behavior problems. Average ratings for the 12 questions in this section ranged from 5.00 to 6.88.

Discussion

The goals of this study were to: (a) conduct a cross-cultural replication of the *CLASS* program in Costa Rica; (b) test the program's effectiveness in remediating the behavior problems of disruptive children in Costa Rican schools; and (c) expose Costa Rican teachers and other school personnel to a comprehensive self-

Table 3. Means and Standard Deviations for Percentage of Appropriate Behavior (N=10 in each group).

	Pretest		Posttest	
	Experimental	Control	Experimental	Control
Mean	35.21	33.72	50.38	34.61
S.D.	6.77	6.67	12.18	6.15

During the 3-month implementation period for *CLASS*, the local program coordinator (LPC) met weekly with the 10 *CLASS* consultants and also worked closely with them in supervising and facilitating their application of the program. At the end of the implementation period, the LPC rated each consultant's fidelity of program implementation on a 5-point Likert scale.

The LPCs fidelity ratings averaged 3.7 (S.D. = .94) and ranged from 2 to 5. These ratings were correlated with gain scores in appropriate behavior for the experimental target subject assigned to each consultant (N = 10). The obtained correlation (r = .68; p < .05) indicated a statistically significant relationship between implementation fidelity and behavioral gain scores.

The *CLASS* program was rated very positively by the consultants who completed the consumer satisification measure (N = 8). Items in Sections One, Two, and Three required either a yes/no response or a Likert rating on a 1-7 point scale.

In Section One, the *CLASS* Program Manual received a perfect average score across the 8 responding consultants (e.g., 7) on each of the descriptions of *comprehensive, useful,* and *precise.*. Consultant ratings indicated high levels of clarity of presentation for both *CLASS* pre-intervention and intervention program components, e.g., average ratings ranged from 5.00 to 5.87. Average ratings of the importance of 15 major program components (e.g., school rewards, parent involvement, teacher feedback, etc.) ranged from 5.88 to 7.00.

In Section Two, program consultants rated the inservice training they received in the *CLASS* program as effectively preparing them to implement it. Three questions in this section were of particular interest. These were: (1) How effectively were you

contained package for coping with school behavior problems. In the authors' view, positive outcomes were achieved for each of these goals.

Results of this study indicate that the *CLASS* program was successfully applied in a Spanish-speaking country where language and cultural conditions were quite different. Application of the *CLASS* program produced statistically significant behavioral gains for pupils exposed to it. Feedback from program consultants suggests the *CLASS* program may be highly feasible for use in Costa Rican schools.

The strong relationship obtained between the fidelity of implementation measure, e.g., Likert ratings of consultants by the LPC, and child gain scores is an important one. It confirms a familiar, but often untested, assumption seen in the professional literature, i.e., that there is a direct relationship between implementation quality and the magnitude of achieved program outcomes.

Disruptive child behavior is a significant problem in Costa Rican schools. Systematic programs such as *CLASS* are not generally available. Since the program is already translated in Spanish and has been proven effective, a future goal will be to develop efficient consultant and teacher training procedures in order to make the program more widely available in Spanish speaking settings.

References

Hersen, M., & Barlow, D. (1976). *Single case experimental designs*. New York: Pergamon Press.

Hops, H., Bieckel, S. L., & Walker, H.M. (1976). *CLASS* (Contigencies for Learning Academic and Social Skills) *program consultant manual.* Available from the Center at Oregon for Research in the Behavioral Education of the Handicapped (CORBEH), Center on Human Development, Clinical Services Bldg., University of Oregon, Eugene, OR 97403.

Wolf, M.M. (1978). Social validity: The case for subjective measurement, or how applied behavior management is finding its heart. *Journal of Applied Behavior Analysis, 11*, 203-214.

Coaching Teachers

continued from page 1

To determine if previously coached teachers (i.e., teachers who had mastered one of the models of teaching) could effectively coach their peers, Showers (1984) conducted a study using peer coaches instead of consultants. As in the earlier study, coached teachers scored significantly higher on the transfer of training measure than uncoached teachers. Although the uncoached teachers in the 1984 study practiced the new models more than the uncoached teachers had in the 1983 study, their skill levels did not increase. Showers hypothesized that practice alone may not result in successful implementation because teachers tend to practice skills incorrectly unless they receive appropriate feedback regarding implementation.

Table 2. Mean Transfer Scores: Follow-up Study (Baker, 1983)

	Coached	Uncoached
Transfer of Training: Bruner's Concept Attainment Strategy		
Mean	15.00	8.30
Standard Deviation	3.80	1.55
Transfer of Training: Taba's Inductive Thinking Strategy		
Mean	15.20	12.00
Standard Deviation	2.00	3.10

These studies demonstrate that coaching is an effective means for training teachers to use new skills. Following initial training, teachers who were not coached implemented new teaching models poorly or not at all, and coached teachers used the new strategies more consistently and effectively. The coached teachers felt positive about the coaching process, and admitted that without coaching, they would not have continued using their new skills.

Although findings from the Showers' studies (1983, 1984) and from Baker's (1983) follow-up study suggest that coaching is a promising approach for improving teacher's skills, several issues remain unresolved. First, in the studies just described, teachers were taught to use *atypical models of teaching* that were not research-based. Were the skills being taught relevant to improving student achievement? Sparks (1983) has cautioned that the content of a training program is just as important as the training procedures themselves. A staff development program can only be successful if it trains specific skills that are associated with improvement in *student achievement* (Sparks, 1983b).

Second, most authors have described what the coach actually does in fairly vague terminology (e.g., "provision of technical feedback," "analysis of application"). This lack of clarity renders comparison across coaching studies difficult.

Conflicting Research Findings

Other authors besides Showers and her colleagues have not shown large treatment effects for coached teachers. Sparks compared three approaches to inservice training: workshops alone, workshops plus peer observation, and workshops plus coaching by outside consultants. Teachers in all three groups attended four weekly workshops, and participants in the peer observation and coaching groups were observed or coached on two occasions. Results showed that teachers in the workshop-plus-peer-observation group implemented new techniques better than teachers in either of the other two groups. Although the findings indicate that coaching was less effective than peer ob-servation, Sparks (1985) suggests that teachers in the coaching condition may not have improved because of their perceptions of the coaching relationship. Teachers may have viewed their consultant-coaches as out-siders who would not be involved in their classrooms after the study was completed. Teachers in the peer observation group, however, may have felt more support and encouragement from their peers and therefore may have been more motivated to implement the new skills. This hypothesis seems especially reasonable given the limited contact between teachers and their consultant-coaches (only two meetings).

The relationship between teachers and their coaches may be of considerable importance in evaluating the effectiveness of coaching. While Showers (1983) and Gersten, Carnine, Zoref, and Cronin (1986) have interviewed teachers to document their perceptions of the coach-teacher relationship, even further objective analysis of the coaching relationship is needed to understand this rather delicate process. As Sparks (1985) points out, this analysis may be difficult given the lack of standardization in coaching procedures. The label "coaching" is vague and may describe several different kinds of interventions. Also, the coaching process necessarily changes depending on who the coach is, who the teacher and students are, and what the instructional content is.

Summary

Athough there are some conflicting findings on the effectiveness of coaching, there is evidence that coached skills are more likely to be used in the classroom. When teachers are learning new skills that are quite different from procedures they have previously used, coaching seems to beparticularly important (Showers, 1982).

In the studies reported here, both "expert" and "peer" coaches have been used with success. Although peer coaches may be more easily accepted by teachers (Sparks, 1985; Wagner, 1985), most authors have cautioned against simply placing teachers in the role of coaches without first training them in supervisory skills (Gray & Gray, 1985; Kent, 1985; Little, 1985; Wagner, 1985). A teacher who works well with students does not necessarily work well with teachers. Little (1985) found that even highly trained peer coaches were hesitant to "advise" other teachers; "professional good manners" dictate against advising peers in the teaching profession. Additional research is needed to

Continued on Page 5

Coaching Teachers -- continued from page 4

determine the effectiveness of "peer" versus "expert" coaches.

Coaching in Project Follow Through

Research from the Direct Instruction Follow Through Project supports the general training methods described by Showers (1983). During this 14 year project, researchers were able to evaluate teacher training methods in the context of a comprehensive implementation effort. Teachers and instructional aides in 20 communities, previously untrained in the Direct Instruction Model, learned the highly structured teaching methods through participation in an intensive training program. This situation required teachers to make radical changes in their teaching behavior, and as a result, researchers were interested in teachers' reactions to the training program as well as the training program's effects on their skill levels in the classroom.

Like Showers and others reporting in the staff development literature, researchers who evaluated the teacher training procedures in the Direct Instruction Follow Through Project found that an effective training program consisted of: (a) presentation of rationale, (b) demonstrations, (c) practice and feedback, and (d) on-site coaching (called "supervision" in the Follow Through literature). However, several aspects of the Direct Instruction training program differ from the Showers model. Following a discussion of these differences, specific training and coaching techniques will be presented, and the results from two representative studies will be summarized.

The one difference between the Direct Instruction teacher training studies and those of Showers and her colleagues is that Direct Instruction trainers worked with paraprofessional aides as well as teachers. In most Direct Instruction classrooms, aides had many of the same responsibilities as teachers, including teaching small groups for language and arithmetic.

Second, teachers who participated in the Direct Instruction Follow Through project learned new teaching skills involving highly specified techniques. This is very different than the Taba or Bruner models used by Showers and Baker. Teachers implemented these skills for at least two and a half hours a day, every day. Teachers in other teacher training studies involving coaching (e.g., Showers, 1983) were not required to make such radical changes; they learned several new strategies, such as Bruner's "Concept Attainment Strategy," that they used at their discretion (e.g., once or twice a week).

Third, coaches in the Direct Instruction program used an additional training technique: modeling specific techniques with students in the classroom. Direct Instruction coaches found that modeling teaching skills with the teachers' students was more effective than out-of-class demonstrations (Carnine & Gersten, 1985).

Fourth, Direct Instruction coaches focused on student behavior (not teacher behavior) to determine what kinds of suggestions they would make to teachers (Gleason, 1984). Unless coaches observed student problems (either academic or behavioral), they did not suggest that the teacher change his or her behavior. Coaches used fairly objective criteria to determine the need for assignments. For example, if students were not at least 90% correct on oral responses, the coach and teacher discussed possible suggestions to improve student accuracy. In this sense, the Direct Instruction coaches used classroom data in ways similar to those described by Stallings (1982).

Finally, coaching in the Direct Instruction Follow Through project often lasted several years, with weekly visits during the first four months and then, perhaps two times a month after that. Teachers required several months to master basic techniques, and did not demonstrate proficient use of more advanced skills (e.g., remediation procedures) until the end of the school year. The length and intensity of the coaching process in Follow Through is in sharp contrast to the five week coaching program described by Showers (1983).

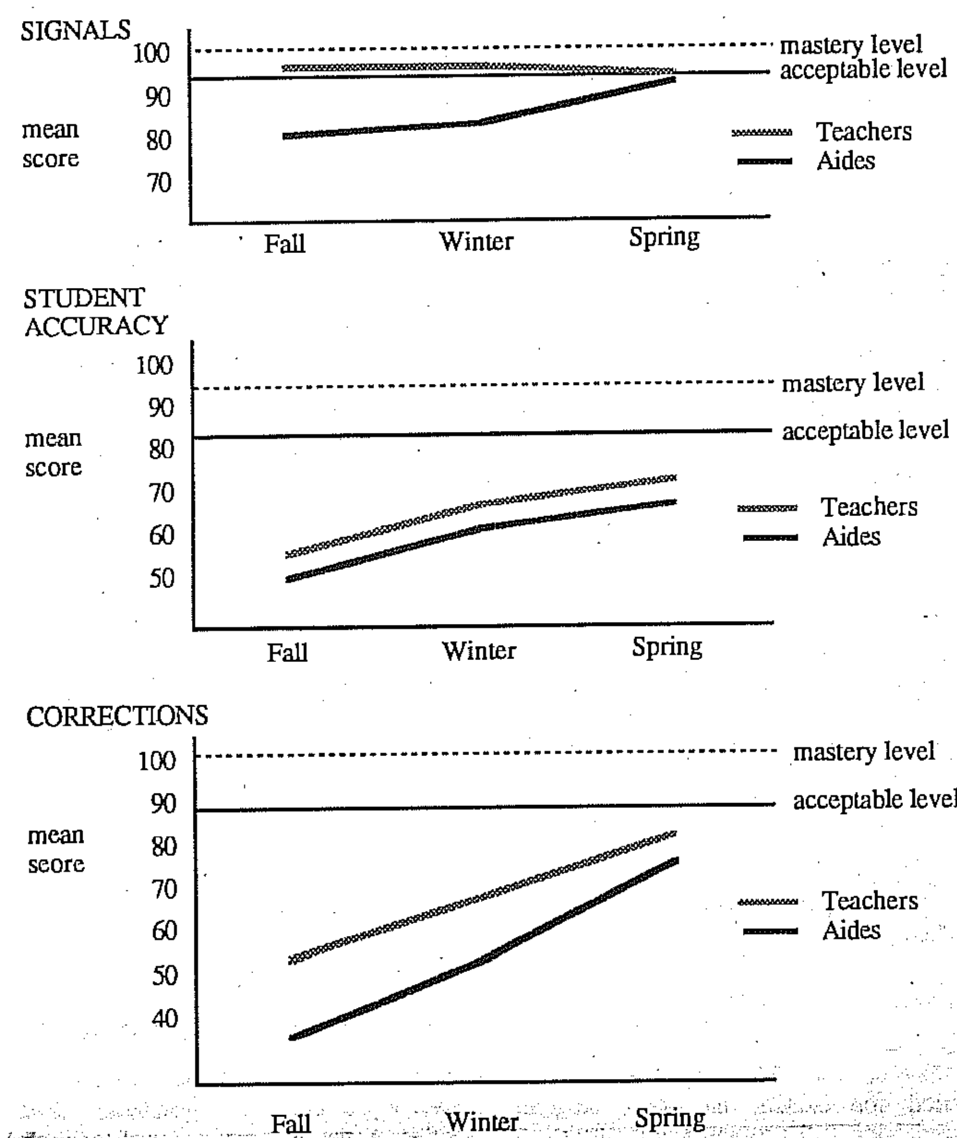
In spite of these differences, the Direct Instruction training procedures were quite similar to the methods described by Showers (1983). Teachers attended inservice workshops in which trainers explained and demonstrated teaching skills, and participants initially practiced techniques and received feedback from trainers. In the classroom, coaches observed at least once a week and then met with teachers to give feedback and make specific suggestions ("assignments") to improve teacher performance.

Evaluators of the Direct Instruction Follow Through program analyzed both student gains and changes in teacher performance. The purpose for evaluating student outcomes was to determine the effectiveness of the Direct Instruction model, and to compare student gains with teacher implementation levels. Researchers hypothesized that students taught by teachers with high implementation ratings would make the most significant academic gains.

Gersten, et al., (1986) suggest that in many ways the Follow Through teacher training process was analogous to what research shows is effective instruction for students (e.g., Brophy & Good, 1984). Training was designed so that teachers could succeed: (a) teachers' assignments were clear and achievable (assignments usually involved only one aspect of teaching a week); (b) practice and feedback were adequate; (c) teacher's progress was assessed frequently; and (d) remediation was provided when necessary. While the coach was concerned with the teacher's success, the coach framed all interactions with the teacher in terms of student performance. Thus, all problems that the coach identified related to students' academic or behavioral problems. An effective coach could quickly identify problems, prioritize them in order of importance, and describe remedies to the teacher. Coaches often took over groups and taught for 3 - 5 minute segments.

Follow Through coaches found that they were most effective when they: (a) helped teachers organize time effectively sothat most time was spent on academic tasks, (b) chose materials that were at an appropriate difficulty level, (c) provided immediate feedback following observations, and (d) made frequent classroom visits (Carnine & Gersten, 1985). In addition, coaches found that modeling specific techniques with the teachers' students was an effective training procedure. When teachers saw how well students could perform when coaches modeled certain techniques with their own students, teachers' expectations increased (Carnine & Gersten, 1985).

Figure 1. Skill Acquisition Trends for Teachers and Aides (Gersten, Carnine, & Williams, 1982)



Other authors have reported on the effectiveness of the Follow Through program outlined above (Stallings, 1975). Two representative studies are summarized next.

Study 1

Gersten, Carnine, and Williams (1982) trained 21 primary teachers and 21 paraprofessional aides who were involved in a year long implementation effort in an urban school district. Teachers participated in monthly inservices in which they learned about five key teacher behaviors (format accuracy, use of signals, corrections, pacing, and student accuracy). On-site coaches (who were teachers for the district) visited teachers once a week, and outside consultants observed once every three weeks.

Teachers and aides were rated in their use of the five teacher behaviors on several occasions throughout the school year. The results indicated that all teachers and aides improved in their use of the teaching skills. Although aides' mean scores were usually slightly below those of the teachers, the interesting patterns of the two group's skill improvement was the same (see Figure 1 for three of the variables).

All teachers in the study took a significant amount of time (e.g., a full eight months) to master those complex skills that have the most impact on student performance: provision of immediate corrective feedback and maintaining high student accuracy during the lesson. As anticipated, students of teachers who mastered these critical skills (and who also had the highest overall implementation scores) made the most significant academic gains on the Comprehensive Test of Basic Skills. This finding is in direct contrast to the student outcomes reported by Showers (1983). Showers found no significant differences between students of uncoached and coached teachers on measures of student performance.

Results from the Gersten et al. (1982) field research showed that the majority of teachers and aides who participated in the Direct Instruction training program mastered a complex set of new teaching behaviors.

Study 2

The second study to be discussed here was experimental. Carnine and Fink (1978) used a multiple baseline design to determine if there was a functional relationship between the Direct Instruction training procedures and implementaion levels for two teaching techniques -- rate of presentation and signaling.

Before the study began, the subjects (two aides and one teacher) read a teacher's manual describing the two techniques. Following baseline, teachers participated in

Continued on Page 7

Distar Language— A powerful tool for teaching

A powerful tool for teaching:

- A basic vocabulary
- A rich body of knowledge about the world
- The oral language and writing skills needed to ask precise questions and to communicate ideas.

These are the abilities that a new report, *Becoming a Nation of Readers*, lists as being *important* to all children who are learning to read… *critical* for children who have not grown up with oral language that resembles the language of school and of books… because these abilities are the basis of comprehension.

And these are the abilities that teachers have been successfully teaching children for almost twenty years with Distar Language programs.

But Distar Language does more than teach the complex language skills needed to understand classroom instruction and comprehend written text. Distar Language programs go beyond the content of other language programs to give you the help you need to teach critical thinking skills, skills that enhance a child's intellectual development.

With Distar Language you teach logical thinking through:

Classification
Analogies
Deductive reasoning
Inductive reasoning

You teach students to be "THINKERS" who use language as a tool. And that is the foundation for eventual success in all school subjects.

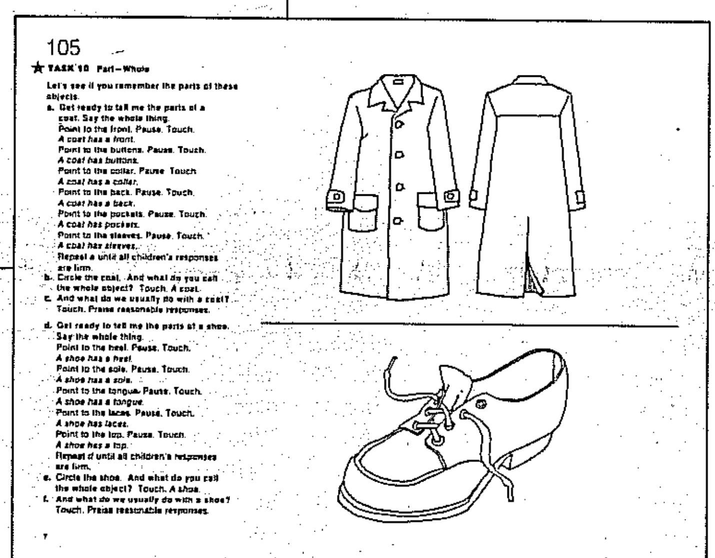
And now the Distar Language program is better than ever! Distar Language I has been revised to give you:

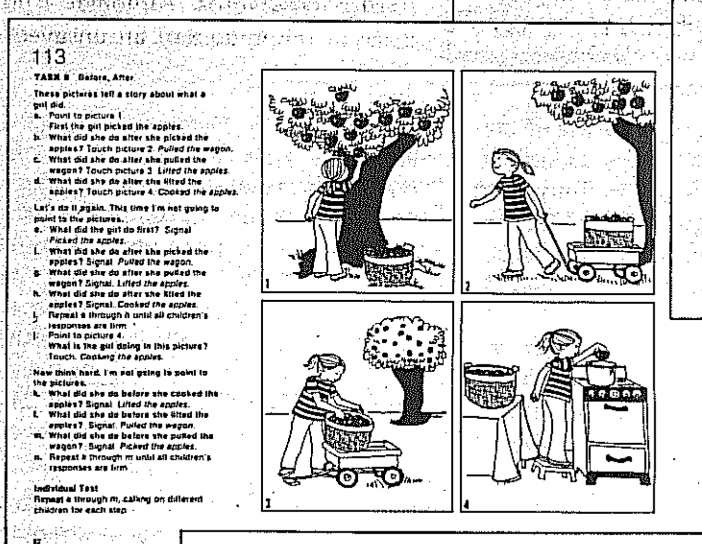
Expanded Language Activities—ideas for fun-to-do songs, read-aloud stories, nursery rhymes, and plays. These informal lesson extensions encourage students to apply their language skills in classroom activities. Language achieves full naturalness at a remarkably early stage.

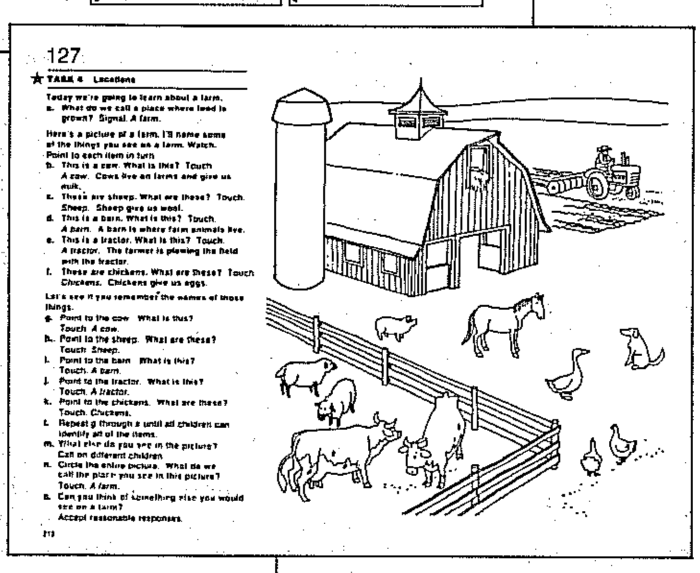
Fast Cycle—an in-lesson skipping schedule eliminates unnecessary drill and practice for average and above-average students. A "star" identifies the tasks that you teach to all students. You are free to skip the remaining exercises with the faster children. Lessons are easier to adapt to student ability.

Take-Homes—lively pencil and paper activities teach color, shape and workbook skills. Activities reinforce skills, demonstrate that students can apply language concepts. Illustrations are improved. There is more to do on each page.

Use this order form to receive these exciting new materials as soon as possible.







Examples from Teacher Presentation Book D

SRA®

Mail to: SRA, 155 N. Wacker Drive, Chicago, IL 60606

Quantity			Price	Extension
______	7-7340	Distar Language I Classroom Kit	$280.00	______
______	7-7346	Additional Teacher's Guide	10.00	______
______	7-57347	Take-Home Workbook 1 (pkg of 5)	14.85	______
______	7-57348	Take-Home Workbook 2 (pkg of 5)	14.85	______
______	7-57349	Take-Home Workbook 3 (pkg of 5)	14.85	______

Ship to:	Sold to:
Date / SRA Account Number	SRA Account Number
Purchase Order Number	Account Name
Ordered By	Address
Account Name	City, State, Zip Code
Address	Attention
City, State, Zip Code	Telephone Number / Good time to reach
Attention	Tax Exemption Number
Telephone Number / Good time to reach	Preferred Delivery Method

All orders are offers to purchase, subject to acceptance or rejection by SRA in Chicago, Illinois, in accordance with SRA's published terms and conditions of sale. Customer pays all shipping charges. Prices subject to change without notice.

Coaching Teachers

Continued from page 5

daily training sessions with a coach. Training sessions involved practice sessions with coaches (in which techniques were modeled and practiced), feedback, independent practice, and video feedback (each day the teachers viewed videotapes of themselves and coded their behavior on an observation form). Coaches did not make classroom visits, but made suggestions to the teachers on the basis of the teacher's performance in the daily practice session and the videotape.

For all three teachers, the training intervention produced significant and immediate effects. All teachers increased their skill levels to points above the comparison standard (for example, after training, the teachers' rate of appropriate signaling was 95.2%; the comparison standard was 73.5%), and maintained their skill levels on two followup measures. This study demonstrated that training procedures that were effective in training hundreds of teachers involved in the Direct Instruction Follow Through program could be experimentally validated. Findings from Carnine and Fink (1978) and Gersten, et al. (1982) show that teachers and aides trained in the projects effectively used the skills they were taught in their classroom instruction. While it is impossible to determine the precise contribution of each training component, there is no doubt that coaches were instrumental in the training's success. As Showers (1984) notes, teachers who practice new skills without receiving specific feedback tend to practice skills incorrectly and therefore fail to effectively implement skills in the classroom.

Summary of Research on Staff Development and Inservice Training

An effective training program involves initial instruction in new skills as well as practice in the real setting with feedback. An integration of research findings documents the efficacy of the following teacher training guidelines:

1. Training and transfer tasks should be similar -- i.e., if students are learning counting skills, the teacher should be trained to teach counting skills. (Ripple & Drinkwater, 1982).

2. Trainers should provide a clear demonstration of the technique or strategy (Joyce & Showers, 1981; Gersten, et al., 1986).

3. Teachers should understand the rationale behind the skills they are learning (Joyce & Showers, 1982; Ripple & Drinkwater, 1982).

4. Teachers need multiple opportunities for practice (in the Direct Instruction program, teachers practiced for 90 minutes a day for eight months) (Gersten et al., 1986; Showers, 1983; Ripple & Drinkwater, 1982)

5. Trainers must help teachers make discernible changes in their teaching so that teachers feel successful (Sparks, 1983). Trainers can help teachers be successful by: (a) making assignments clear and achievable, (b) providing adequate practice and feedback, (c) assessing teachers' frequently, and (d) providing remediation when necessary (Gersten et al., 1986).

6. On-site coaching will greatly increase the likelihood that teachers will transfer skills to the classroom (Carnine & Gersten, 1985; Gersten, et al., 1986; Joyce, et al., 1983; Joyce & Showers, 1980;1982; 1985; Showers, 1983, 1984).

7. Coaches should make frequent classroom visits and modeltechniques with students so that teachers can see the effectiveness of the procedure (Gersten, et al., 1986).

In conclusion, the research on staff development suggests that the above procedures are effective in training teachers in new skills. Teachers who participate in training programs that: (a) include the above components, and (b) attempt to teach research-based teaching techniques should help students make substantial gains in learning.

Several issues relating to coaching remain unresolved. First, it is unclear whether "peers" or "experts" are the most effective coaches. Although peer coaches may be more easily accepted and readily available to teachers (Sparks, 1983), teachers may require extensive training in supervisory skills prior to coaching other teachers (Gray & Gray, 1985). Such training may prove to be cost-ineffective.

Second, the short classroom interventions used by Direct Instruction coaches (and also used in this study) may enhance the coaching process. When a trainee sees that a technique improves student performance, the trainee's expectations increase and the trainee is more likely to implement the new technique (Carnine & Gersten, 1985; Gersten, et al., 1986).

Third, most teachers require a substantial amount of time to master new skills (Borg, 1977). Although teachers will require varying amounts of time to master new skills, it is clear that teachers learning brand new skills or skills that are in conflict with previous behaviors will require substantial practice and coaching to be able to use their skills naturally and effectively.

References

Editor's Note: A complete set of references may be obtained by writing to The Editor, ADI NEWS P.O. Box 10252, Eugene, Or. 97440

Gersten, R. Camine, D.W., & Williams, P.(1982). Measuring implementation of a structured educational model in an urban school district: An observational approach. *Educational Evaluation and Policy Analysis*, 4,(1), 67-79.

Gersten, R., Camine, D.W., Zoref, L., & Cronin, D. (1986). A multifaceted study of change in seven inner-city schools. *The Elementary School Journal*, 86, (3), 1-20.

Gleason, M. (1984). The key to effective supervision: focus on student performance. *Association for Direct Instruction News*, 3(4).

Joyce, B. & Weil, M. (1980). *Models of teaching*. Engelwood Cliffs, New Jersey: Prentice-Hall Inc.

Showers, B. (1983). *Transfer of training: The contribution of coaching*. Eugene, OR: Division of Educational Policy and Management.

Showers, B. (1984). *Peer coaching and its effects on transfer of training*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans.

SchoolWriter – A Software Review

SchoolWriter, C.C. Publications, Inc.
19576 S.W. 90th Court
Tualatin, OR 97062; (800) 547-4800
Cost: $79.95; additional workbooks, $3.95; computer lab package, $239.95 (5 sets of disks).*

Reviewed by Nancy Mather

SchoolWriter is a recently released 80-column word processor with 64K and 128K versions developed for Apple IIe/-IIc computers. Operation requires an 80-column text card, an 80-column video monitor, and one or two disk drives. The program is written in PASCAL, an advanced computer language. SchoolWriter was designed for the school population, primarily students in grades 4-12. All materials and instructions have approximately a fourth-grade readability level.

Description

The package includes a program master, a back-up disk, an activities file disk, an *Instructor's Manual*, and a *Student Workbook*. The disks, manual, and workbooks are designed for both teaching and performing word processing. Word processing is systematically introduced in 10 lesson tutorials that can be presented in approximately 20 minutes each. The 96-page *Instructor's Manual* provides answers to the Student Workbook, objectives for each lesson, instructions for classroom presentation, and a Student Progress Sheet. The 56-page *Student Workbook* contains instructional and review activities, a quick reference chart, and an index/summary of terms. The SchoolWriter activities disk contains supplementary practice exercises. The program and workbooks can be used with a classroom, small group, or individual students.

Running SchoolWriter

After loading SchoolWriter, the main menu appears at the top of the writing screen. This menu contains the following choices: Get File, Save, Options, Print, Find/Replace, Underline, Clear, Delete File, Jump, Center, Move, Block Delete, Prepare Disk, and Help. The lower portion of the screen displays the number of words written on the page and line numbers. All commands are executed from the main menu while text is entered below. The "Help" command is a mini-manual that describes and explains how to use different program tasks. Before entering text, it is necessary to prepare a file disk for storing information. This procedure formats a blank disk for use with SchoolWriter.

Evaluation

Several features make SchoolWriter appropriate for use with learning disabled (LD) students. Foremost, the program is easy to operate. Students and teachers familiar with word-processing systems can learn to operate the program in 30 minutes without reading the manual. Most students unfamiliar with word processing can learn to write, edit, and print files in less than an hour.

Some familiarity, however, is required for adroit, accurate execution of the ESC, Apple keys, and return commands. Although the screen provides instructions, selecting the right key at the right moment requires a modicum of practice. With a little experience, one learns that the ESC key moves the cursor between the writing screen and the main menu, the Apple keys select a task on the menu, and the return key completes a task or moves the cursor to a new option.

All instructions are written in simple English and most students will have little difficulty in reading the screen or the workbooks. Specialized microcomputer terminology is minimal; one *prepares* a disk instead of *formatting* it; *gets* a file instead of *loading* it. Additionally, the on-screen menu and the single keystroke operation reduce memory requirements. There is no switching back and forth between operation modes. Another positive feature is that the printed copy is identical to what appears on the screen. Using the various options, a student can alter and view the new format of a report or story before making a printed copy. No guesswork is involved.

Many rather advanced functions are accomplished with relative ease. For example, by selecting Print from the Main Menu, one can decide whether or not to number pages, whether to print the number at the page top or bottom, where to set the top and bottom margins, and whether or not to have a page heading. By selecting Options from the Main Menu, one can set the line spacing, tab spacing, the size of the left and right margins, and request a Save prompt.

The Save prompt reminds the user to save text anywhere between a specified 100 to 1000 words. Although a power surge in the middle of an unsaved text tends to minimize future forgetfulness, this prompt is a nice feature for reminding beginning users. Fortunately, the program makes it difficult to make irreparable mistakes. Before erasing text or deleting a file, a prompt queries: Are you sure you want to delete this text?

Although the program contains the basic necessary writing, editing, and printing functions, students and teachers familiar with word processing are likely to prefer a more advanced, flexible system. In SchoolWriter all functions are performed from the main menu. If one wishes to save text, the first step is hitting the ESC key and returning to the main menu. It is impossible to save text with one command while typing. Although a single keystroke executes all commands, several intermediate steps are required to complete the process.

For example, if one is entering text and wishes to underline a word, the first step is to hit the ESC key to enter the main menu. Next, one hits the Apple Key to highlight the word "underline" and presses the return key to continue. Now one presses the right arrow key to underline the text (the left arrow key removes the underline). Finally, one hits the return key to reinstate the main menu, followed by the ESC key to return to the text. If there are several words in the text to underline, one may wish to employ a simpler, more expedient technology: a ruler and a black pen.

Other functions such as deleting and moving text can also be rather cumbersome. The block delete and move command allow one to delete or move only 11 lines of text at a time. Consequently, moving or erasing an entire page of text

Continued on Page 13

*Reprinted by permission of the Division on Learning Disabilities of Special Press from *Learning Disabilities Focus*, 1986, 1(2), 116-117.

Intelligent Computer Assisted Instruction -

by John Woodward
Doug Carnine
University of Oregon

Special education has passed through a phase where technology has been widely embraced and uncritically adopted. It was hoped that technology, particularly computer assisted instruction (CAI), would have far reaching effects on both what students learn and how they learn. Most research to date has looked at how computers have been implemented in the schools, with lesser attention paid to the effects of CAI on learning (Hanley, 1984). What we can glean from this research is a distinct gap between the possible applications of technology -- the highly individualized instruction (Bork, 1981) and rich problem solving environments (Papert, 1980) touted in the early eighties -- and the realities of current CAI use. Some writers (e.g., Salomon & Gardner, 1985) now warn that CAI may follow the same fate as educational television, teaching machines, and other innovative technologies of the last 25 years.

Researchers in artificial intelligence (AI) predicted this current disappointment in CAI. For years they have criticized it as an extremely limited instructional medium because its pre-formatted, linear orientation offers very little in the way of sophisticated, "intelligent" instruction. As such, CAI needlessly restricts the possible interactions between the student and the program. For example, the learner usually branches to a predictable error correction routine when a mistake is made (e.g., "Sorry, that's incorrect," "Try another answer.") rather than a tutoring dialogue that would permit the system to reason with the student. This high degree of system control is due to the fact that CAI programs tie interactions with the student to a predefined frame or unit of the program, thus precluding fine grain adaptations to the individual student (Duchastel, 1986).Carbonell (1970) has derisively compared CAI programs to mere electronically programmed textbooks.

In contrast, intelligent computer assisted instruction (ICAI) claims to offer a dramatic alternative to CAI, one that has been emphatically recommended to regular educators for the last fifteen years (Carbonell, 1970; Kearsley,1977-78; Anderson, Boyle, & Reiser, 1985; Ohlsson, 1986) and more recently, to special educators (Hofmeister, 1984; Jones, 1984; Roberts, 1984). Although the number of ICAI programs are limited, this emerging form of computer based instruction has considerable implications for the future. This article describes the components of ICAI that underlie this capability and how they are incorporated in a variety of ICAI programs. The next section critiques these programs from a content analysis and design perspective (Engelmann & Carnine, 1982), which is further illustrated in three studies that describe the teaching of generalized knowledge. In the end, we suggest how techniques from ICAI programs can be effectively incorporated into a content analysis and design approach to instruction.

Intelligent Computer Assisted Instruction

Discussions over the potential applications of artificial intelligence research into education range from *expert systems* to *robotics* to *natural language processing* (Kearsley, 1977-78). However, ICAI is most commonly associated with intelligent tutoring, where the optimal characteristics of human tutoring are incorporated into the overall program. It has been suggested that intelligent programs should be able to adjust to different student backgrounds, measure progress, review previously learned material when it arises, cause the problem solving methods of the student to converge with those of the tutor, generate and answer student problems, and give feedback on errors while still giving the student some leeway in deciding how the problem should be solved (Gable & Page , 1980).

Woolf and McDonald (1984) consolidate these characteristics into four broad components which are indicative of recent ICAI systems: (1) an expert module, (2) a student model, (3) a tutoring component, and (4) some kind of communication module. A similar set of components has been outlined by Dede (1986).

The expert module contains both subject area knowledge and methods or "heuristics" for solving problems. It may contain many problem solutions and, in general, it can usually derive the optimal solution to a problem. In some systems, it is the basis for comparing student performance to optimal or desired performance.

Although the student model varies fromsystem to system, it generally has three basic functions. First, it diagnoses responses by attempting to determine the student's style of learning and/or current comprehension of the subject matter. A second and complementary function is to determine the student's optimal learning style (e.g., does he or she learn best from examples, diagrams, etc.?; What kinds of errors does the learner make consistently?). Finally, the system must determine if the methods a student uses to derive solutions to problems are incorrect or if acceptable, how close they are to those contained in the expert module.

The tutoring component contains rules and strategies for the system's interaction with the student (Woolf & McDonald, 1984). Based on information from the student model, the tutor will determine what kind of instruction to present and how often to present it. Some ICAI systems are careful not to overcorrect student errors, thus leaving intrusions into student performance to those occasions that indicate serious misconceptions.

The final component, the communication module, has appeared most recently in ICAI systems. This module analyzes or "parses" requests and questions from the learner. In some systems it can categorize the kind of information that the student is responding to or interested in, thus helping the tutoring component do its job. The communication module may well be the most complex part of any ICAI system, not only because it must syntactically analyze what a student types into the computer, but ultimately, because it must detect (understand) what the student has *intended* by his requests or responses.

ICAI systems can be employed in virtually any content domain. A relatively simple example involving the four components described above would be a prealgebra word problem.

A worker assembles 4 linear yards of steel tubing in 6 hours. In 2/3's of an hour, how many linear inches of tubing can the worker put together?

The expert module would contain the algorithm (or set of rules) for solving this problem and others like it. Even more, it would contain the optimal means for deriving the answer (i.e., the "best" or most appropriate strategy for translating the sentences into an equation). The student model would not only represent the student's method or algorithm for generating answers, but evaluate his or her method for translatings other word problems into equations. Some ICAI researchers (e.g., Goldstein, 1982; Ohlsson, 1986) would recommend that in addition to tracking error patterns over a series of interactions, the system should evaluate how the student best learns these kinds of problems (e.g., through diagrams, analogies, explanations).

The tutoring module would use the information derived from the student model and present the most relevant, individualized instruction in word problems. This may even entail review work in solving equations if computational errors are the consistent problem. Finally, throughout the interactions, the student would be able to ask the system questions through the communications module (e.g., "What is a linear yard and a linear inch?," "I don't understand the second sentence. Please explain it or say it another way.").

Because of the size and complexity of the issues, most ICAI programs to date have prototyped only one or two of these components (Barr & Feigenbaum, 1982). A brief summary of a few of the more widely discussed systems which will be critiqued later in this article appear in Table 1.

Critique of ICAI Systems

The overall reaction to ICAI, though generally positive in some circles, is actually a bit confusing. It is difficult to determine whether researchers and educators are impressed with these systems as alternatives to traditional CAI, as advancements in technology, or as symbols of success carried over from other Artificial Intelligence (AI) fields, such as expert systems. In general, ICAI systems seem to suffer from the same problem Hanley (1984) finds with today's CAI programs: Too much emphasis is placed on the technology -- in this case, the *AI techniques* -- and too little on the learning outcomes. Recent

Table 1. A Brief Overview of some Intelligent Computer Assisted Instruction (ICAI) Program

SCHOLAR. One of the earliest ICAI systems was SCHOLAR (Carbonell, 1970), a system designed to teach South American geography. The program uses a network of facts and concepts as well as an extensive data base. The original system allowed the student to conduct a "mixed initiative" dialogue, allowing SCHOLAR to ask the student questions and then, with a limited natural language interface, permitting the student to ask questions of the system. This kind of interaction highlights SCHOLAR's most advanced qualities: the tutoring component (i.e., following a student's unexpected line of inquiry or interest) and a limited communication module. These two features enable the student to interact with SCHOLAR in a "non-deterministic" fashion, a noticeable deviation from the linear orientation of CAI programs. SCHOLAR's information structure (i.e., semantic net) permits the system to infer answers to questions that were not specifically stored in the data base. More importantly, SCHOLAR is designed as a generic program, providing the courseware designer with an executive program or template that permitted similar interactions with different content areas. Thus, by reprogramming the information in the data base, a teacher or courseware designer could just as easily teach another subject and use the same mixed initiative techniques.

WHY. The WHY program (Stevens & Collins, 1977) is an extension of the SCHOLAR research. WHY focused even more on the tutoring component and student model, all in an attempt to use Socratic methods in teaching the various causes of rainfall. Based on a more sophisticated student model than the one in SCHOLAR, WHY attempts to carefully prod students to use information about basic geophysical processes to infer the deeper causes of rainfall (i.e., a model that ultimately includes the variable of relative humidity). Essentially, the WHY student model tries to accomodate several conceptions of the causes of rainfall, arguing that an adequate explanation was contingent on what the student's particular model of this geophysical process. In the process of doing this, WHY attends to various student misconceptions and simplifications as the dialogue proceeded. One weakness of WHY is that the tutoring dialogues lacked any long term instructional goals (Barr & Feigenbaum, 1982).

WEST and WUMPUS. Two instructional games have received considerable attention in the brief history of ICAI systems: WEST (Burton & Brown, 1982) and WUMPUS (Goldstein, 1982). WEST is an arithmetic computer board game designed to reinforce the use of basic math operations. After being given three numbers, the student combines them into an expression that advances him so many spaces on the "board". Towns are situated at ten space intervals as ways to skip ahead, and the game contains rules for bumping an opponent. Tutoring in WEST is done judiciously, just enough to improve a student's skill level but not enough to deflate his or her interest in the game. The tutor "coaches" the student when he or she is stuck by providing added information, new strategies, etc. Burton and Brown have devised many rules for interrupting the student and only do so when student moves are deemed markedly suboptimal by the system. Evaluating the student (i.e., constructing a student model) is done only in the context of the game.

ICAI proponents claim that many with AI backgrounds are concerned more with the nature of mental processes rather than "practical aspects of building useful teaching and learning tools" (Yazdani & Lawler, 1986, p. 197).

As a result, what one sees are well-developed computational techniques used with inefficient and sometimes dubious instructional principles. Many of the systems are quick to place the learner in control of instruction, thus letting him or her investigate topics with occasional feedback, various forms of tutoring, and the capacity to ask the system various kinds of questions (Duchastel, 1986). This type of environment rests heavily on the validity of inquiry or discovery learning models. The latter model, which has a strong Piagetian influence, has been recently popularized by Papert (1980) and LOGO in CAI circles. As Dede (1986) points out, part of the problem with ICAI systems rests with the system designers who are unfamiliar with precollege instruction.

Beyond this influence, there is an even stronger orientation for information processing theories of cognitive psychology to underlie efforts. While asserting that ideal ICAI systems should embody a well-articulated curriculum and tutoring strategies based on an explicit theory of instruction (Yazdani & Lawler, 1986), it is also argued that ICAI systems should transcend the linear, heirarchical approach so prevalent in traditional instruction and CAI (Ohlsson, 1986). That is, an ICAI system should offer more than one way to teach a curriculum; it should adapt instruction to a student's needs and style of learning at any given time, thus capturing more than one viable mental model a student might have of the subject matter. Designing systems to do this is difficult, in part, because it is claimed that not much is known about teaching; and little, if any, work has been done with specific teaching strategies (Ohlsson, 1986).

These orientations -- discovery learning and multiple models for teaching -- sharply contrast with the growing body of empirical research that closely describes another style of instruction. Effective teaching principles (cf., Brophy & Good, 1986) and direct instruction (Engelmann & Carnine, 1982; Rosenshine & Stevens, 1986) not only delineate what makes for good teaching, but precisely capture a variety of research-based teaching strategies. What follows is an appraisal of ICAI systems based on this systematic method of instruction, one that embodies the content analysis and design approach of Engelmann and Carnine (1982).

Systematic Instruction and ICAI Systems. WUMPUS and WEST attempt to teach broad cognitive skills in the context of games. Each uses a discovery method as the means of teaching the student how to play the game, with only subtle, infrequent guidance offered by the tutoring module. Although the terminal goals in each case are worthy, it is not clear -- and certainly not documented with any substantial data -- what students learn. Teaching complex cognitive skills such as inferential and deductive logic or broad arithmetic ability through a game is often a kind of learning that is confounded by the game itself. Although a student may eventually learn the rules of a game, and even how to successfully play it, there still remain questions about the student's residual understanding of the broader skills. Research on educational simulation games (Fletcher, 1971) indicate that this is a common problem. In any event, it is likely that many students, especially low achieving ones, will make little progress in such games. Telling students to "try another strategy," as in WUMPUS, is unlikely to be of much benefit to a confused or misguided student.

A second problem with WEST and WUMPUS, which is more evident in SCHOLAR, is the assumption that the student will somehow integrate what they experience into an overall, coherent framework. Ostensibly, SCHOLAR is designed to advance a student's knowledge of geography by allowing him or her to probe a database (structured in a semantic net) using a limited natural language interface. Yet Carbonell's (1970) examples show a student merely inquiring about and retrieving isolated facts (e.g., What is the capital city of Chile? What is the population of Brazil? What is the area of Paraguay?). Beyond the technical descriptions of the program and how the knowledge is internally structured, there is no indication that this information is presented to the student in any way that rises above the factual level. It is not evident how the student *integrates* this assortment of facts. Even if students were to ask broader, more categorical questions (e.g., What cities in South America have a population greater than one million?), it is doubtful if we would see a significant improvement in student learning. This kind of searching, typical of a relational database, would still leave the student to integrate the material into a synthesized framework so that it could be used in more demanding application exercises. Thus, it appears that a well-structured knowledge base and a natural language interface by no means assure a useful ICAI system as some have claimed (e.g., Duchastel, 1986).

Sophisticated tutoring interactions, apparently absent in SCHOLAR, appear with considerable force in the WHY program. Here the intention is to teach basic scientific information (the rain cycle in this case) in a Socratic fashion, as well as preserve several "mental models" of the same subject matter as advocated by Ohlsson (1986). WHY presents a careful series of counterexamples (i.e., cases where the student's current model of the rain cycle does not apply) in the effort to test the strength or validity of a student's conceptual model, always attempting to refine it when necessary. In doing so, the counter-examples act as feedback to the student, thus shaping a more appropriate, complex conceptual model. By building on paradoxes and contradictions, systems such as WHY attempt to press the student's current understanding of the material, thus leading to a greater integration and generalization of knowledge (Dede, 1986).

It is no surprise that WHY's designers place considerable emphasis on student errors and misconceptions. Beyond the challenge of diagnosing misconceptions, they are a direct and inevitable byproduct of the instructional principles used in the system. *By continually presenting students with new and often contradictory information, most students should become confused.* It is quite likely that many students will soon find this kind of interaction bewildering. Essentially, does it really make sense to base instruction on an array of different mental models if a substantial amount of instructional time and confusion is the result?

Of the ICAI systems reviewed above, only two seem to have a firm educational basis. The reason for this is quite sensible. SOPHIE and GUIDON present challenging problems that are *predicated on a mastery of basic facts and concepts in well defined subject areas.* Unlike the other systems reviewed, students are at relatively advanced stages of instruction when they encounter the problems and are thus able to concentrate on the problems, not having to sort out or derive important facts and concepts at the same time. Students have mastered the necessary, antecedent knowledge (prerequisite skills) that underlies domain-specific problem solving (cf., Glaser, 1984). To some extent this is truer of GUIDON than SOPHIE. Following a test of SOPHIE III (Brown, Burton, & DeKleer, 1982), the designers noted that a longer period of basic instruction, among other things, would have led to a higher level of knowledge acquisition. The value of using ICAI systems with advanced learners was recently noted by Duchastel (1986),

> As a tentative generalization regarding the sophistication of the learner, it could probably be hypothesized that the more mature and knowledgeable a learner is with respect to the contents of the system, the more learner control will be enjoyed and found productive. The less mature or less knowledgeable learners, on the other hand, will more likely profit from greater system control (p.391).

Most ICAI systems that we have described can be best appreciated by their computational techniques, not by their instructional principles. Even though education is a fertile area for artificial intelligence techniques, it in no way follows that ICAI systems automatically embody optimal instruction. This should be somewhat obvious, because the human tutor -- the very element that ICAI programs model -- isn't necessarily a well-trained or competent instructor. The suggestion, for

Table 1 -- continued

WUMPUS (Goldstein, 1982) is a much more elaborate game, one that attempts to teach logic, probability, decision theory, and geometry (Barr & Feigenbaum, 1982). The object of the game is to hunt the monster WUMPUS in a warren that is replete with caves, bats, and pits. Students use this information to infer where to move next in the warren until they finally discern the location of WUMPUS and slay him with arrows. There are hundreds of rules associated with the game and over many plays, the tutoring component coaches the student, leading him to more economical rules or generalizations for playing WUMPUS. As with WEST, when students are stuck or exhibit consistent misconceptions, the tutor intervenes and provides various hints and suggestions. The developers of WUMPUS have paid considerable attention to the types of explanations offered to students as they move through three phases of performance toward an expert level of play. Depending upon the student model, students are given analogies, generalizations, or inductive explanations. WUMPUS is somewhat unique as the expert module, student model, and tutoring component are all well developed.

GUIDON and SOPHIE. These differ from the previously described systems insofar as they offer problem solving environments for relatively sophisticated users. Both systems have advanced expert modules that direct the student-machine interactions. GUIDON (1982) is most unique in this respect as it capitalizing on the expert system MYCIN (which diagnoses infectious diseases) and teaches diagnosis skills to medical students. The communication module allows the user to request more information about the patient and the student can even explore the reasoning used to derive a particular diagnosis. The system keeps track of a student's curriculum outside of the system and presents diagnosis problems related to the curriculum and the tutoring component, which is designed to be sensitive to student knowledge, will often quiz or pretest a student before it proceeds with tutoring.

SOPHIE (1982) offers a similar experience for electronics students who are given challenging problems in debugging problems with circuits. The expert evaluates student hypotheses about faults in the circuit and an "articulate" expert can model the solution or even explain the nature of the problem. The second version of SOPHIE was weak in modeling student misconceptions (Barr & Feigenbaum, 1982). Also, SOPHIE's relationship to a fixed curriculum is less clear. In any event, the system presupposes that students have a basic background in electronics and circuit design.

BUGGY. Finally, BUGGY (Burton & Brown, 1976) is designed solely as a diagnosis tool. The sole intent of the system is to model student errors or "bugs" in subtraction problems. The expert module in BUGGY includes both correct and incorrect subprocedures in subtraction problems, thus allowing it to simulate possible ways in which a student could solve a problem. The system generates a series of problems and then attempts to explain why the student made the mistake based on the assumption that the student is following a systematic misconception of the subtraction process. BUGGY does not contain any kind of tutorial that attempts to remedy bugs once they are detected.

Continued on Page 10

example, that the tutor constantly shift its tutoring strategies in the attempt to meet hypothesized student learning styles (e.g., from diagrams to analogies to broad hints) may be the *cause* of poor learning.

The success of a contrary tactic -- one that relies on carefully-designed and field-tested curriculum, sound and consistent teaching strategies, and a very pragmatic sense of what works in a classroom-- will be presented in the three studies that follow. Finally, the article describes how the content analysis and design approach could employ AI techniques embedded in WUMPUS, SCHOLAR, WEST, etc., and where AI techniques can improve the teaching of content specific and generalizable knowledge.

The Content Analysis and Design Approach

Figure 1 pictures a different approach to instruction than that found in WEST, WUMPUS, or even BUGGY. As a research based approach predicated on a detailed theory of instruction (Engelmann & Carnine, 1982), this diagram shows how *different kinds of knowledge* can be taught over time. Ideally, students progress from a rudimentary foundation where they master basic facts and concepts to increasingly refined applica-tions of this information in problem solving situations. Initial instruction promotes "near transfer" to a controlled set of examples quite similar to those presented during instruction. Explicit rules and strategies are crucial to this approach, guiding students from what might be isolated information -- the main problem with SCHOLAR -- to a more complex understanding of how these facts and concepts fit within a given model or theory (e.g., chemical bonding, the rain cycle, rate problems in algebra). The teaching of the facts and concepts underlying an understanding of rainfall was the critical element of instruction missing in WHY.

To a large extent, ours is a linear orientation, at least as far as we assume that the student should be taught -- and master -- preskills before new and more complex knowledge is presented. Eventually, artificial intelligence techniques could be applied when students encounter challenging problems that enhance "far transfer" to problems quite different than those found in initial instruction. Clearly our view of instruc-tion favors domain-specific problem solving rather than the broader, metacognitive style of instruction implicit in WEST and WUMPUS. It is not that the latter form of instruction is invalid, but that metacognitive skills are exceedingly difficult to teach (Deshler, Schumaker, & Lenz, 1984; Glaser, 1984; Wagner & Sternberg, 1984; Tarver, 1986).

What follows are brief descriptions of three studies that represent a range of primary delivery models -- videodisc, teacher, and computer. The success of the curriculum in each study was dependent on the initial structured teaching as a method for allowing students to master antecedent knowledge. With the assistance of teacher modeling and explicit strategies, students were eventually guided toward more generalized problems. It is the initial phase of instruction (e.g., structured teaching) that prepares students for more generalized applications to knowledge that is frequently ignored, overlooked, or underestimated by many current ICAI designers.

Three Studies in the Generalized Application of Knowledge
Videodisc Instruction in Fractions

Kelly, Carnine, Gersten, and Grossen (in press) taught basic fractions concepts to remedial and mildly handicapped secondary students. The study extends a carefully controlled experiment conducted by Carnine (1980) which demonstrated how a limited range of examples can cause students to form misconceptions, and another study by Kameenui, Carnine, Darch, and Stein (1986) that compared a basal approach to introducing fractions with a content analysis and design approach. In the present work, students learned fractions concepts either through a traditional basal program (*Mathematics Today* by Harcourt Brace Jovanovich) or with *Mastering Fractions,* a videodisc program by Systems Impact.

Mathematics Today was chosen from four widely used texts because it was most similar to the videodisc program in terms of four aspects of curriculum design: review procedures, discrimination practice, example selection, and the use of explicit strategies. Although there were similar components in the two approaches, the details of the two programs were quite different. The videodisc program is based on the content analysis and design approach described by Engelmann and Carnine (1982). It provided: (1) dispersed, shorter periods of independent work, (2) more comprehensive review on a daily basis, (3) explicit strategies, (4) a full range of examples, and 5) carefully planned discrimination practice between frequently confused strategies (e.g., multiplication and addition), and a separation in time of easily confused labels.

The 28 subjects who participated in the study were screened for mathematic knowledge and then randomly assigned to one of the two approaches. After ten days of instruction at 30 minutes per day, a criterion reference test was adminstered. Three weeks later, a parallel form maintenance test was administered. A 2 x 2 ANOVA was performed on the scores, showing significantly higher performance by the videodisc treatment on both tests ($F = 17.28$, $p < .001$, for the instructional method and $F = 4.53$, $p < .05$, for time of test). Patterns of student errors confirmed the importance of the specific differences between the programs.

In the basal program, students had to discriminate addition problems from subtraction problems, and multiplication problems from division problems, but never addition from multiplication. These problem types are often confused in that students erroneously generalize the operation for computing the denominators in multiplication (e.g., __/3 x __/2 = __/6) to cases of addition (e.g., __/3 + __/2 = __/5). The National Assessment of Education Progress (Lindquist, Carpenter, Silver, & Matthews, 1983) found that only one-third of U.S. seventh graders could add 1/3

Continued on Page 11

and 1/2 correctly. In our study, students in the basal treatment made four times as many strategy errors, such as adding unlike denominators, than did students in the videodisc treatment. In the videodisc treatment, students received demonstrations and extensive guided practice in discriminating addition from multiplication problems. This parallels the results of the Carnine study (1980) cited earlier and clearly demonstrates how initial misconceptions directly related to instruction can present major problems for learners as they progress through the curriculum. It portends the problems likely to occur with ICAI systems such as WUMPUS, WEST, or WHY. Furthermore, it is doubtful that these misconceptions can be corrected through a few counterexamples or broad hints, or by shifting tutoring strategies. By initially controlling instruction through example selection, explicit strategies, etc., students are better prepared to tackle problems that require far transfer of learning, as in prealgebra word problems. This antecedent knowledge, then, is the foundation for the eventual shift to student controlled learning as portrayed in Figure 1.

Strategies for Reading Comprehension

One of the central concepts that has emerged from the work of the Institutes for Research on Learning Disabilities is that learning disabled students have not acquired efficient strategies for processing information (McKinney, 1983). This observation is especially true when these students are required to "actively" comprehend long passages or short stories on their own. Unlike cases where students respond to literal or inferential questions about a particular sentence or paragraph in a story, students must construct images, descriptions, and summaries that cover the entire story.

One approach that has had demonstrated success with non-learning disabled students is schema theory (e.g., Mandler & Johnson, 1977; Thorndyke, 1977). A recent study by Carnine and Kinder (1985) attempted to assess the relative effectiveness of teaching remedial and special education students to answer and ask schema-based questions (Singer & Donlan, 1982).

Twenty-seven intermediate remedial and learning disabled students who met criteria on a screening test were selected for this study. The two groups of subjects were randomly assigned to schema training or a comparison method. Narrative and expository prose passages were devised for both groups.

In the schema treatment, teachers were more directive in focusing students' attention on the structure and key elements of the narrative stories and expository passages. For narrative stories, the schema-based questions highlighted a story's structure by asking about the central characters, their goals, obstacles to reaching the goals, and a resolution. Students were repeatedly asked, "Who is this story about?," "What is he or she trying to do?," "What happens when he or she tries to do it?," and "What happens in the end?" In expository passages, the schema techniques were modified and students were taught to extract a key principle from a passage (e.g., "Liquids and gases move from places of high pressure to places of low pressure"), apply the principle to examples in the passage, and use the principle to construct new examples.

In the comparison group ("generative training"), a procedure was developed involving student-generated imagery, students' verbal descriptions, and summary statements of the passages. At key points in the story the teacher would say, "Close your eyes and make a picture. Tell me what has happened in this part of the story." At the end of the story, the students summarized the entire story. The same procedure was used for the expository passages.

Over the series of training sessions on materials (10 on the narrative and 9 on the expository), teachers followed carefully designed scripts. Each day, teachers read a narrative story aloud and asked questions, followed by a group reading of the story and finally, one silently read story. For the expository materials, only one passage was read each day. The teacher for each group introduced activities by reminding the students of the appropriate questions (e.g., "In each action story, we ask four questions ...") or strategy (e.g., "Remember, close your eyes and make a picture."). In both groups, teachers responded to errors by modeling the correct answer.

On the posttest, new selections were presented with no assitance from the teacher. The intent was to prepare the students to monitor their comprehension of new material. A planned comparison on the overall effect of training (pretest versus the posttests) was significant, $F(1,20) = 14.8$, $p < .001$ for the narrative tests and $F(1,20) = 102.1$, $p < .001$ for the expository test. Post hoc tests revealed a significant difference on the maintenance test. These analyses indicated that scores on comprehension material dramatically improved after training.

This study again demonstrates the importance of concentrated, carefully designed instruction in the initial stages of learning a complex set of skills. The students' near mastery levels of performance over the short intervention time of this study can be attributed to a precise application of strategies across a range of examples, teacher modeling, and the teacher's use of the instructional strategies to correct errors.

Problem Solving in Health

Some educators (Doob, 1972; Greenblat & Duke, 1975; Budoff, Thornmann, & Gras, 1984) have suggested that one way to enhance the higher order skills of students is through educational simulations. A recent study conducted by Woodward, Carnine, & Gersten (in press) combined conventional instruction with a computer simulation designed according to content analysis and design principles. One main interest in the study was to see how this combination could enhance secondary-level instruction, not only in terms of their effect on basic fact and concept retention, but as they relate to higher-order skills.

Thirty mildly handicapped high school students were randomly assigned to either the conventional or simulation condition. Students were also selected on the basis of Metropolitan Achievement Test reading comprehension scores. Only those who had, at a minimum, a sixth grade reading level or were at least two years below grade level in comprehension were selected for the study.

All students were instructed for 40 minutes per day for twelve 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. Students were taught to mastery on basic health facts and concepts (e.g., What is cholesterol?, Which foods should a diabetic avoid?).

At the end of the initial instruction, students separated into two groups - one treatment 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 activities.

Simulation students, on the other hand, were taught in a computer lab, each student working individually at a microcomputer. The twelve day course of instruction for these students was broken into three phases: (1) initial modeling by the teacher on playing the game (three days), (2) guided practice on three simulation gameswhere the teacher gave directive feedback on individual performance (two days), and (3) independent practice with occasional feed-back from the instructor (seven days). This explicit strategy was critical to using this particularly complicated simulation. It also functioned as a mechanism for integrating information taught in the group session into the simulation activities.

Following the intervention, all subjects were given a 30-item short-answer test covering basic facts and concepts. This test was readministered two weeks later. A 2 x 2 ANOVA indicated a significant effect only for those ten items on the test that were reinforced in the simulation ($p < .01$).

Students were given an individually administered test that measured health related problem solving skills (i.e., detecting important health problems facing an individual, identifying and changing related health habits, and controlling stress as it increased due to the health changes). A significant difference between the two groups ($p < .001$) 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.

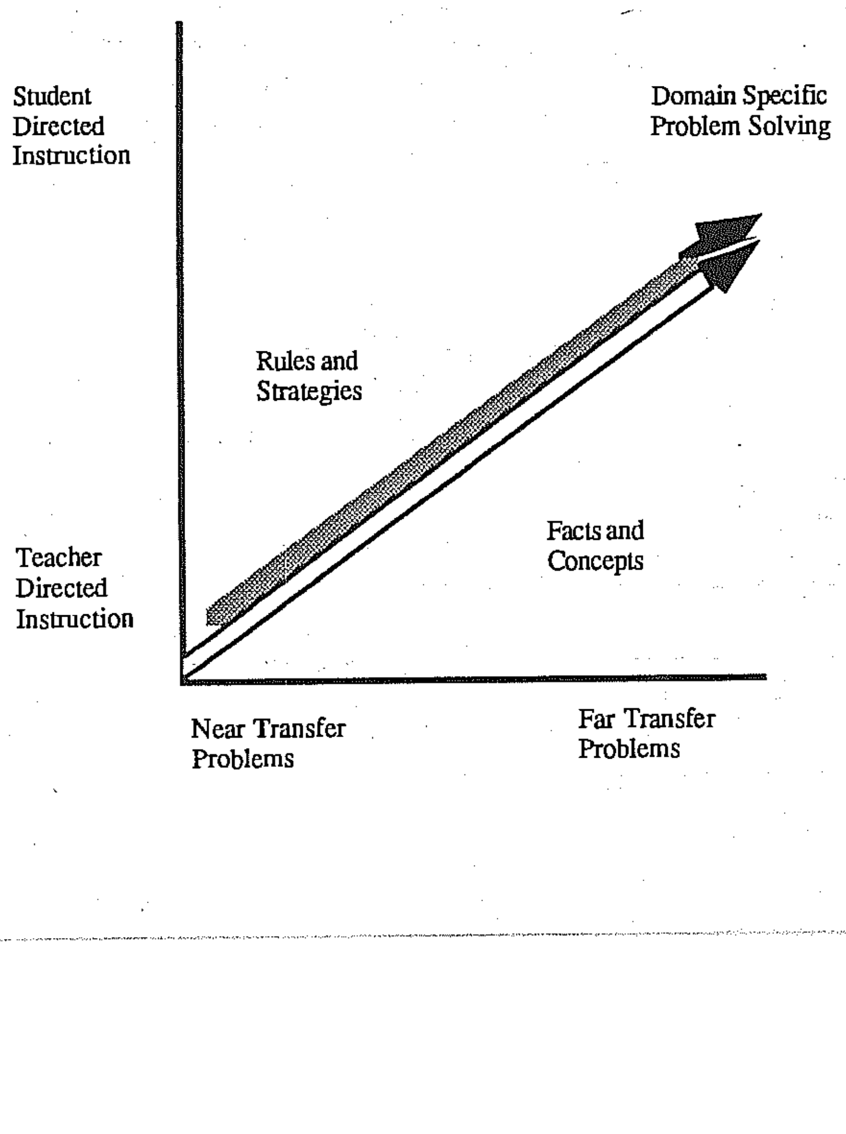
The results of this study support the use of computer simulations in conjunc-tion with a written curriculum in present-ing material not easily taught by traditional means. Furthermore, the explicit strategy allowed the experimental students to integrate and master fundamental or antecedent knowledge before they played some of the hardest simulation games. In this sense, explicit strategy instruction was a successful bridge to the activities required for complicated profile analysis.

Artificial Intelligence Techniques and Education

These studies all show the very positive effects of careful use of content analysis and design principles. In each study, students not only learned fundamental knowledge (e.g., addition versus multiplication of fractions, key elements in narrative and expository passages, foods that lead to an increased chance of heart disease), but they began generalizing this knowledge in problem solving exercises This kind of instruction, which is particularly effective when goals are clearly specified, is suited to well-designed CAI (Duchastel, 1986) and direct instruction.

When students move toward exercises that demand increasing levels of generalization (i.e., where there is greater complexity and more distracting information), artificial intelligence techniques become much more viable. It is not that the instructional goals are any less clear, but that the context supports a much higher degree of learner control as shown in Figure 1. In fact, aside from providing important practice on generalizing facts, concepts, and strategies previously mastered, students are in a better position to apply metacognitive techniques to the subject matter. More will be said on this topic shortly.

Figure 1



Continued on Page 12

ICAI critique -- continued from page 11

For the moment, let us re-examine our prealgebra word problem example described earlier. It now appears that each ICAI component -- the student model, expert module, tutoring component, and communication module -- varies in potential usefulness. There are several reasons for this, especially as instruction that uses the content analysis and design approach is less reliant on the student model than many of the ICAI systems mentioned in this article.

Work in prealgebra word problems would be preceded by a mastery of fractions (computation and word problems) and explicit strategies for solving a limited set of prealgebra problems, thus encouraging near transfer of learning. Should students err, these strategies are the immediate reference point for corrections. Over time, learners make less errors because of our attention to well-chosen examples (i.e., ones that dem-onstrate the range of application without inducing misconceptions) and a persistent emphasis on the strategies. By carefully controlling instruction in its initial phases, we better prepare students for success when they encounter more challenging problems later.

All of this has considerable implications for three of the common ICAI components. As we have said in our earlier description, the expert module would contain the algorithms for solving the problem. These algorithms would parallel the explicit strategies taught to the students. Even further, these strategies would be woven into the modeling and tutoring components of the system. Student performance over time (i.e., the student model) would be gauged in light of these strategies and they would form the basis of corrections and remedial tutoring. The ability to track student performance over time (or a large set of examples) is one of the distinctive characteristics of ICAI systems, something that makes it clearly superior to CAI programs. As a coaching strategy, it is a powerful means for student focused, directed learning (Dede, 1986).

This concept of instruction is very unlike the assumptions behind a program such as BUGGY. That is, rather than search for the "ultimate" reason for a student's misunderstanding, which is potentially an impossible task given the uniqueness of of a student's erroneous strategy (or the more likely occurence -- there is no pattern to a student's mistakes), errors are evaluated in respect to past instruction. It appears that ICAI advocates (e.g., Burton & Brown, 1976; Ohlsson, 1986) muddle a learner's patterned, systematic misunderstanding of a concept with simple confusion, which is indicated by highly inconsistent responses. In their quest for a final account of subtraction "bugs," Burton and Brown (1976) not only reveal how difficult it is to account for the sheer number of types, but gloss over those many occasions where there is no "type" of error at all to be found. Nonetheless, we regard errors not only as a byproduct of instruction, but the instruction serves as a logical reference point for correcting these errors.

In using an ICAI system to teach prealgebra word problems, the communication module would make the most unique contribution. As students break down word problems, they often encounter difficulties translating certain portions of the problem or determining the most relevant information. Even competent students experience these difficulties, especially when the word problems contain a high degree of distracting or irrelevant information. A limited natural language interface, perhaps like the one used in SCHOLAR, would permit students to ask about story problems in three ways. Returning to our example earlier, students could: (1) ask for clarification ("Rephrase the second sentence in the problem") (2) ask for more information ("What is a linear yard?"), or (3) ask for help ("I don't understand what the problem asks, please help"). This communication module would enable students to concentrate on the central difficulties of a word problem because we assume that at this point in instruction, students will have mastered the rules for constructing the prealgebra equation, computational techniques needed to complete the problem, and the translation of easier word problems that are amenable to a consistent strategy. Again, this cumulative view of instruction -- one predicated on careful example selection, practice, and mastery -- is unlike the instructional assumptions found in WEST or WUMPUS.

As we can see, ICAI techniques can be useful in guiding students as they tackle challenging problems in a specific content domain. The communication module appears to be particularly beneficial, not just in the ways mentioned, but as a way to facilitate more general, content independent problem solving. Asking for more information, recognizing that one does not completely understand the problem, etc., are metacognitive techniques that apply to a wide range of problems.

Ten years ago Joesph Weizenbaum (1976) characterized AI research as a field of inquiry that had fixated on a series of "lamp post" problems. Like the drunk at night who looks for his lost keys under the light of the lamp post -- not because he that's where he lost them, but because that's where the light is best -- AI researchers had distorted complex problems of human cognition (e.g., vision, problem solving, natural language) so that they could be "reproduced" in computer programs. This is a broad and perhaps exceedingly harsh view of AI research today. As we have said, the AI techniques that have been incorporated in popular ICAI programs have promise.

The problem with many of these programs is that they suffer from a variant of Weizenbaum's (1976) "lamp post" problem. It is not that they have tried to solve only a limited set of problems as much as they have been unduly influenced one kind of instructional philosophy. What must be distinguished are the viable AI techniques from the often dubious notions of discovery learning and multiple student models. What must be acknowledged is the importance of mastering antecedent knowledge before the student encounters complex and challenging problems -- ones that promote generalization and, to some extent, metacognition. It would seem that AI techniques, when linked to content analysis and design principles, could contribute greatly to higher order instruction.

References

Editor's Note: A complete set of references may be obtained by writing to The Editor, ADI NEWS P.O. Box 10252, Eugene, Or. 97440

Coaching Athletes- continued from Page 1

Effective Procedures

Point 4 (above) -- use effective procedures -- is the heart of the matter. The rest of this article summarizes some research-based procedures.

Use of Reinforcement

The principle of reinforcement is central to all good teaching, including coaching. In working with youth and adolescents, let them know when they have done a good job. Praise from a coach of the same sex is not a problem for high school youth. They appreciate it. However, dishing out verbal punishment for a poor performance may only make the matter worse. It is likely to upset the athlete and make it harder to do better. When mistakes are made, focus on how to do it the "right way." *Demonstrate, guide,* and *encourage.* "Do it this way, and you'll get it. The important thing is to keep trying." With a positive approach, you show your players that you respect them as individuals. With good demonstrations and instructions, you earn their respect as a teacher.

Just as the regular classroom teacher does, the coach needs to survey the reinforcers available to him or her. Beyond positive attention and praise, consider how to effectively use the following possible reinforcers:

- Improving times, scores, etc. Post them; chart them; talk about them.
- Improving skills that may not show in times, scores, etc. Give frequent feedback on improvement in component skills.
- Getting public attention in newspapers, on TV, on radio. Be sure the news gets out.
- Getting awards.
- Getting to travel with the team.
- Getting playing time or participation time in practice and in competition.

In talking with athletes, remind them about some of the good things that hard work can produce. And, when special goals are reached, call them to the attention of the group and of individuals.

Cracklen and Martin (1983/84) studied the effects of using reinforcers in swimming training. They had 8-13 year old swimmers earn the opportunity to participate in relay races at the end of practice by: (1) improving the frequency of racing turns made in practice, and (2) by reducing the number of stops made when doing a practice set (e.g., 4 - 100 yard backstrokes). This reinforcer produced a dramatic drop in the inappropriate practice behaviors.

Attendance Boards and Program Boards

McKenzie and Rushall (1974) developed a board which permitted a group of 16-year-olds on a swim team to self-record their attendance. A large waterproof board was constructed on which the swimmers could check each attendance at practice. There was also space for each swimmer's best consecutive record and current attendance record. When a student was absent, all of his/her check marks were erased and s/he started over on a new "string." Use of the board reduced absences by 45 percent. Part way through the study, coming late or leaving early led to a failure to earn an attendance check that day. Under this condition, late arrivals dropped 63 percent and early leaving stopped all together. The attendance board proved to be very motivating. The team was very enthusiastic about the use of the board. After 11 months, the record attendance was over 130 consecutive days.

In another study with 8 boys and girls aged 9 to 16, McKenzie and Rushall used 3 by 2 feet "program boards" to cue swimmers as to what they were to do next in their training program. Transparent pockets at the top of the boards could receive "work-unit" cards that specified an activity (e.g., do four 100 yard freestyle sprints). The training could be altered from session

Continued on Page 13

Coaching Athletes- continued from Page 12

to session by changing cards. A row at the top also indicated cumulative laps swum after completion of each task on the board. Students made check marks under the appropriate work-unit card beside their name when they completed work-unit. They could then look to find out what was up next.

This study went through a baseline condition (with the usual coaching procedures) and then using the program board. Each condition was repeated a second time. The number of laps per minute swum increased by 23.9 percent for the four boys and by 30.6 percent for the four girls. This is an average increase of 619 yards per session for each swimmer. With the program boards, the swimmers were totally self-directed. They knew what they were suppose to do and did it. They no longer had to gather in groups and wait for instructions. Also, the coaches were more readily available for coaching, not just managing.

Careful Analysis of Performance Requirements

Komaki and Barnett (1977) studied the effects of breaking football plays down into their component parts with a football team of 9- and 10-year olds. Three different plays that were frequently run were each broken down into a series (chain) of five stages, and then each stage was carefully described in behavioral terms. Training was provided to the offensive backfield and center.

The team had one game and three practices each week. Three different plays were selected by the coach. All ran off the wishbone set. The plays were introduced one at a time in a multiple-baseline design. First, the option play was taught by the new method, then the power sweep, and then the off-tackle counter. The detailed de-scriptions specified exactly under what stimulus conditions (Sd's) what was to be done. Checklists were used to evaluate execution of the plays. Observations were made for 7 games and 17 practice sessions.

At the start of the season, each player received a playbook with diagrams to commit to memory (about 30 plays). About half of each practice was spent on scrimmage where plays were practiced. The backs would go through the plays and the coach would offer suggestions from the sidelines. This typical procedure was used during the baseline phase of the experiment. Each step was explained, demonstrations were given, and the backs walked through the play by themselves. Praise was given for good performances.

The percentage of stages correctly executed increased from 61.7 percent to 81.5 percent for play A, from 54.4 percent to 82 percent for play B, and from 65.5 percent to 79.8 percent for play C. In baseline, plays were executed perfectly (all 5 stages correct) only 2 times out of 84. During the experiment, perfect plays increased to 22 out of 89. The quarterback showed a dramatic increase in correctly deciding when to "keep" and when to "pitch" on the option play.

The coach had difficulty at first in analyzing the components of some of the plays (as teachers do in analyzing components of a complex task). Once this had been accomplished, however, he was in a better position to instruct his players. The players found the checklists intriguing and held many discussion over the fine points.

Allison and Aylion (1980) applied a similar systematic behavioral approach to coaching in teaching blocking by football linemen; in teaching of backward walk-overs, front handsprings, and reverse kips in gymnastics; and the forehand, backhand, and serve in tennis. The correct action for each skill was first carefully described in all its components so that reliable judgments could be made by observers about their execution. After a baseline of typical coaching (which the research report describes for each sport), the following five-step procedures was used as the experimental procedure for each study:

1. The athlete was instructed by the coach on how to execute the performance and the athlete would do it.
2. If the task was executed correctly, the coach allowed it to proceed and reinforced the athlete.
3. If the coach saw an error, the coach blew a whistle or said "freeze","don't move", etc. The athlete had been instructed to stop and hold that position (when that was possible). The freeze position was held while the coach described the incorrect position (e.g., "Your feet are too close together. You can't get any power in a block that way.").
4. Next the coach modeled the correct procedure.
5. Finally, the athlete imitated the model while the coach described what was now being done right.

With behavioral coaching, the percent of correct of blocks made by five players was ten times greater than in baseline, increasing on the average from under 10 percent correct to 50 to 70 percent correct. A similar effectiveness of behavioral coaching was found with six teenaged gymnasts, and in tennis, with 12 college students. The freeze procedure drew negative comments from the football players, suggesting it was a little embarrassing. Also, it was hard for gymnasts to hold some positions. However, the tennis players thought it really helped them learn the strokes. All three coaches were impressed with the behavioral coaching procedures and said they would continue to use them. The football coach thought it should become an "integral part" of teaching the basics.

Using More Telling Statistics

Heward (1978) applied a reinforcement procedure to a barnstorming baseball team--the Indianapolis Clowns, who were once members of the Negro American Baseball Team. The manager posted a sign in the dugout at mid-season telling the team he was starting a new program "HIT FOR MEAL MONEY." They could earn a pot of $10 a week, $5 for first place, $3 for second place, and $2 for third. Players were to be rated for their efficiency average (EA), a new statistic. Hits, runs, RBI's, walks, sacrifices, and hit by pitched ball all count as single points for the EA. Total points are divided total times at bat to get the EA.

Under this reinforcement condition, EA increased from .681 to .831 and runs scored increased from 5.21 to 7.36 per game. Perhaps, it was not surprising that the number of hit batters increased from .179 per game to .357. This seems too much to be produced by a $10 reinforcer! Other variables were likely operating. The team liked the statistic. To think of your EA as .800 instead of having a batting average of .250 would likely be a good feeling. The EA statistic better reflects the contributions of team members toward winning a game. Also, there seemed to be a lot of side-betting going on among team members that added to the "action." After the EA game was terminated, the players them-selves kept calculating EA's and posting them in the dugout.

This study suggests that it might be beneficial to think about different ways of producing statistics that might have more reinforcement value for the players. The critical question is: "What point system would best reflect a player's contributions to the team?"

Applications of Cognitive-Behavior Modification

A number of sports psychologists have been working with athletes to help them control what they think about before and during competition as a means of improving performance. Martin and Hrycaiko (1983) report five such studies covering applications to a football kicker (Titley, 1976), karate performance (Weinberg, Seabourne, & Jackson, 1981), golf (Kirschenbaum & Bale, 1978), cross country ski racing (Gravel, Lemieux, & Ladouceur, 1980), and tennis (Desiderato & Miller, 1979). This work holds much promise for the future.

1 Adapted from W.C. Becker, *Applied Psychology for Teachers: A Behavioral Cognitive Approach.* Copyright, Science Research Associates, 1986. Reproduced with permission of the author.

References

Editor's Note: A complete set of references may be obtained by writing to The Editor, ADI NEWS P.O. Box 10252, Eugene, Or. 97440

SchoolWriter

Continued from Page 7

is somewhat awkward and tedious, particularly if the file is double-spaced. Additionally, the delete key only removes one letter at a time and, consequently, to erase a few lines, one must either hit the delete key repeatedly or return to the main menu and execute a *block delete*. Finally, one cannot print double-spaced text and single-spaced text within the same file.

SchoolWriter is designed and intended for classroom instruction and contains only those functions that are most frequently needed for writing in school. Brenda McDowell, a junior high computer instructor, field tested this program and reported that the activities disk and *Student Manual* were easy to use in a lab with LD, remedial, and bilingual junior high students. Students with some background in word processing were immediately off and printing.

SchoolWriter is a comprehensive, easy-to-teach, word-processing package. Aptly described, the program is advertised as "a sophisticated first word processor for the student writer" that will produce as scholastic- or professional-looking a document as a printer will deliver. As we all know, a word processor is just a writing tool: SchoolWriter can print as scholarly a report or as creative a short story as a student can produce.

Nancy Mather *received her Ph.D. in special education from the University of Arizona. She is now Adjunct Assistant Professor in the Department of Special Education at the University of Arizona. Current professional interests include adapting special education methodology to the regular elementary classroom and training in the use of the Woodcock-Johnson Psychoeducational Battery. Address: Nancy Mather, Ph.D, College of Education, Department of Special Education, The University of Arizona, Tucson, AZ 85721.*

Teaching Effectiveness and Tolerance for

by Russell Gersten[1]
Hill Walker
University of Oregon

Craig Darch
Auburn University

In the past decade, a host of studies have explored the relationship between teachers' expectations and student achievement. In a recent review of this literature, Good asserted that "every research effort that has examined the relationship between student achievement and teacher expectations has yielded positive relationships" (1981, p. 419).

In the classic explorations of successful inner city schools, both Edmonds (1979) and Brookover (1981) found that teachers (and administrators) in these schools demonstrated consistently high expectations for students in both academic and social/behavioral domains. Recently, there has been a concurrent move in inservice education programs to stress high expectations (e.g. Clark and McCarthy, 1983), and to urge teachers to increase their standards and expectations in the hope of raising student achievement.

However, there is a curious irony associated with this issue that has never been brought into the forefront. This issue may partially account for the negative experiences of many handicapped children who have been integrated into regular classrooms as part of P.L. 94-142 (Gresham, 1982). Might not the most successful teachers, those with the highest expectations and standards for their students, tend to resist placement of a child with obvious behavioral or learning problems, social skill deficits, or other atypical characteristics? Such children are typically perceived as difficult to teach, demanding of teacher time and resources, and as having low potential achievement levels (Semmel, 1984; Gerber and Semmel, 1984).

The obvious, direct route to exploring this question would be to unobtrusively record occasions when regular education teachers actually resist placement of handicapped students in their classrooms, and then determine the relationship between these instances of rejections and teachers' performance. However, this would be neither a feasible nor an intelligent route to take. For one thing, rejection of placement of a handicapped student in a regular classroom is rarely a clearcut "black and white" public event. A range of polite, but subtle evasions often enter into the picture. Teachers are usually indirect and sometimes evasive in such situations, perhaps suggesting the child "really would do a lot better in the room across the hall" or alluding to how the teacher cannot find an appropriate reading group for the student. For this reason, researchers such as Ysseldyke and his colleagues (Ysseldyke & Thurlow, 1983; Thurlow, Christenson & Ysseldyke, 1983) resorted to studies where in teachers are asked what they would do if a child with a certain problem (e.g., a drooler or a well-behaved charming child who read well below grade level) were placed in their class. Ysseldyke and colleagues analyzed possible determinants of these simulated decisions. Ysseldkye & Thurlow argue that teachers who anonymously tell a researcher that they will actively resist placing a problem child in their classroom will more likely to do this in practice. This simulation approach underlies the two studies discussed in this paper.

These studies explore the relationship between teachers' social behavior standards (SBS) -- that is, their statements about social behavior standards that would lead them to resist placement of a child in their classroom -- and their observed teaching performance.

Study 1 focuses on observations during math instruction in elementary classrooms in a middle-income community. Study 2 was conducted in two low-income, low-achieving schools and assessed the effectiveness of teachers' overall performance, with a particular emphasis on behaviors linked with effective instruction for low achieving students, i.e. -- the set of effective teaching variables isolated by Brophy and Good (1986) and Englert (1984).

Study 1

The first study was conducted by Walker and Rankin (1983) and explored the issue of teachers' resisting placement of handicapped students in less restricted settings (Walker, 1984). Two self-report instruments were used: (a) the SBS Inventory of Teacher Social Behavior Standards and Expectations, and (b) the SBS Checklist of Correlates of Child Handicapping Conditions (Walker and Rankin, in press). These self-report measures assessed: (a) which student adaptive behaviors teachers deemed essential for successful functioning in the classroom (the *Expectations* scale), (b) which student maladaptive behaviors would preclude admission to their classroom (the *Tolerance* Scale), and (c) the number of characteristics for which the teacher would actively resist placement (the *Resistance* scale). These scales are described in more detail later in Study 2. Because of the low ratio of predictor variables to number of subjects in this study, these results were deemed as only exploratory. Scores on these measures were correlated with teachers' observed instructional behavior and their teaching performance during mathematics lessons. Multiple regression procedures were used in this analysis, with the three self-report scales treated as predictor variables and observed teaching performance measures as the criterion variable. Forty-three elementary teachers in a middle-income community (Eugene, Oregon) completed these measures.

Teachers were observed while teaching math during two separate math classes. The two sessions averaged a total of 70 minutes of observation per teacher. Data were recorded by professionally trained observers using Walker's *SBS Teacher Observation Code*. This code is also described in more detail in Study 2.

Table 1 presents the teacher performance variables for which significant multiple R's were found with the three SBS self-report measures. The magnitude of the multiple correlation's are in the low-moderate range. They suggest a pattern of teacher behavior consistent with the literature on effective teaching (Brophy & Good, 1984). The pattern found is similar to what Rosenshine (1983) calls direct instruction; Good, Grouws, and Ebmeir (1983) call active teaching; and Englert (1984) and Rieth and Frick (1982) have identified as teaching behaviors associated with strong academic growth for mildly handicapped students. Both Rosenshine (1983) and Good et al. (1983) have reported that more effective teachers ask a higher proportion of product questions (i.e., questions with clearcut right or wrong answers), that they give clear signals and directions to elicit students' attention, and that they actively monitor seatwork. All of these aforementioned variables were found to be correlated with the SBS scores in the Walker and Rankin (1983) study.

Table 1. Significant Multiple Rs Obtained Between Three SBS Measures (Expectations, Tolerance, Resistance) and Teacher Code Observation Categories (Adapted from Walker & Rankin, 1983)

Code Category and Lahel Definition	Multiple R
1. Product Questions: Requires knowledge, choice or recall response from students.	$.18^b$
2. Attention Signal: Verbal, gestural and physical teacher responses to obtain or focus a pupil's attention.	$.25^a$
3. Initiating Teacher Command: Teacher commands that pertain to or relate to instruction.	$.18^a$
4. Organizing Noninteractive: Teacher physically manipulates materials/objects in classroom to prepare for or terminate instruction.	$.34^b$
5. Monitoring students performance as they work. Behavioral	$.22^a$
6. Indirect Behavorial Consequence- Negative: Teacher verbally expresses disapproval of behavior.	$.14^a$
7. Indirect Behavorial Consequence- Negative: Teacher acts upon negative behavor.	$.36^b$

$^a p < .05$
$^b p < .01$

These results suggest that teachers identified by research as most likely to succeed with low-performing students were those who expected the most adaptive behaviors, who tolerated the fewest maladaptive behaviors, and who showed the least tolerance for handicapping behaviors. Interpretation of these findings should be tempered by the observation that only one portion of the teaching day (mathematics) was observed. This finding was a source of some surprise and major interest to us, and led to the development of the second study.

Study 2

The second study was conducted in a low income, rural community. All participating teachers were involved in the Follow Through Project (Direct Instruction Model), a federally funded compensatory education program. Their implementation of effective teaching techniques was assessed by a trained consultant using a standardizedevaluationprocedure(TeacherEffectiveness Observation Form) rather than the SBS Teacher Observation Code used in Study 1. The Teacher Effectiveness Evaluation form was previously validated in a study by Gersten, Carnine, Zoref and Cronin, 1986. As in Study 1, teachers completed measures which probed their expectations for adaptive behaviors, their tolerance of maladaptive behavior, and their propensity to resist placement of a handicapped child in their room. Although this study did not attempt to actually observe teachers resisting placement of handicapped students, like Ysseldyke, we believed teachers' self-reports could provide a basis for predicting what they actually would do. We hoped to see if the findings in the first study could be replicated in a quite different setting with rural Hispanic children.

Subjects and Setting

Subjects were 15 primary grade teachers in a low income community in rural Texas, with a high proportion of limited English speaking students, some of whose parents had limited literacy skills in either Spanish or English. Over 99 percent of the students were Hispanic and 85 percent were classified as low income by their district (qualifying for free or reduced lunch). Eight of the teachers were Hispanic and seven Caucasian.

Measures

As in the first study, the SBS *Expectations Tolerance*, and *Resistance* scales were used. The teachers were also asked to indicate which behavior and learning problems of students they thought they would request technical assist for if their student had such problems. The scales developed by Walker and Rankin (1983) as part of the SBS battery were used.

Description of SBS measures. The *Expectations* scale asks teachers to delineate components of children's social behavior they deem *critical* for successful functioning in their classroom.

The 56 *Expectations* items are evenly divided between teacher-child behavioral interactions and items relating to comp

Continued on Page 15

[1] The authors wish to thank Kathy Knippa (Uvalde Schools) and Gary Davis (University of Oregon) for their assistance in the implementation of the project. The authors also wish to thank Gerald Tindal for his helpful feedback on earlier drafts of this manuscript. This research was supported in part by a grant from the National Institute of Education and a grant from the U. S. Department of Education, Follow Through Division.

tent peer-to-peer interactions. Teachers are asked to make one of three rating judgments in relation to each item. These are (a) critical, (b) desirable, or (c) unimportant. Sample items are: (1) Child seeks attention at appropriate times, (2) Child cooperates with peers in group activities or situations, (3) Child is flexible and can adjust to changes in routine, teacher, or setting.

The *Tolerance* scale asks teachers to delineate student maladaptive behaviors they find intolerable in their classroom. This inventory contains 51 items describing a set of student behaviors that would tend to impair classroom adjustment or interfere with peer social relationships. Examples include: (a) actual acts of aggression, and (b) ignoring teacher warnings or reprimands. Teachers rate the items along an acceptability dimension. For each item the teacher indicates whether the behavior is (a) unacceptable, (b) tolerated, or (c) acceptable. "Tolerated" means that although the rater would prefer to see the behavior reduced in frequency and/or replaced by an appropriate one, he or she is willing to "put up" with it (at least temporarily). Sample items are: (1) Child tests or challenges teacher imposed limits and classroom rules, and (2) Child manipulates other children and/or situations in order to get his/her own way.

The *Resistance* scale focuses exclusively on characteristics frequently associated with handicapping conditions (EMR, LD, orthopedically impaired) of a more severe nature (eneuresis, encopresis, deficient self-help skills, etc.). It consists of 24 items. Teachers are asked to delineate child characteristics that would cause them to actively resist placement into the classroom.

Perceived technical assistance needs. For items on the *Expectations* scale that a teacher marked as critical, the teacher indicates whether technical assistance from a specialist would be required in remediating or dealing with any behavioral deficits (e.g., seeking attention at inappropriate times, inability to work with peers) following placement of a handicapped student into the classroom. Similarly, for items on the Tolerance scale marked unacceptable, the teacher indicates whether technical assistance would be required in coping with the specific behavior (e.g. tantrums, ignoring teacher reprimands after integration).

Measure of teacher effectiveness. The *Teacher Effectiveness Observation Form* evaluates concrete, observable teaching behavioral competencies that are related to increased student achievement in the teacher effectiveness research literature (Brophy and Good, 1984; Rosenshine, 1983). A total score derived from this rating form will be called the Teacher Effectiveness Observation Scale or TEOS. Scale items measure three domains: (a) teaching procedures, (b) classroom management and organization, and (c) monitoring of student progress. The instrument covers a wide band of teacher behaviors including remediation activities, classroom atmosphere, procedures for motivating low achieving students, and student success rate. Examples of two items appear below:

1. When this teacher hears a student respond incorrectly (or not at all) he/she:
   a. corrects the error immediately
   b. does not use any correction procedure
   c. corrects at the end of the task
   d. makes a note of the child needing help and attends to him/her later.

2. For a typical lesson, for the low performing group, the entire group answers correctly:
   a. almost never (i.e., less than 30%)
   b. almost always (80% or more)
   c. rarely (30 to 60%)
   d. sometimes (50 to 70%)

Reliability

Internal consistency coefficients (Alpha) for the three scales from the SBS battery were .96 for Expectations, .93 for Tolerance, and .82 for Resistance. Temporal stability correlations for a six-week interval ranged from .74 to .81 for Expectations and Tolerance, and from .48 to 54 for Resistance (Walker & Rankin, 1983).

For the Teacher Effectiveness Observations Form (Gersten, Meyer and Zoref, 1979), internal consistency was .93, and interrater reliability was .81. A criterion-related study (Gersten & Carnine, 1986) indicated significant, moderately strong correlations between scores on the Observation Form and mean class gains in academic achievement on standardized tests (median *r* of .79).

Procedures

The Teacher Effectiveness Observation Form was completed by two supervisors who had received extensive training in observing and monitoring the teacher behavior competencies included in the form. The supervisor at each site had observed each teacher at least 10 times during the academic year. Each supervisor had at least ten years experience in inservice teacher training. Teachers completed the self report instruments after school at their convenience. All instruments were completed in the spring of 1982.

Results

Descriptive statistics for the three SBS teacher self-report measures and the Teacher Effectiveness Observation Scale (TEOS) are presented in Table 2. The mean score on the TEOS was 65.8 with a standard deviation of 8.2, indicating a reasonable amount of variability. Table 2 also presents correlations between each teacher self-report measure and the TEOS measure.

The highest correlation was found between the *Resistance* scale and the TEOS measure ($r = .75$, $p < .01$). The SBS *Resistance* scale is a list of characteristics that would cause a teacher to resist placement of a handicapped child in her or his class. In other words, the teachers with the strongest repertoire of effective techniques for children with academic difficulties would be most likely to resist placement of a student in their class if the student, for example, lacked self-help skills, had impaired language, or required adapted instructional materials.

The correlation between the *Tolerance* scale and the TEOS measure was also significant, ($r = .47$, $p < .05$). This result indicates that teachers who say they have low tolerance for maladaptive behaviors tend to be those that show better classroom management and organization.

Table 2. Mean and Standard Deviations for the SBS Scales and Correlations with Teacher Effectiveness Observation Scale (TEOS) (N=15)

Teacher Self-Report Measures	M	SD	Correlation with TEOS
Expectations Scale	124.4	6.9	.47[a]
Tolerance Scale	122.5	7.9	.47[a]
Resistance Scale	5.3	2.5	.75[a]
Perceived Technical Assistance Needs	40.8	14.3	.50[b]

[a] p<.05 [b] p<.01

Table 3. Correlations TEOS Score, SBS with Factor Scores (N=15)

Expectation Scales	
Factor A	**Factor B**
Inclass Behavior .62[b]	Peer Interactions -.29
Maladaptive Scales	
Factor A	**Factor B**
Maladaptive Behavior That Challenges Teacher Authority .54[a]	Maladaptive Behavior That Does Not Challenge Teacher Authority .36[c]

[a] p< .05 [b] p< .01 [c] .05 < p < .15

The correlation between the *Expectations* scale and the TEOS measure was also significant ($r = 47$, $p < .05$). The most successful teachers tend to have the highest expectations for classroom behavior and achievement.

These correlations repeat the findings from Study 1. Those teachers with the strongest repertoire of direct instruction teaching techniques, have the highest expectations of students, say they will tolerate less maladaptive behavior, and say they are more likely to actively resist placement of students with specific handicapping conditions.

The correlation between Perceived Technical Assistance Needs and use of effective teaching techniques was significant and moderately strong; $r = .50$, $p < .01$. There was a significant tendency for the more effective teachers (as assessed by the observational rating form) to indicate a greater willingness to receive technical assistance in dealing with the behavior and learning deficits they identified as problematic.

SBS factor scores. The self-report battery was factor analyzed by Walker and Rankin (1983). The correlations between the factor scores and the TEOS measure are presented in Table 3. Quality of teaching correlates significantly with 2 of the 5 factors, i.e., Maladaptive Behavior that Challenges the Teacher's Authority and Adaptive Behavior Relating to Appropriate in Class Behavior. Because of the small sample size (15), caution should be used in interpereting these findings.

Conclusions

At face value, the results of these studies suggest that the teachers who would be most likely to maximize the achievement gains of students with learning and behavior problems were also those likely to resist their placement in their classes. Thus, low-performing students who have intensive instructional or management needs may have difficulty accessing the most skilled teachers in school settings.

However, it must be kept in mind that this possible conclusion applies to teacher self-reports about expectations and tolerance, not to what they would actually do; and assumes, as Ysseldyke did, that one predicts the other. However, the fact that the effective teachers with high standards and low tolerance for problem behavior would seek technical assistance with problems if they did find them, suggest an alternative interpretation of the findings. The most successful teachers are those who, among other things, efficiently use their instructional time. Therefore, one reason for the type of resistance identified in this study may be the effective teacher's attempt to guard against inefficient use of his or her academic instructional time, which could result in an overall decreased level of student performance. If the necessary technical assistance could be provided on how to implement teaching models that are effective for all students, it is likely these skilled teachers with high standards would be the first to accept handicapped students into their classrooms. It remains for future studies to examine this question.

Editor's note: Teachers, what are your experiences? Write me about your reactions to these findings and your experiences

References

Editor's Note: A complete set of references may be obtained by writing to The Editor, ADI NEWS P.O. Box 10252, Eugene, Or. 97440

ADI Workshop Schedule

Please call or write to the Association for Direct Instruction for a brochure on any of these workshops.

February 11 & 12, 1987
Valley River Inn, Eugene, Oregon
Implementation of Effective Instruction- Problems and Solutions
Presenters: Zig Engelmann, Ed Schaefer, Bob Dixon, Marilyn Sprick
This workshop is for Administrators, Supervisors, Teachers and other personnel involved in the evaluation and adoption of programs.

February 20 & 21
Emerald Hotel of Anaheim, Anaheim (L.A.), California
Teaching the Beginning Reader
Presenter: Adrienne Allen
Training on how to implement and teach Reading Mastery I and Fast-Cycle. A good session for beginners as well as those wanting a brush-up on the latest procedures.

February 27 & 28
Emerald Hotel of Anaheim, Anaheim (L.A.), California
Teaching Basic Language
Presenter: Adrienne Allen
This workshop will provide in-detail training on Language I (revised 1986) and Language II. The trainer will also focus on specific techniques for working with ESL students as well as those weak in language skills.

February 26 & 27
Salt Lake City Marriott, Salt Lake City, Utah
Management and Teaching Techniques for the Severely Handicapped Learner
Presenter: Ann Arbogast
This workshop is designed for Special Education teachers needing practical, how-to information on teaching the Low-Performer.

February 27 & 28
Salt Lake City Marriott, Salt Lake City, Utah
Managing Students with Emotional Problems
Presenter: Geoff Colvin
This workshop is appropriate for Regular and Special education teachers, School Psychologists, Directors of Special Education and School Administrators

March 19-21
Towne Plaze Hotel, Yakima, Washington
Yakima Direct Instruction Mini-Conference
Presenters: Siegfried Engelmann, Phyllis Haddox, Bernie Kelly and other ADI traners
This mini-conference will allow participants to attend sessions that will update them on the latest techniques for working with students having a wide range of skills. Sessions are planned in Beginning Reading, Reading 3-6, Developmental and Corrective Arithmetic and other areas of instruction.

Need a Workshop in Your Area?

If you have any training needs and would like to have an ADI training workshop scheduled in your area, please contact Bryan Wickman at ADI and he will work with you to explore the possibilities.

It is helpful if you have a specific date in mind, such as a district or statewide inservice day. Also, if you can give an idea of how many other people are in need of the training and who the key contacts are in your area, the workshop will have a better chance of getting off the ground.

The Association for Direct Instruction would like to help you to improve your technical confidence and competence. Help us help you!

AVAILABLE AGAIN
Teach Your Child to Read in 100 Easy Lessons
By Engelmann, Haddox & Bruner
$15
ADI Members
$12
PLUS $1.50 SHIPPING & HANDLING

Join the Association for Direct Instruction

Membership Options:

A) Regular Membership..... $15.00 per year (includes one year of DI NEWS and a 20% discount on ADI sponsered items and events).
B) Student Membership..... $7.00 per year (includes one year of DI NEWS, a 40% discount on ADI sponsered events and a 20% discount on publications sold by ADI).
C) Sustaining Membership..... $30.00 or more per year (includes regular membership privileges and recognition of your support in the DI NEWS).
D) Institutional Membership..... $50.00 per year (includes 5 subscriptions to the DI NEWS and membership privileges for 5 staff people).
E) DI NEWS subscription only..... $5.00 per year (outside of North America and Hawaii $10.00 per year).

ADI sponsored products and events include books and other materials published or marketed by the Association. The DI NEWS is published 4 times a year (Fall, Winter, Spring, Summer).

To join the Assocation, complete the lower portion of this form and mail it, with your check in U.S. funds to:

Association for Direct Instruction
P.O. Box 10252
Eugene, OR. 97440

Check one:
I wish to become an Association member. Please enroll me as a:
__ Regular Member ($15.00 annually)
__ Student Member ($7.00 annually)
__ Sustaining Member ($30.00 or more annually) *
__ Institutional Membership ($50.00 annually)
__ I wish to subscribe to the DI NEWS only ($5.00 annually; $10.00 outside North America & Hawaii)

NAME______________________________

ADDRESS______________________________

CITY________________ ST______ ZIP______

* As a Sustaining Member, I grant permission for my name to be used in the DI NEWS. SIGN____________________

ADI MATERIALS PRICE LIST

Theory of Instruction
By Siegfried Engelmann & Douglas Carnine
Membership Price $20.00 — List Price $25.00

Direct Instruction Reading
By Douglas Carnine & Jerrry Silbert
Membership Price $24.00 — List Price $30.00

Direct Instruction Mathematics
By Douglas Carnine, Marcy Stein & Jerry Silbert
Membership Price $24.00 — List Price $30.00

Generalized Compliance Training
By Siegfried Engelmann & Geoff Colvin
Membership Price $16.00 — List Price $20.00

Structuring Classrooms for Academic Success
By Stan Paine, J. Radicchi, L. Rosellini, L. Deutchman, C. Darch
Membership Price $8.00 — List Price $10.00

Members of the Association for Direct Instruction may purchase copies of the materials listed above at the Membership price. Shipping charges are $1.50 per book for 1-5 books and $1.00 per book for orders of 6 or more. Orders are to be paid in U. S. Funds, in advance. Purchase orders are also accepted. Please allow 4 weeks for delivery.

ADI cannot provide copies for entire classes nor can we provide desk copies. All such requests must be made to the publisher of the specific book.

SEND YOUR CHECK OR PURCHASE ORDER TO:

ADI

Association for Direct Instruction
P.O. Box 10252
Eugene, OR. 97440