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ADI NEWS

Volume 4, Number 3 . Association for Direct Instruction, P.O. Box 10252, Eugene, Oregon 97440 Spring, 1985

The Impact of DI

Striving for Literacy in Tuscaloosa, Alabama

By Roberta S. Weisberg
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and Paul Weisberg
Department of Psychology
University of Alabama

When Distar Reading was considered by the Tuscaloosa City School System for use in the early grades of those schools which contained hard-to-teach children, the following was known. The vast majority of the children were Black, from poverty-level backgrounds and attended inner-city schools where from 84% to 90% were eligible for free or reduced lunch programs. For as long as school administrators and principals could recall, as many as three-quarters of these children who were passed onto the junior high schools were functionally nonreaders. By third grade, over 90% had reading scores on standardized tests below the 50th percentile, and at least 60% of them fell into the bottom 3 stanines. Only 22% of a randomly selected group should place this low.

School A: Beginnings

Shortly after our return from a 1976 sabbatical leave at the University of Oregon, and excited about the possibility of launching DI programs in Tuscaloosa, Roberta received permission to begin a small-scale project at School A. School A was a small school which at any grade level contained no more than two classes. A close friend of Roberta's was the Title I teacher there. This teacher helped to influence the principal and the other teachers to try this new program. While in Oregon, Roberta wrote the Director of Instruction in Tuscaloosa to tell about the Direct Instruction training she was getting and how DI could help the kids in Tuscaloosa. The Director, who had heard of DI, was openminded and was able to convince the Superintendent to give DI a chance.

It was to be a three-year pilot project. Roberta chose to phase-in the DI programs, starting the first year with Distar Language and Reading programs just for classes in first grade, Special Education, and for kids pulled by the Title I teacher. In succeeding years, second and third grade teachers also used these programs and, in the second implementation year, Distar Arithmetic was added to first grade. Employed then as a full-time Title I evaluator and psychometrist, Roberta squeezed in about 12 morning hours per week to train and supervise the teachers. Training was tight: the teachers were not accustomed to having someone sit beside them as they taught, modeling entire lessons, helping with multi-step formats, and making certain the teachers and kids repeated until firm. Title I truly supplemented the regular teacher by continuing DI instruction or repeating lessons or formats. The teacher did not use other programs.

The Program Was Working

From its inception, the data from standardized tests were analyzed to see if Distar Reading was working. No basal reading program before Distar was ever so carefully scrutinized and evaluated for effectiveness. The initial results were dramatic. For almost every year prior to 1978, approximately 70% of School A's third graders taking the Stanford Achievement Test (SAT) fell within the bottom 3 stanines on Total Reading. In 1978, when the first group of third graders with two previous years of Distar Reading under their belt took the SAT, 19% of the youngsters now scored in the bottom 3 stanines.

Ramifications and Other Changes

Word about School A's success spread slowly at first. Talk about program effectiveness passed from among the handful of successful teachers using DI to those who were not. Interested teachers came to observe at School A. They also visited Paul's day care center which implemented Distar Reading with 4 and 5 year-olders. Sometimes Paul would bring the kids to certain schools during an in-service day and have them

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The Tactile Reception of Speech by the Deaf

—A Historical Perspective—

By Robert J. Rosov, Director
Department of Biomedical Engineering
Research Division
Institute of Logopedics
Wichita, Kansas

Children with profound hearing impairment invariably suffer severe deficiencies in expressive and receptive speech and language development (Ling, 1976). Although lip-reading and hearing aids enable partial reception of speech, the acoustic information necessary for the accurate perception and intelligible production of speech is largely unavailable to the profoundly deaf. Despite special educational programs, materials, and personnel, the academic progress of these children lags significantly behind that of their hearing peers, and their social and economic potentials are considerably reduced.

For the past fifty years, researchers in a varity of disciplines have wondered whether speech could be adequately perceived and learned through the sense of touch (Kirman, 1974; Reed et al., 1982). This was a question with which Wes Becker introduced me to Zig Engelmann in mid 1971. I was then a Research Associate at the Oregon Research Institute (ORI) in Eugene, involved with the development of a biomedical engineering program there. Zig was convinced that it was possible to perceive speech tactually because of some experiments in tactile pattern recognition he had performed with Don Bitzer at the University of Illinois some years before. He argued that he could develop the instructional methods to train children and adults to fluently perceive speech through the skin, if I could build a device which would faithfully transmit all the acoustic components of speech to skin.

At the time, I was unaware of previous research in this field, and so set about to reinvent the wheel. From experience in speech research at Haskins Laboratories (now in new Haven, Connecticut), I knew that speech could be broken down ("analyzed") into fifteen or so bands of channels for telephone transmission and then re-assembled ("synthesized") at the receiver with little degradation in quality and intelligibility. Such devices were called "vocoders" (from "voice coder"), and had been investigated at Bell Laboratories since the later thirties (Dudley, 1939). We would present the acoustic energy present in each of the analyzer channels of the vocoder to different points on the skin. Since the skin is insensitive to frequencies much above 400 cycles per second (Hz), we had to convert the audio frequency energy in each channel to vibrational energy at some relatively low frequency; we chose 60 Hz and utilized a vibrator which would operate at this frequency for each channel. Since the output of the analyzer portion of the vocoder contained virtually all the speech information at the input, it seemed reasonable that presentation of this information to the skin in a suitable form could result in speech preception if the brain was assisted by the right kind of training and could interpret the tactile patterns in much the same way it interprets speech and language.

ORI agreed to fund the construction of the device, and Zig agreed to fund the training personnel costs. Early in 1972, a young technician, John Hunt, was hired to assist in the design and fabrication of the device, which we now called a "tactual vocoder". The device was assembled by late 1972, and spanned the frequency range from 85-10,000 Hz in 24 channels so that high and low speech frequencies, which are not present in telephonic transmission, were included. The vibrators, were organized in five modules of five each (minus one) which were worn on either one or both arms. Both subjects and trainers had their own microphones so that the subject could perceive both her own speech as well as that of the trainer.

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HELP US ADVERTISE THE ANNUAL CONFERENCE AND GET NEW MEMBERS

1. With this issue are FOUR EXTRA COPIES of ADI NEWS and the conference broucher. Post the broucher. Give the NEWS and brouchers to friends who should be a part of our Association.

2. Note: Those joining NOW receive memberships through August, 1986. **(See Page 16.)**

Dear Editor,

I am interested in communicating with teachers who have used Direct Instruction with hearing impaired students. Has it been done? Does it work well? What are the problems or areas in need of adaptation when using this approach with hearing impaired children? What experiences do teachers have using sign language with Direct Instruction?

I would like to have this information before expanding Direct Instruction's use to the hearing impaired children in our school district. Other special-needs students are succeeding with Direct Instruction and I'm excited about it.

Karen Suhadolnik, Product Sales Administrator, suggested that I might get this information through Direct Instruction News if a request of this sort is published there.

Sincerely
Beth Freed, Teacher
Hearing Impaired
Delta County
Joint School District No. 50
1002 Hastings Street
Delta, Colorado 81416

Readers, if you can help, write to Beth and send me a copy for the Editor's column.

Dear ADI:

In August I attended Randy Sprick's Secondary Management Class. He told us about his new book to be published in December, 1984. I need to know the publisher and address etc. so I can purchase a copy. My school is looking for ideas on how to make our management better and I'm sure his book will be a monumental help. Thank you for sending me the info quickly.

Sincerely,
Donna Radford
Mills School
Klamath Falls, OR 97601

Dear Donna:

The book will not be out until this Summer (1985). The reference is: *Discipline and Motivation in the Secondary Classroom — Practical Strategies for 7th to 12th Grade Teachers*. Prentice Hall, Englewood Cliffs, New Jersey, 07632.

Don't forget to send your nominations for the ADI Excellence in Education awards.
DUE JULY 1

Advertising Policies and Rates

The Direct Instruction News will publish advertisements for materials (programs, books), training (conferences, workshops), and services (consultation, evaluation) related to direct instruction. All proceeds from the sale of advertising space will be used to help pay publication costs incurred by the News. Ad sizes and corresponding costs are as follows:

Full page: $200
Half-page: $125
Quarter-page: $75

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.

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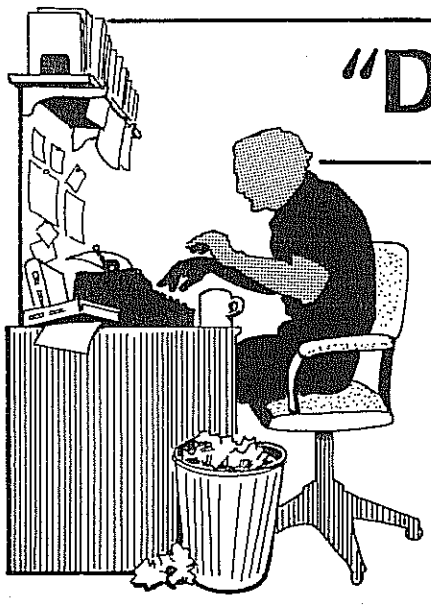

"Dear Ziggy"

Dear Ziggy:

I supervise many elementary special eduction teachers who are very enthusiastic about D.I. Programs because of their effectiveness with handicapped learners.

There are problems, however, trying to fit children, who enter the special education program after the year begins, into existing instructional groups, when placement tests and teacher judgement indicate they need skills the group has mastered. The teacher's schedule usually does not allow forming additional groups. In addition, the teacher is usually the only one using D.I. in the building so that a more appropriate group cannot be found elsewhere.

At times teachers have included new children in existing groups and have found after 2-3 weeks they do well. All would like to do more "catch up" tutoring with new children, but with huge caseloads this is difficult.

I am wondering if anyone has developed formats for cassette tape or language master lessons that teach some of the skills such as *a - an* discrimination, sentence or rule repetition, long vs. short vowel patterns. It seems these, if done using sound teaching strategies that include careful movement from modeling to testing, could help us with new children, or other lower performers in a group who tend to slow the group's progress.

If done properly, I would also like to see software developed and included with all the DISTAR and Corrective programs to assist with such children. Software instruction could be much more sophisticatd than cassette tapes, based on some of its possibilities you have reported in the *D.I. News*. However, tape recorders and language master machines are more available than computers so I feel there is still a need for lessons for these machines.

Many of us in Knoxville want to thank the authors of D.I. Programs for their work producing programs that are effective. Since we have economic and staffing problems, I am hoping that someone can help us use our machines to back up our efforts.

Sincerely,
Shirley Johnson
Supervisor
Elementary Special Education

Dear Shirley:

There are possible solutions, but none is very graceful. If the programs are used in a variety of schools, it might be possible to have a "port of entry" classroom that is sponsored by the district. The purpose of this classroom would be to prepare incoming students for a specific classroom, or for placement in some classroom. Here's how it would work: A kid comes into the district, mid-year. Instead of going directly to the classroom, the kid goes to the port of entry classroom, which has one or two teachers (or hotshot instructional aides) who prepare the kid for some group. (The people in the port of entry room have information about where the various groups are in the different programs.) Their goal is simply to prepare the kid for a group, and they may have to work with the kid a couple of weeks to achieve this goal.

The port of entry classroom could also be a half-day, or part day program (two hours in the morning).

Depending on the number of classrooms and the rate of mid-year entry, the classroom may be a very economical means of dealing with the problem. Obviously, it would not be economical if we were talking about only a few kids each year. A different format would be more appropriate — the floating aide or teacher. A teacher has a part-time assignment (perhaps during the afternoons) of working with incoming students in various classrooms. If no kids have come in, the teacher works on regular classroom assignments. If there are incoming kids who must be placed, the teacher goes to the school where the kid is and works with him or her during the afternoons or part of the afternoons.

Some form of this remedy is needed if the teachers are to be efficient. A classroom teacher can spend a lot of time working with an incoming student only to find that many other students in the classroom have been neglected. And unfortunately, the person who prepares the incoming student for a group must be experienced so that the placement is achieved quickly.

I know my solution may represent administrative headache, but if it is established, it could serve as a strong administrative commitment to a coordinated program that is based on quality control.

As you can guess from my reply, I don't think the Language Master or cassettes are the way to go. Perhaps interactive computers will help someday, but programs are not available now.

Exceptions

Continued from Page 15

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A College Reading Program with DI Components

By Robert McQ. Taylor
Judy C. Lambert
Patrick M. Flynn
University of Arkansas at Monticello

In the fall of 1983, the University of Arkansas at Monticello (UAM) and other colleges and universities in the state, region, and nation were faced with the problem of declining admissions test scores. In addition, a large proportion of first time freshmen were entering with academic deficiencies. One of the foremost deficiencies of the freshman class of 1983 at UAM was reading.

The Problem

UAM, a small campus of the University of Arkansas System, is located in the rural southeast region of Arkansas. The region contains much of the Delta area on the Arkansas bank of the Mississippi River. The history and culture of the region are contributing factors to the dilemma the University faced. Traditionally, education has not been afforded the importance in this region as it has in other parts of the country. Education for much of the population was not encouraged, and until recent decades, educational opportunities for both Blacks and Whites were limited. Further evidence, supporting the lack of importance and the limited availability of education, may be found in the uniqueness of UAM's student body. Each year more than 70% of the freshman class indicate that they are "first generation" college students. These students are the first in their families to attend college. Their parents having had little, if any, exposure to college, do not possess the experience of having "been there," and are not able to assist their sons and daughters in preparing for and dealing with college life.

The University provides an important service for the region in that it has an open admissions policy. A high school diploma and ACT scores are the admissions criteria. This policy has assured educational opportunities and encouraged personal advancement for many who might not otherwise have attended college. Unfortunately, it has also given false hope to many individuals who could not meet the demands of college as is evidenced by the dropout rate. UAM averages a 55% dropout rate for its freshman class at the end of the first term. The average freshman dropout rate for four year institutions is 35%. With no junior colleges in the region, UAM freshmen are in many ways more like junior college freshmen students. Still, the average dropout rate for freshmen in junior college is only 40%, which is well below UAM's 55%.

One significant contributing factor is the difference between the reading ability of many students and the level of reading ability required in most entry level classes. A study of readability of texts used at UAM revealed that instructors of freshman courses use textbooks written on the average at the 13th or college freshman level; with, however, the range being from grades 11 to 15. A significant number of freshmen served by UAM do not have the ability to read at these levels of difficulty.

This reading problem became particularly apparent when testing of incoming freshmen was instituted in the fall of 1983. *The Nelson-Denny Reading Test* (Brown, Bennett, & Hanna, 1981) yielded average grade equivalent scores of 8.8 and 8.2 on Vocabulary and Comprehension respectively. Analysis of the scores suggested that as many as half of the entering students were seriously weak in reading skills. With the existing federally-funded Learning Development Center (LDC) filled to capacity, many students were left unserved. Recognizing the need for an acceptable level of reading proficiency, the Vice Chancellor for Academic Affairs created reading skill classes for the 60 overflow and LDC ineligible students. UAM had determined its approach to the dilemma; it was going to try to offer its students a more realistic opportunity for higher education. This initial action, however, was only a stopgap measure until a more comprehensive reading program could be developed.

The Solution

The administration, not feeling comfortable with its level of understanding of the teaching of reading, asked two of its professors in the Department of Education for help. These faculty members had a total of twelve years experience in the teaching and supervision of reading with Southern rural and/or disadvantaged populations. Ironically, their backgrounds in methodology were somewhat different, one from a Direct Instruction background and one from a more psycholinguistic background. Surprisingly, they found much common ground in terms of goals for the college students.

As a result of their cooperation, a university-wide committee was charged with the task of planning a feasible college reading program. This committee, representing such diverse areas as Forestry and Botany, was a rare example of the cooperation, expertise, and clear thinking that can be so difficult to achieve through committee effort. The result was a college reading program that was revolutionary in its design, but sound in its rationale. Realizing the diverse needs of the students, an effective, efficient, and flexible program was planned that would help students deficient in reading skills reach an acceptable level of reading proficiency.

This involved developing a comprehensive, three-tiered college reading program. The lowest level was designed for students with severe basic reading deficiencies in the areas of word recognition and comprehension. Direct Instruction seemed an appropriate approach for these students (see Herr, 1984, for a description of another college program that used Direct Instruction). They would receive instruction using the *Corrective Reading Program* (Engelmann et al., 1980).

The middle level of the College Reading Program was designed for students with moderate reading problems and was to emphasize vocabulary development, selected comprehension skills, study skills, volume reading, and spelling. This less structured, somewhat eclectic, language arts approach seemed appropriate for students who were closer to the level of skills necessary for college work. *Corrective Spelling Through Morphographs* (Dixon & Engelmann, 1979) was included for use at this level.

The third level of UAM's College Reading Program was designed for students with isolated areas of weakness, and for those weak in the application of reading skills. It would emphasize study skills, volume reading, and composition. The entire program is flexible in that there are many avenues for student movement within and through the program.

This program was then presented to the Curriculum and Standards Committee, the watchdog of academic programs. It approved and passed the program on to the governing University Assembly, where the faculty, convinced of the need and merit of the program, approved it. Recognizing the universal need for such college reading programs and feeling this one innovative enough, the State Department of Higher Education then provided significant funds to support it as an experimental program. The degree of support and cooperation at all levels from committee, to faculty, to local administration, to state administration was pleasantly surprising, but in many ways typical of Arkansas', and particularly southeast Arkansas'. attempt to improve the quality of education.

The Implementation

In the spring of 1983, Dr. Judy Lambert was appointed director of the College Reading Program; she began immediate preparations to implement the program during the fall semester, 1984. Her leadership during the formative months was instrumental in the realization of the program. In close cooperation with the program director and also with Dr. Robert Taylor, Direct Instruction consultant to the program, Dr. Pat Flynn organized the use of the *Nelson-Denny Reading Test* as the screening instrument for entering freshmen. Based on the experience of other universities (Ahrendt, 1975), a cut-off score at the 25th percentile for Total Reading (Vocabulary and Comprehension) using national norms for a four-year college was selected to place students in the program.

For the Fall of 1984, four sections of Fundamentals of Reading, the official course of the program, were scheduled. Maximum enrollment to be allowed was 60 students per section. Each section was then to be divided into three subsections, one for each level of the program.

In the first four days of class, students in the program were given Level 14 of the *Reading Yardsticks* (Riverside Publishing Co., 1981) diagnostic test to determine their specific areas of need. Based on the results, students were then reshuffled within their class hour into one of the three subsections. Students particularly weak in the Vocabulary, Literal Comprehension, and Structural Analysis subtests or in Total Comprehension were placed in the lowest subsection. Students relatively strong on the Comprehension subtests and on Structural Analysis, but who showed weaknesses in Study Skills were placed in the top subsection. All others, with miscellaneous weaknesses, were placed into the middle subsection.

Corrective Reading

Students in the lowest subsection were then tested with the *Corrective Reading Program Placement Test*. For the fifty-four students, results were mixed (see Table 1).

Table 1. CRP Placement Testing Results

	Decoding	Comprehension
	A1 - 1	
	B1 - 8	B1 - 43
	B61 - 10	
	C1 - 31	C1 - 11
	out - 6	out - 1
Total Students	55	55

The informed reader may have recognized an organizational dilemma. In each of the three classes at this lowest level of the reading program we needed to cover both the Decoding strand and the Comprehension strand in a 50 minute period five days a week. Also, as might be expected, not all students in each subsection placed at the same lesson. With only one instructor for these Direct Instruction subsections, there was not a way to form more than one group per class. The university scheduling procedure made moving students from one time period to another essentially impossible.

A decision was made, therefore, to begin all four subsections in Decoding C, Lesson 1. For the first two weeks these classes worked in Decoding only. This was to give both instructor and students a chance to orient themselves to the program without other complications. This also gave us an opportunity to observe the progress of those who did not place at the C1 level of Decoding. At first, only 11 students placed below C1. Students who came into the term late or had been absent for testing had a tendency to be weak in Decoding. If we had known initially that 19 students had not placed in Decoding C, we might have tried another solution. Nevertheless, at the end of two weeks only two students, both placing at B61, seemed to be having noticeable difficulties. The instructor reported that the lower-placing students were trying very hard and were improving, suggesting that perhaps they had more preskills than they exhibited during placement testing.

After the first two weeks, two of the four subsections started the Comprehension Strand at level B1 *on alternate days*. We hoped that while providing for more variety in tasks for the students and their instructor, this would not compromise either of the strands by allowing too much time to occur between lessons. The other two subsections continued only in Decoding for the next several weeks when the situation was reevaluated. At that time, since no ill effects from alternating the strands were observed and lower placing students did not seem to be suffering, the other two subsections also began alternating Decoding and Comprehension.

Another concern about our approach for a college level program had to do with how students would feel about working with material that is used with elementary students and has, in addition, oral group responses. But as our instructor for these subsections said in amazement, "They really seem to enjoy it! I can't understand it for the life of

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The Tactual Vocoder

Continued from Page 1

A vocabulary list of some sixty words was developed. Some of the words differed only in vowel sound (boot, bait, bat), some in consonant sound (silly, filly; sly, fly), some were similar (days of the week), and others were quite dissimilar (the subjects' names). The initial participants in the study were Millie Schrader, Laurie Skillman, and Linda Youngmayr — training coordinators from the Follow Through Project (Engelmann-Becker Model) who each spent about ten hours per week alternately as subjects and trainers. The subject's hearing was masked by ear plugs and by loud continuous noise in a headset. Subjects were trained without visual contact so that the only information received was through the tactual vocoder. A structured stimulus/response protocol with correction procedures was faithfully followed. Despite interruptions caused by travel schedules, all the words in the vocabulary could be reliably identified after roughly 50 hours of training. There was no evidence of an asymptote in word acquisition rate, and learning rates were similar whether vibrator module placement was on one or both arms. Carol Morimitsu joined the study somewhat later, and it was with her that no diffeence in tactual perception was seen whether the vibrator modules were placed on the forearms or thighs. Even more surprising was the discovery by Linda and Laurie that speech intonation and stress could be accurately mimicked by the subject without training specifically directed to these skills. The first experience was judged successful, and a second experiment was undertaken with several profoundly deaf children from the Eugene school district.

Carol, Laurie, and Linda were the teachers for the deaf children. Both teacher and subject wore microphones connected to the tacutal vocoder so that the children could receive tactile feedback from their own verbal productions. The vibrator modules were worn on the children's thighs so that their hands and arms were unencumbered. There was no visual contact between the children and their teachers during perception training, but face-to-face contact was used during production training. Initially, the children learned to identify readily discriminable nouns (e.g., aligator vs. hat) by pointing to pictures of these objects placed in front of them. As training and verbal proficiency progressed, language concepts and phrases were introduced. A token reinforcement system was used for correct responses. Accumulated tokens would be used to purchase toys from a "store" in the lab. Gary, the child with the most extensive training, had acquired over 150 words at the time the results of both studies were published (Engelmann and Rosov, 1975). Gary ultimately went on to acquire over 600 words in his vocabulary before the study was terminated.

Because of these results, research interest in the field increased considerably. Engelmann was awarded a contract by the (then) Bureau of Education for the Handicapped to develop and evaluate an instructional program in speech and language for deaf children utilizing the tactual vocoder as a training aid. While deaf children who were taught with the program performed at a significantly higher level of speech and language proficiency than those receiving convential instruction, there was no significant difference between the vocoder and non-vocoder groups. At the Smith-Kettlewell Institute in San Francisco, Frank Saunders (1973, 1976) was developing a tactual vocoder utilizing electrical rather than vibratory stimuli. This provided the potential for a significant reduction in device size, mechanical complexity, and power consumption. At the University of Washington, Dave Sparks (1978) adopted Saunders' electrocutaneous stimulation technique, and developed another version of the tactual vocoder on which he did considerable evaluative research. Similarly, two postdoctoral fellows at the University of Washington, Kim Oller and Rebecca Eilers, developed a keen interest in the concept, and, using a more compact version of the device built by Hunt at ORI, published a very encouraging study of tactual speech perception in older deaf children after moving to the University of Miami (Oller et al., 1980). At about the same time, Trish Brooks and Barry Frost (1983) of the Queen's University in Kingston, Ontario, built their own sixteen channel vibrotactile vocoder, and independently confirmed the results of the Engelmann and Rosov study in a very tightly controlled experiment in which a hearing subject acquired a tactual vocabulary of 150 words. This was subsequently enlarged to 245 words with evidence of phonetic generalization (Brooks et al., 1982; Frost et al., 1983). These investigators also extended their studies of tactual vocoder performance to deaf children (Brooks et al., 1983).

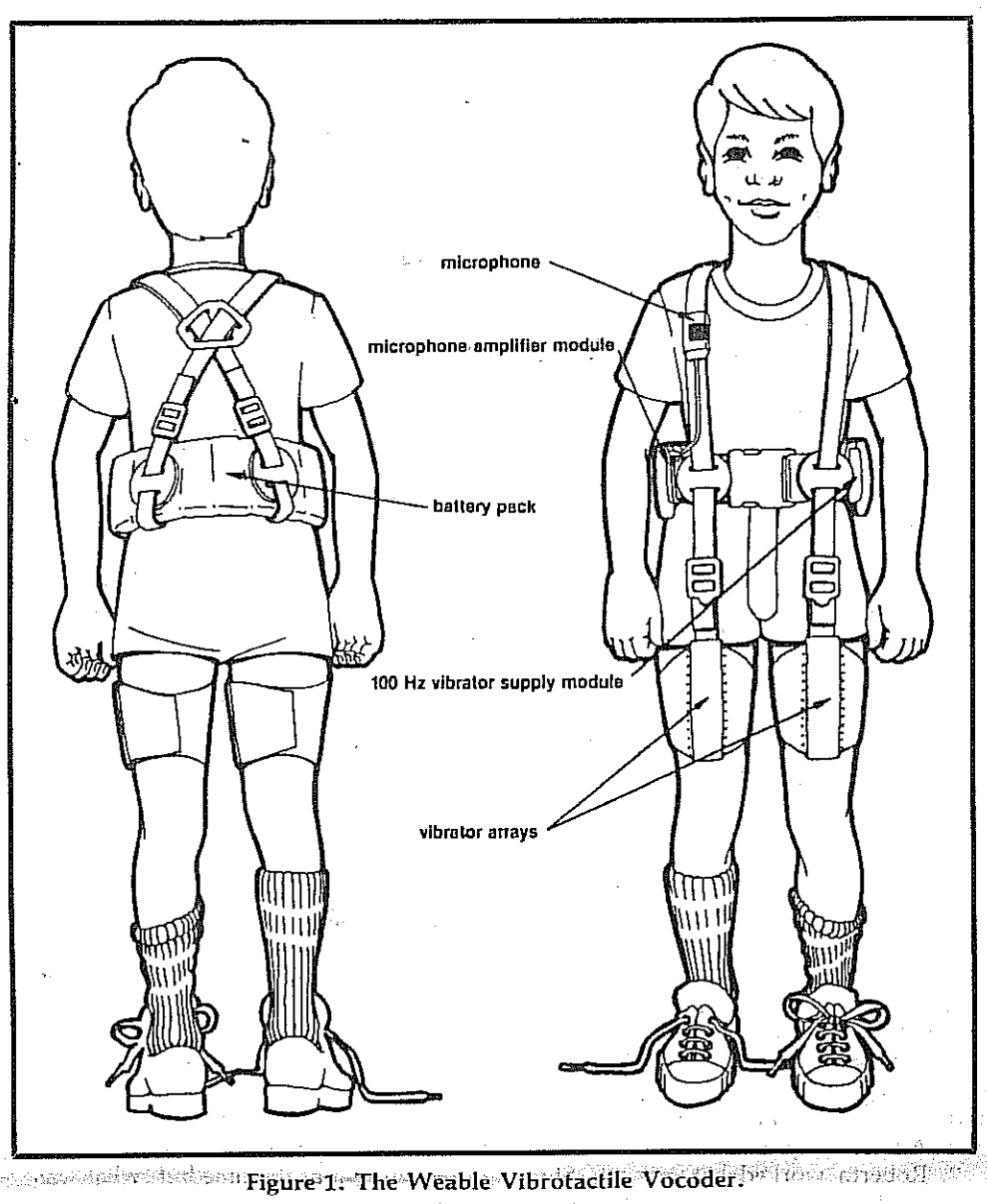

Figure 1. The Weable Vibrotactile Vocoder.

Utilizing the functionally compact vocoders that Hunt has built for Engelmann's BEH contract, Bill Gavin set up a vocoder-based oral training program for deaf preschool children in the Fall of 1982 at the Institute of Logopedics in Wichita, Kansas. This program is being conducted as a pilot study of vocoder usage with deaf preschoolers (Harr et al., 1984; Born et al., 1984), and is intended to become a full scale clinical research study of vocoder usage in the near future. At the present time, five preschoolers are enrolled in the program. They wear the vocoder arrays for approximately three of the six available classroom hours per day. The time spent wearing the vocoder arrays is necessarily limited because the children are tethered to the vocoders by the cables which connect the vibrator arrays to the box containing the electronics.

It was precisely these limitations of non-portability and limited vocoder exposure which prompted Gavin and me to submit a proposal to the Department of Education in the late summer of 1983 for the design and construction of a fully wearable/portable vibrotactile vocoder, functionally identical to the non-portable units that had been built by Hunt at ORI. A contract to perform this task was awarded to the Research Division of the Institute of Logopedics in October 1983, and the first fully wearable vibrotactile vocoder was worn by Julie, a profoundly deaf four-year old, in December of 1984.

The wearable vibrotactile vocoder is shown in Figure 1. The unit weighs 5.5 pounds, 3.5 pounds of which are contained in the rechargeable battery pack which is worn at the back of the waist. The vibrator arrays are strapped to the anterior surface of the thighs in the same configuration as the non-portable unit, except that the arrays now contain most of the electronic circuitry. A small microphone, worn on a suspender strap, is connected to a microphone amplifier module on one side of the belt, and vibrator power supply/low voltage battery alarm module is placed on the other side. The device is powered by plugging in the battery pack, and disconnected by unplugging. When unplugged, the battery pack is readily plugged into a battery charger. Battery life is about six hours, which is sufficient for a school day. Julie frequently wears the unit home after school and on weekends; a spare battery pack is easily inserted into the harness on these occasions. The unit has proved to be unexpectedly durable in the first few months of field testing. No significant equipment problems have occurred, and only minor engineering changes have been incorporated to further increase reliability.

The wearable vibrotactile vocoder has performed so well that the Institute of Logopedics will proceed with the construction of thirty additional units destined for its deaf preschool program, and for evaluative programs at the Wichita Public Schools, the University of Miami's Mailman Center for the Childhood Diseases, the Central Institute for the Deaf in St. Louis, and the Massachusetts Institute of Technology. With a relatively large number of units being subjected to evaluative research, we expect that the acceptance and use of the vibrotactile vocoder either as a speech training aid or as an external auditory prosthesis for severely and profoundly deaf children will become widespread.

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DI in Tuscaloosa Continued from Page 1

show off. To see poverty-level preschoolers reading better than a group of second or third graders stopped the talk that poverty-level kids could not learn to read and it made formerly unsuccessful teachers try Distar.

Two other events helped to legitimize the Distar Reading program: the use of Junior League volunteers at School A and the establishment by Roberta of a private summer tutorial for poor readers at the YMCA. Both events involved the middle class, better educated, and more vocal members of the community.

The Tuscaloosa Junior League consists primarily of mothers who, as part of their membership requirements, do voluntary work for the community. From 1977 until 1981, 4 to 5 different women served as reading aides in school A until it eventually closed in 1981. They received an orientation to DI philosophy and methodology each Fall, and since several of them were former teachers, some actually attended summer training sessions and learned to teach the program.

The summer tutorial at the YMCA lasted for 5 years. Many of the poor readers were the children of Junior Leaguers. Since Distar and Corrective Reading were successful with these and other paying-for-service youngsters, some respected members of the city now knew about the program and what it could do. Some articles about the YMCA program appeared in the local newspaper which allowed Roberta to contrast DI with traditional reading methods. Through these efforts, DI was earning a reputation for being a unique, but respectable program.

The Compensatory Schools

From 1977 to 1980, DI spread to other schools for these reasons:

1. Central office administrators allowed it to happen. They bought instructional kits for interested teachers and eventually Roberta spent half of her time helping others implement programs.

2. The time was right. Accountability was in the air. Programs that worked were needed. Teachers wanted something that worked.

3. DI inservice training lasted for two weeks—not just a day or two— which allowed time for teachers to learn the philosophy as well as to master the necessary implementation behaviors, and see the programs actually in use at Paul's preschool program.

4. Training was done by local personnel. Responsibility was internal. Teachers voluntarily learned the programs; they weren't coerced into it.

5. Through the YMCA and Junior League experience, the community heard about and endorsed its use for its own children.

6. A strong sense of *esprit de corps* and purpose united us against the *status quo*. Adversity spurred us on.

7. Roberta worked her tail off. She was highly visible, assisted in teaching groups, established behavior management systems, spoke to PTA's, the Junior League, and to principal groups.

8. And of course, the programs were good and there was quality control. They were being done right (most of the time).

ROBERTA WEISBERG & PAUL WEISBERG

In 1980 the times changed dramatically. The Justice Department, following its successful attempts in years past to racially integrate the students and faculty of the Tuscaloosa secondary schools, now turned its attention toward the still racially segregated elementary schools. Concern over academic performance led Justice officials to subpoena CAT scores and to visit the schools with large Black populations. One outcome was the recognition of the DI reading program at School A; the officials were encouraged by its improvements in CAT reading and gratified by the strong commitment and enthusiasm toward instructional quality and student improvement shown by its teachers and principal.

At first bussing was considered by the U.S. Court as a means to raise academic quality, but it was rejected as too costly and nonpractical. The judge was willing to preserve the concept of intact neighborhood schools, a position advocated by the City School Board and the Black community, if an alternative plan were submitted that specified how instructional quality and chances of student success could be enhanced.

So the Superintendent asked central office supervisors to write a plan. The targeted population was children scoring in the bottom 3 stanines. Use of DI programs for this population was specifically written into the plan. Other severely at-risk kids could also be served upon teacher recommendation and, as it turned out, all Special Education and Title I classes in the compensatory schools also adopted DI. The plan did not mention the use of DI in kindergarten and, for the first several years, it was not implemented there.

It was not really what Roberta wanted. A broader approach was preferred, with DI programs taught to all compensatory-school children regardless of their stanine ratings, and for DI to begin in the compensatory kindergartens in order to accelerate and integrate skill acquisition. We didn't fully recognize it at the time but, what was essentially advertised as school policy in the community was that, DI was fine for the slow learners whereas "smarter" kids deserved some other reading program. As so often happens, it never occurred to school personnel (and it was hard to convince them) that a program and delivery system workable with low performers has got to work with high performers. Since the latter group can learn at a faster rate, progression from one level to the next should be accelerated, and so should academic achievement. [This is exactly what Engelmann & Carnine (1982) found when DI programs were used with middle-class second graders; not unexpectedly, the majority of students also rated themselves as smart and having high confidence in themselves.]

The Tuscaloosa school plan, which became part of a court order, was implemented in the Fall of 1981. There were five schools having primarily large Black enrollments. Two schools, smaller and/or more rundown than the rest, were closed that Spring. One of them was School A, most of whose DI teachers were dispersed among the remaining three schools. School E, which also closed, had never adopted DI. The three compensatory schools were thus B, C, and D. School B had two classes and Schools C and D had three to four classes per grade level. School B had a head start in adoption of DI since three of its teachers, one at each grade level, had previously observed DI at Paul's facility and implemented Distar Reading in the fall of 1979. School C had two teachers (one first grade, one second grade) trained in 1980. Nevertheless, a major training and supervisory effort lay ahead for Roberta.

Roberta was appointed as the Compensatory Program Coordinator and spent full time in this capacity. She was allowed a Lead Teacher in each of the three compensatory schools. While responsible for teaching three groups, the Lead Teachers were to function as program implementation facilitators. This included giving demonstration lessons, observing and suggesting alternative teaching strategies, giving continuous progress tests and helping to organize instructional groups.

Training and Supervision

In the early years, from 1976 to 1978 at School A, training and supervising went on simultaneously; there were no reading workshops. Working directly in the teacher's classroom, Roberta would do some demonstration lessons, then she and the teacher would teach together, and gradually that person would take over. When tough questions about formats or delivery arose, Roberta called Oregon. One first grade teacher had problems with classroom organization and behavior management before DI and these continued after DI. Because she did not learn to implement the program effectively, Roberta had to firm-up her groups. The other seven teachers did reasonably well and spoke highly of DI. These were good years for Roberta partly because the principal of School A (Cliff Bain) openly supported DI and gave Roberta an encouraging hand in training and supervising.

The first summer workshop in 1978, at Paul's preschool, ran all morning for two weeks. It became the framework for each summer workshop conducted since then. A key feature was the attempts by trainees to teach various groups of preschoolers. Not surprisingly, the trainees contrasted their ineptitudes at teaching with the model lessons provided by Roberta and other experienced teachers. By experiencing initial failure with the kids and then seeing how the difficulties could be overcome when DI teaching components were practiced and utilized (Paine, 1982), the trainees' faith in the potency of these instructional components was bolstered. (The trainees soon realized this wasn't going to be one of those "talk workshops.")

To reassure them there was hope if they practiced their formats and mastered components of the delivery system, we showed TV tapes of our own initial fumblings at teaching DI in Oregon. These training tapes served another function. By showing us being supervised by a supportive and experienced teacher (Jane Dougall) who sat beside us, making constructive comments and demonstrating troublesome tasks, it legitimized this direct interaction style of educational supervision, not only during the workshop, but also when Roberta came to the teacher's school. They knew that Roberta was not some unknown outsider there to evaluate, but instead, to help them and the kids get better.

The workshop agenda which evolved included daily supervised teaching of the kids, and this was sandwiched between pre-teaching opportunities that included format discussion, role-playing, and check-outs of teaching skills, and then post-teaching opportunities that included feedback and demonstration of the

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DI in Tuscaloosa Continued from Page 5

next day's formats. When time permitted, the origins and current trends of DI philosophy and research were presented. Engelmann's (1975) *Your Child Can Succeed* was read and discussed as well as the various programs and outcomes of the Follow-Through project. DI was also contrasted with traditional approaches at every opportunity.

The first few workshops were small attracting 8 to 10 curious participants. By 1980, 20 showed up. These consisted primarily of dedicated teachers who came voluntarily after having observed DI at the "Y", School A, and/or Paul's preschool. They came because they could not bear to face another year of having failed to teach reading to low performers.

The then SRA representative serving Alabama (Jim Burks) was very helpful in providing supplies and leaving the training to local professionals rather than pushing sales first and believing that a one or two day "talk" workshop by an outsider would produce well-trained teachers. Administrators of the city system also came through on their promise to buy instructional kits for those opting to implement the program.

With the 1981 court order, making DI the program of choice for low performers, the number of workshops together with the size and composition of its participants changed. In addition to the two week, regularly scheduled 1981 workshop attracting 20 teachers, two more workshops were offered that summer. One ran all day for one week and the other (in *Corrective Reading*) ran all day for just two days. The attendance at the last 1981 workshops and the one in 1982 was now up to 30 to 40 participants, largely because attendance was made compulsory by their principals. Many of these teachers were hold-outs, and included those unwilling to budge, no matter what the program, as well as those hostile to DI. When 20 teachers participated, things went smoothly and more practice was possible. Subgroups of 4 to 5 teachers could take turns individually instructing 5 to 7 children which matched the number these new teachers would later teach in their own classrooms. Having 40 trainees made the number of subgroups inordinately large, provided less practice, and reduced the number of kids per group to 2 to 3. Fortunately, Roberta was allowed several teacher trainers to help with the skill check-outs and teacher supervision, but the quality of these more recent workshops suffered.

The 1981 court order also affected Roberta's supervisory role in the schools. Before *The Order*, the DI teachers readily accepted Roberta as the local DI reading expert: they welcomed suggestions about better firming-up procedures, more careful monitoring, changes in group size or composition, and other major DI components. Frequent evening phone calls had teachers asking her for advice and inviting her into their classroom. Following *The Order*, when DI was absorbed into the system and managed like other programs, Roberta became part of the bureaucracy. She could not easily enter the classroom of a weak teacher (the ones who were usually hostile at the DI workshops or got limited practice), unless requested by a principal or that teacher. And, if she were invited, a traditional supervisory model was sometimes encouraged—sit quietly away from the teaching action and offer suggestions well after the lesson (when the damage of poor teaching skills or format distortions had been well-practiced).

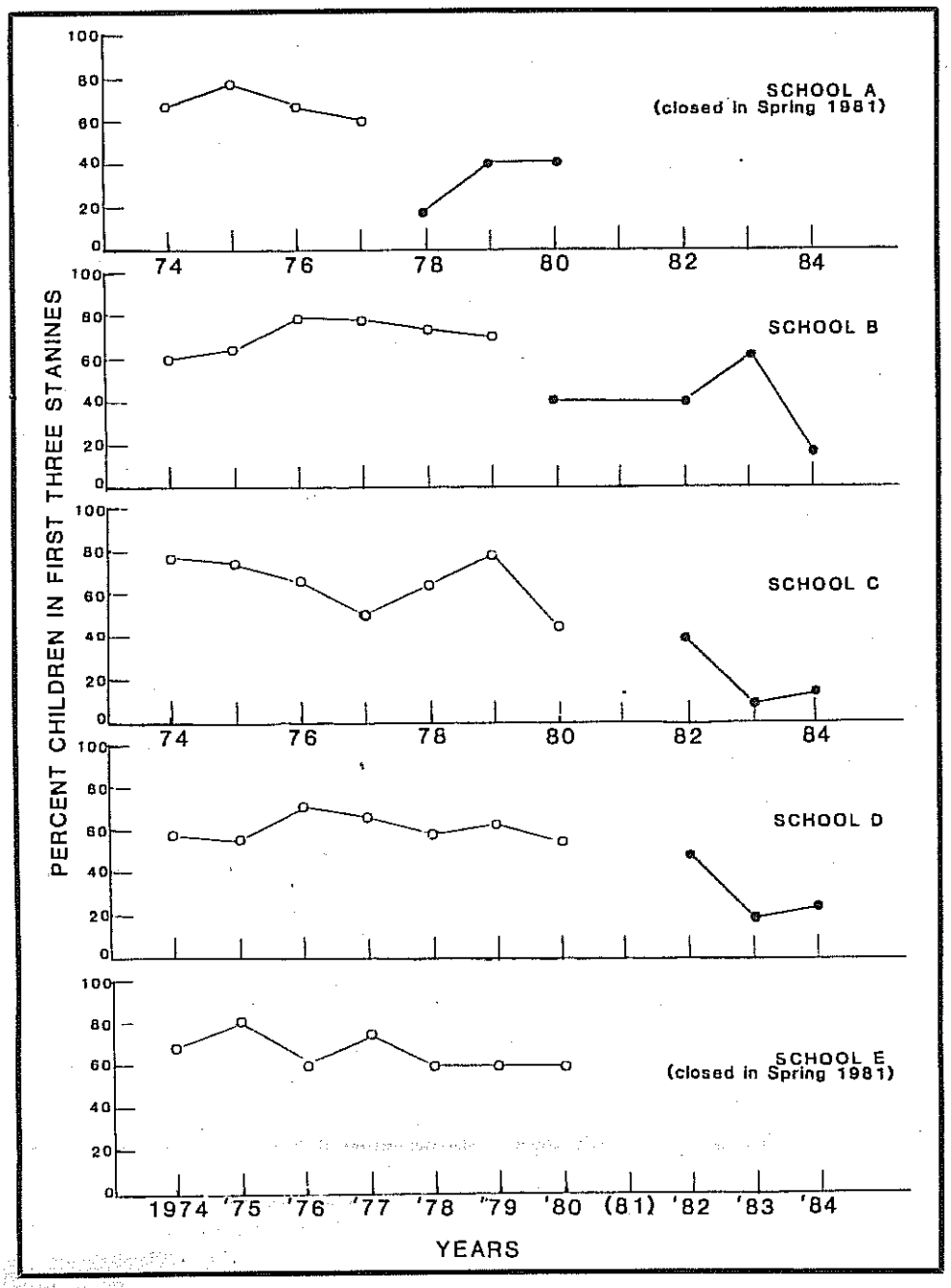

Figure 1. Percentage of third graders in first three stanines without (open dots) and with (closed dots) a history of Distar Reading in grades 1 to 3. From 1974-78 the Stanford Achievement Test was administered. From 1979-1984 the California Achievement Test was administered. In 1981, no third grade testing occurred.

Findings and Interpretations

Figure 1 shows the percentage of third grade cohorts from each school who placed in the lowest 3 stanines on the total reading section of the standardized reading achievement test given during the Spring of each year.

Combining percentages across the Pre-Distar years (open dots), the mean weighted percentages for the respective schools are as follows (the number of third graders tested is in parentheses): School A, 69.3% (127); School B, 70.9% (385); School C, 63.8% (467); School D, 61.0% (754); School E, 66.7% (487).

Comparable mean weighted percentages and the associated total number tested during the DI years for each school, when its third graders had an instructional history of two-to-three years of Distar Reading are: School A, 33.9% (118); School B, 41.1% (231); School C, 25.6% (242); and School D, 30.3% (218). Relatively speaking, these values represent an incredible reduction in the percentage of initially low-performing third graders falling in the bottom 3 stanines compared to the percentages reported for the years prior to the introduction of Distar Reading. For Schools, A, B, C, and D, mean percentage differences between the pre-Distar years versus post-Distar years were highly reliable (p's less than .0001), as evaluated by a procedure that tests for differences between two uncorrelated proportions (Guilford, 1965, p. 185-186).

When initially large stanine reductions appeared at one target DI school, similar reductions were not likely to occur at the Non-DI schools. Only when DI was firmly implemented in a former Non-DI school, did the lowest 3 stanine percentages plummet. School E, only a few miles from Schools B and C, can be considered a control school. It never had DI and it never did rid itself of its large population of nonreaders.

The sequential nature in which DI was introduced across schools (much like an A - B, multiple baseline design) and the systematic improvement in reading performance suggests that the causal factor in the change was the use of Distar.

We believe that the lows and highs in the data during the post-DI years are attributable to teacher training variables and implementation practices. For example, Roberta shifted her training responsibilities in 1978 from School A to School B, and thus no longer could help firm up kids in that previously discussed weak first grade School A classroom; this neglect in program implementation and monitoring probably resulted in a rise in the 1979-80 percentages (Fig. 1).

Improving the third grade stanine rankings were correlated, of course, with a corresponding rise in the target school's mean grade equivalent score. Prior to DI, the average third grader in the compensatory schools was about one grade level (9 months) below national norms in reading, a finding typical of children with similar backgrounds placing near the 20th percentile (Becker & Carnine, 1980; U.S. Office of Education, 1976). Now, with the implementation of *Distar Reading* into the compensatory schools, the number of months that third graders were below the national average was cut by half a year (corresponding to an improvement of a 1/2 standard deviation unit). A spin-off has been an elevation in the city school system's overall mean grade level for third grade, which in pre-DI years had always been 4 to 5 months below national norms (due in large part to the dismal performance of students in the five high-risk population schools). By 1983 and 1984, the system was now a month ahead of national norms!

There is also some data related to the maintenance of effects beyond third grade. In Figure 2, are the percentages of *fourth graders* classified by three stanine groupings on the 1979 CAT for the five high-risk population schools.

Only in School A did the children have a previous history of *Distar Reading*. These fourth graders, which included mostly those from School A's 1978 third-grade group (cf., Fig. 1), were taught reading through the basal reader approach in their fourth grade. Additionally, transfer and other students encountering reading difficulty were taught through *Corrective Reading*.

As is evident, the preponderance of fourth graders from Schools B, C, D, and E occupy the bottom three stanines, with the percentages varying from 50% to 68%, whereas for School A, there is a shift in the peak percentage to the middle stanine grouping. School A fared better or did equally as well in 1978 as two other city schools which had much lower rates of children of free or reduced lunch. What saved these two other schools from looking dreadful in terms of their average grade score was the 12% to 18% of their children who placed in the *top three stanines*.

Discussion

The good news is that school personnel now acknowledge that illiteracy can be reduced in low performers through DI. This has led to its use in all of the city's elementary and secondary schools (although, almost exclusively with hard-to-teach students). Knowing that there are hardly any upper graders who need to be remediated anymore by *Corrective Reading* is heartwarming. Those who need remediation are mostly from out of town.

Roberta's summer workshops are full and over *200 teachers* and several ad-

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DI in Tuscaloosa Continued

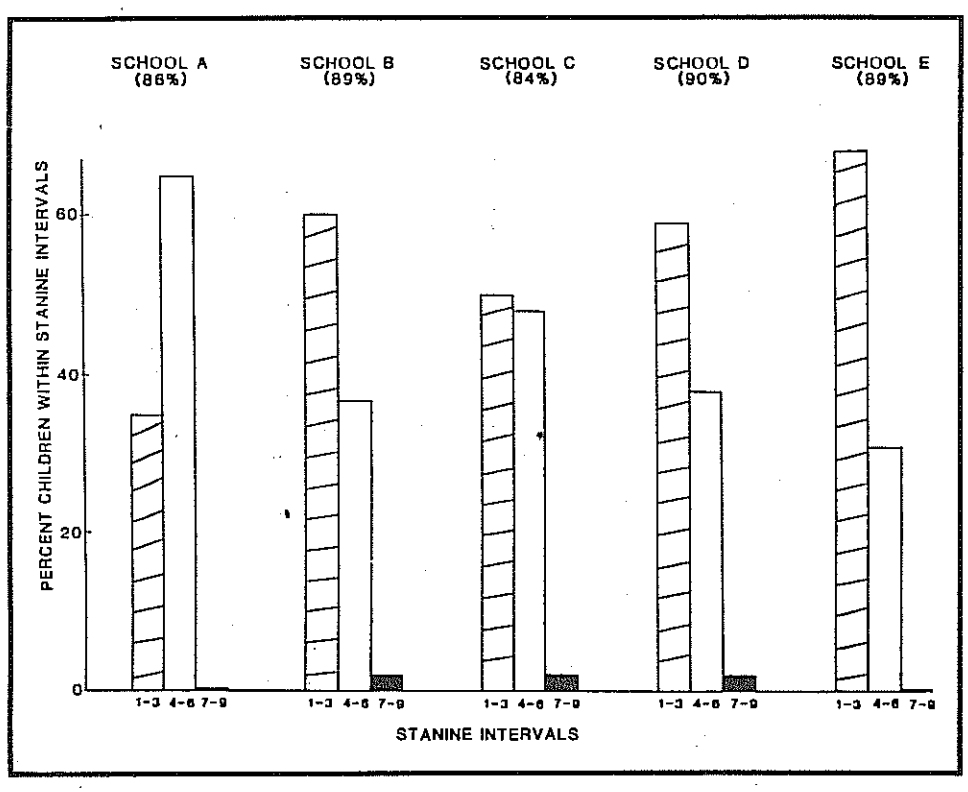

Figure 2. Percentage of fourth graders in different stanine intervals on the California Achievement Test given in 1979. Only in School A was Distar Reading taught in grades 1 to 3. Percentages of free or reduced lunches are reported in parentheses by school.

ministrators representing every grade level have attended them. They draw participants from around the State, and have developed a solid reputation for explicating the principles of DI and then moving forward to impart critical teaching skills in a thorough-going, practical manner. We like to think that the workshops have made the teachers better.

There is now a closely knit group of mutually supportive DI teachers, who, if the commercial programs were suddenly made taboo, would nonetheless continue with the DI delivery system and design their own formats. Many of them have frequently experienced personal insults in their own attempts to use and support DI. Once a couple of university education professors repeatedly put down DI programs and the teachers who used them, without citing a shred of evidence or without ever consenting to see the programs in use. However, the results of this and other kinds of negativism were wonderful! The smears became the glue which united DI teachers and spurred them on. (Incidentally, the anti-DI professors have left the University, and although DI is still not taught in the Education Department, there is a move afoot to send students to Paul's preschool for training and collaborative research.)

The city system has openly invited out-of-towners to see its DI program, and there are DI programs getting started in other locales. There are probably enough of us to *hold a state-wide conference on DI next year.*

Now, the not so good news. True, DI is everywhere in Tuscaloosa but, because it has gotten so big and has been absorbed by the school system, we worry about quality control. The high standards of teacher training, program implementation, and monitoring that Roberta set forth in the pre-court order days have begun to slip, because others less knowledgeable in these matters are increasingly taking over these responsibilities and are making instructional decisions about high-risk children.

Administrators and building principals, now given the responsibility for the low performers, still wish to wrap themselves in their cloaks of curriculum uniformity and eclectism as they did previously as managers of schools catering to average and above average children. They continue to yearn for signs of the old normalcy; school plays, a chorus, lots of student art displayed and so forth. Even though logic and data suggest that high-risk children should spend more time in critical academic content areas, this curriculum priority is losing out to the pressure to normalize it—expose almost every child, no matter how weak in language and reading skills, to social studies, art, music, and P.E.

We worry when DI children showing the first spark of progress are uprooted and planted into basal programs or shunted into more advanced DI groups when evidence suggests they should stay where they are. We worry when DI teachers, with a class size of 30, are reluctant to have more than three reading groups, and some reading groups swell to 10-12 children. We worry when DI teachers needful of frequent monitoring by knowledgeable DI implementers are instead rarely checked or checked fleetingly by individuals using traditional supervisory monitoring procedures.

When on-site administrators, who have never taught DI and are unfamiliar with the sequence of skills programmed, are placed in charge, they are caught in the dilemma of being instructional leaders of their school without the ability to give specific advice about DI instruction. They walk a fine line. If they dispute or ignore data-based decisions offered by their more experienced teaching staff, they infuriate these teachers and alienation results. If they admit ignorance and ask central office for assistance, it may be interpreted as a sign of weakness. Some principals would rather preserve the appearance of an untroubled effective faculty than to invite "outsiders," like Roberta, to get down to the serious business of helping teachers improve the kids' performances.

Supervisors are not interacting as much with Roberta about DI instruction in those schools not assigned to her. These individuals are allowed to do as they please, and since the principals in these other schools don't know DI, no one is monitoring supervision. Kindergarten teachers of high risk children in these and other schools are beginning to use the language program, but they are relatively unsupervised. If Distar Reading is done there, it is at the discretion of the teacher.

Guidelines For The Future

After having been at it for eight years, perhaps the following 10 suggestions should be considered by those in a position to start using DI programs in their community:

1. *Start small.* Attract smart, eager and caring teachers who want something new.

2. *Train well.* Supervise closely. Make sure the program is done right. The teacher must be successful.

3. *Have money and support.* No matter how good the program is, if administrators don't want something, they won't let you have it.

4. *Come to administration with proof of effectiveness.* Data alone may not help if there is bias or no interest, but it does help if people are openminded.

5. *Show a success model.* Principals came to Paul's facility to see at-risk preschooler's reading. Some visited the Dayton Follow Through Program in 1980. Don't let outsiders observe the early lessons in which the kids are struggling. Show polished performance.

6. *Don't try to shove DI down throats.* If you do, resentment can be manifested in sabotage so the program won't work. This can be seen as not spending enough time on a lesson, forming groups that are too big or of poor composition and distorting the presentation.

7. *Maintain quality control.* Be visible, stay in the schools, and maintain teaching and learning standards.

8. *Have parent and community support.* Parents asking that their children be in or removed from a program carries a lot of weight with the principal.

9. *Be willing to be an outsider.* If change requires dissention, be prepared to dissent and suffer the consequences which include ostracism, nasty gossip and name calling, and distortion of your efforts.

10. *Finally, if you're successful, be prepared to have your achievements claimed to belong to the powers that be.* After all, they took the risks. You must keep plugging away at these people to maintain your influence, but there's always a chance that your efforts will be absorbed into their bureaucratic methods and lose their effectiveness.

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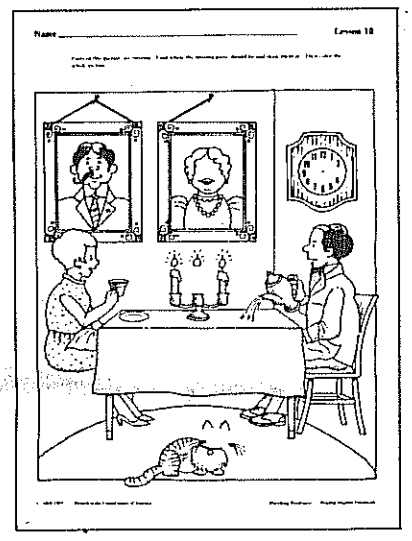

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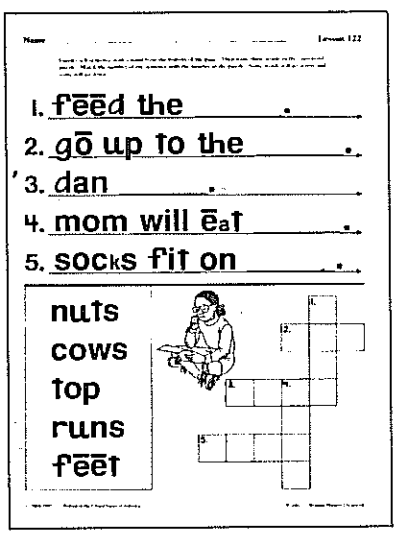

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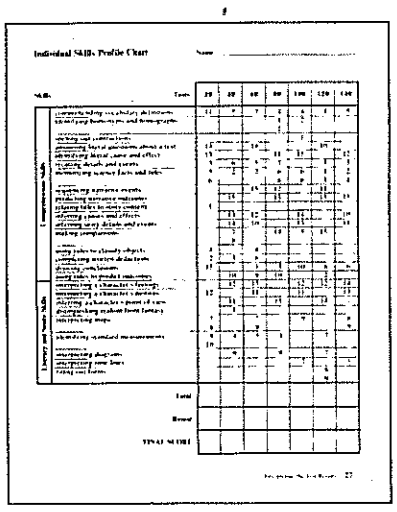

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Teacher Net Computer Feedback Tested

By Marilyn Stepnoski
and Douglas Carnine
University of Oregon

Rosenshine (1983) reported that students spend only about 30% of their school time (allocated time) in teacher-led instruction and 50%-75% of the allocated time in independent seatwork. He found that student engaged time during seatwork was lower than during teacher-led instruction and usually did not exceed 70%. In short, students spend a major portion of their school day working alone, a situation associated with relatively low levels of engagement.

Student accountability for work done independently has been addressed only minimally in the research literature (Brophy & Good, in press).

The research that has been conducted focuses on student engaged time during independent work. For example, Hall, Lund, and Jackson (1963) reported increased student engagement when teachers increased the amount of contingent praise and ignored off-task behavior. Walker and Buckley (1968) successfully used a point system to increase attending behavior. Rosenshine (1983) reported that teachers who informed students regarding their accuracy of performance increased engagement rates by 10% and produced higher achievement. Thus, both reinforcement and academic feedback seem to increase engagement (Brophy & Evertson, 1976). Yet the teacher is often unable to monitor students doing their assignments and to simultaneously provide small group instruction.

A computer-monitored feedback system called Teacher Net allows many students to simultaneously enter responses on individual key pads. A single Apple IIe or IBM PC Jr. can score and analyze the responses and summarize them in a form that is readily useable by a teacher. The summary can present the number of items missed in various skill categories. With the timeliness of the diagnosis and the computer's assumption of the clerical chore of scoring, the teacher has the time to provide process feedback or reteach, rather than just telling students the correct answer. Good and Grouws (1979, 1981, 1983) have reported replicable positive effects of process feedback upon student math performance at both elementary and secondary school levels.

The purpose of the present study was to investigate the effectiveness of two procedures for monitoring student performance and providing academic feedback on independent math seatwork by remedial math students: (a) traditional feedback in which the teacher read the answers while the students checked their papers and counted the number of items missed, and (b) computer-monitored feedback in which the computer summarized the number of items missed by each student. Diagnosis and reteaching were provided during the remainder of each three-minute feedback period throughout the experiment. The three-minute feedback time was based on measures of time teachers spend in conducting group work checks following independent math seatwork.

The dependent variables were: (a) teacher time spent in reteaching during the three-minute feedback period, (b) student accuracy on worksheets, (c) maintenance test performance. Secondary analyses were performed to address whether there were differences in accuracy in the scoring of worksheets.

Method

Students and Setting

Seven remedial mathematics students, who were identified by their teachers as having previously mastered the skill areas making up the initial worksheet item pool, served as subjects. (Students had achieved 90% accuracy for two consecutive days immediately following instruction in each skill area earlier in the school year, but often made errors on mixed worksheet items during independent work periods.) The group mean performance on the Total Mathematics subtest of the California Test of Basic Skills, administered during the first week of this study, was the 40th percentile. The subjects were almost exclusively Caucasian and came predominantly from middle class homes.

The study was conducted in a special education resource classroom in an elementary school. Each afternoon, the subjects worked for 15 minutes (12:55 PM to 1:10 PM) on individual math worksheets. This was an independent work period. The subjects received no instruction from the teacher during this period. A three minute feedback period immediately followed.

The students sat in desks arranged in a "V" shape, with the computer monitor at the open end of the "V" and a blackboard to the side. Board presentations were part of many reteaching procedures. Other students received small-group instruction in other areas of the classroom.

Design

An experimental reversal ABA'B'A'B' was employed for this group of eight students. In the first condition, Traditional Feedback (A), the teacher read each correct answer while the students checked their papers. The students then counted the number of items missed and recorded the number at the top of their worksheet. During the second condition, Computer-Monitored Feedback (B), the teacher told the number of items each student missed and the students wrote the number at the top of their worksheet. Diagnosis and reteaching were provided during the remainder of each three minute feedback period.

With a slight variation, phases 3 and 5 replicated the first condition, and 4 and 6 replicated the second condition. The study ran for a total of 26 days, 5 days each for phases 1 to 4, and 3 days each for phases 5 and 6. A variable-interval-five reinforcement schedule was used throughout all conditions of the experiment to praise the students, thus preventing a potential confounding of verbal praise and academic feedback.

Instructional Materials

Math screening test. This test was developed to identify specific math operation, problem solving, and measurement skill deficits by problem type for subjects who had previously demonstrated skill mastery. There were ten problems for each basic operation (addition, subtraction, multiplication, and division); ten problems in problem solving, fractions, and decimals; and ten problems covering measurement, sampling items from grade two through grade five.

Table 1

First Set of Problem Types

Skill Area	Problem Type	Example
Multiplication	One digit times three digit factor; horizontal	$352 \times 9 =$
Multiplication	Two digit times two digit factor; vertical	$\begin{array}{r} 37 \\ \times\ 25 \\ \hline \end{array}$
Division	One digit division; two or three digit dividend quotient with remainder	$5\overline{)87}$
Problem Solving	Addition/subtraction classification problems	Eight men are in the store. Three women are in the store. How many people are in the store?

Basic fact screening test. One hundred basic facts for each of three operations and ninety for division were given on four fact sheets. Fifty examples were written vertically and fifty examples were written horizontally. Five minutes was given to complete each worksheet.

Independent worksheets. Six sets of math worksheets, one for each phase and comprised of: (1) review items for phases A_1 and B_1, and (2) review *plus new items* for phases $A'_2B'_2$ and $A'_3B'_3$ were constructed using the following procedures. Based on the math screening test, which was composed only of review items on which students previously achieved at least 90% mastery, review problem types were identified and selected for inclusion if the problem type was missed by at least 50% of the students during screening. New problem types recommended by the teacher were included in the A'B' phases of the experiment. The subskills required by new items were mastered by all the students as demonstrated by the fact screening test.

Each independent worksheet was designed to include four problem types. The problem types were presented in a mixed format. Four different sets of problem types were developed in all. Two sets were used in the A conditions (review, and new plus review) and two sets were used in the B conditions (review, and new plus review). An attempt was made to select problems for the A and B conditions that would have minimal generalization or transfer effects, and yet be of equal difficulty. The fact that all subskills required by new items were mastered by all students gives us some assurance that difficulty levels were equated. The first set of problem types appears in Table 1.

Procedures

Each day, eight remedial math students came to the designated area in the special education resource room where they had assigned seats. The experimental teacher gave the following directions:

> You are going to work some math problems that you've seen before. Listen to the directions. Work as many problems as you can. If you are not sure of how to work the problem, go on the the next problem. When you finish the first page, go on to the next page. If you finish early, check your work. Keep on working until I say stop. When I say stop, put your pencils down. Then, we will start to correct your work.

The teacher checked for understanding of the directions by asking the following questions:

1. What are you going to do if you are not sure how to do a problem?
2. What do you do if you finish early?
3. Do you have any questions? I will not be able to answer any questions while you are working.

You may begin working.

After giving directions, the teacher left.

At the end of the 15 minutes, the teacher returned and said to the students, "Stop, pencils down." Then, the following treatment conditions were implemented and the observers took data on reteaching time and completed the teacher observation checklist.

Traditional feedback procedure. During Traditional phases the teacher used this script for introducing group self-correction:

1. I'll read the problem and the answer. Put an X next to the problem if you got it wrong.
2. What are you going to do if you got it wrong?
   (S: "Put an X next to it.")
3. Pick up your red pencil. Find Item 1 on your worksheet.
   (Teacher reads the item number and the answer.)
4. Count up how many you missed.
5. Write that number in the box at the top of your paper.
6. I'll read your names. Tell me the total number of errors.

Computer-monitored feedback procedure. During Teacher Net phases, the teacher used this script:

1. We're going to start correcting our math papers another way.
2. I'm going to tell you how many you missed. You're going to write the

Continued on Page 10

Teacher Net Computer Feedback Tested

number missed in the box at the top of your paper.
3. I'll read your names and the total number you missed.

During the remainder of each three minute feedback session, the teacher decided which skill areas required reteaching and then provided the reteaching.

Diagnosis and remediation. Two important points on diagnosis and remediation were critical in this study: (1) although diagnosis and reteaching were provided during each three-minute feedback period, it was assumed that more time would be available in the computer-monitored (Teacher Net) condition, (2) after errors were recorded by students in the Teacher Net condition, the teacher did not have *specific* information on the cause of errors and would review the entire strategy for a problem type with high error rates.

The academic feedback procedures for this study closely paralleled the procedures for diagnosing and remedying errors that appear in *Direct Instruction Mathematics* text by Silbert, Carnine and Stein (1981).

Teacher training. The experimental teacher for this study was a doctoral student in the Department of Special Education at the University of Oregon. The teacher had previous teaching experience and received training in the experimental preocedures prior to the experiment. The teacher was trained on: (a) leading students in correcting their own worksheets, (b) using the computer-monitored feedback system, (c) diagnosing math error patterns, and (d) reteaching math skills.

Measures

Teacher behaviors. Observers took data on the number of minutes spent on reteaching during the three-minute feedback period. A teacher observation checklist was used to ensure that the experimental procedures were being implemented appropriately. Before the independent seatwork stage, observers focused on teacher directions and materials. During the workcheck/feedback stage, observers focused on scoring, diagnosis, and reteaching procedures. Also, ten lessons were audiotaped and assessed by a trained observer to insure consistency in the implementation of the experimental procedures. During the study, it was necessary to make only slight modifications in the experimental procedures.

Daily performance data. Daily performance data for each subject as well as mean performance for the group were plotted for the percentage of math problems attempted that were worked correctly. Secondary analyses were performed on accuracy of scoring.

Maintenance test. This was a 24-item test that was administered one week after termination of the intervention. This test was designed to test the ability of the students to retain their skills on the review plus new material presented in last four conditions. The test contained 3 items each of 8 problem types. The test took approximately 20 minutes for most students to complete. However, students were given as much time as necessary to complete the test. Students also were scored on their ability to compute the correct answer.

Consumer satisfaction questionnaire. A six-item consumer satisfaction questionnaire (Table 2) was developed to allow the students to rate, on a scale from 1 to 3, their opinions about the monitoring and feedback procedures. All students were asked to complete this questionnaire two weeks following termination of the study.

Table 2

Consumer Satisfaction Questionaire

Name _____

	A Little		A Lot
1. How much did you like working with the computer?	1	2	3
2. How much did you like working with the worksheets only?	1	2	3
3. How much did you learn working with the computer?	1	2	3
4. How much did you learn working without the computer?	1	2	3
5. How much more would you like to work with the computer?	1	2	3
6. How much more would you like to work without the computer?	1	2	3

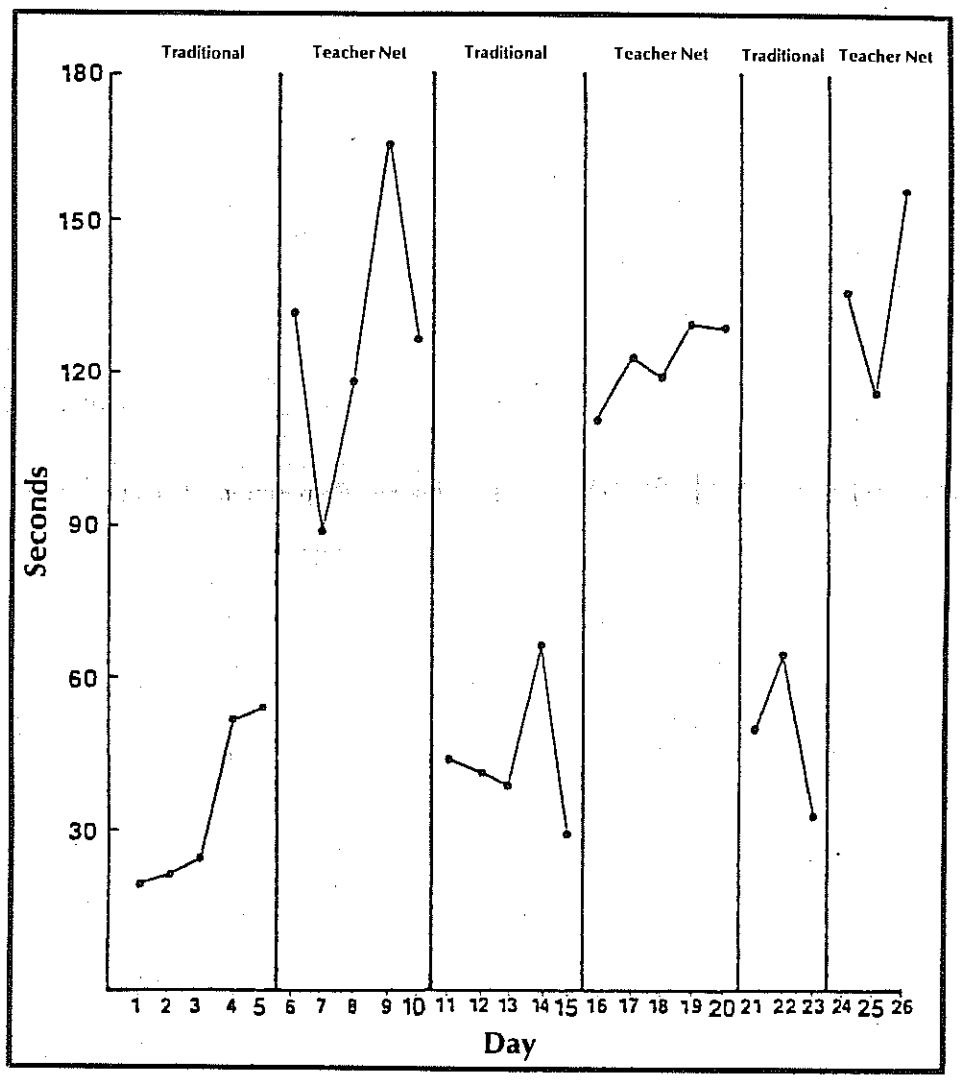

Figure 1. Time spent in reteaching as a function of two monitoring procedures.

Results and Discussion

Teaching Time

Figure 1 shows the amount of reteaching time spent in each phase of the experiment. The observed changes are represented in terms of the number of seconds of reteaching in a three-minute feedback period. The mean number of seconds in reteaching for the Teacher-Net sessions was 128 seconds (2 minutes, 8 seconds); the mean number of seconds in reteaching for the traditional sessions was 42 seconds. As predicted, the amount of reteaching time in the computer-monitored phases was markedly higher than in the traditional phases.

Daily Student Performance

Group performance for percent of items attempted that were correct is presented in Figure 2 and Table 3. Visual inspection of Figure 2 shows that when only review material was used, the students achieved comparable levels of accuracy during both conditions. Additional reteaching may not be particularly beneficial when students review material mastered previously in the year. When new plus review material was used, the students APPEARED to achieve a higher level of accuracy during the computer-monitored phases than during the traditional phases. This interpretation is relative at best because of the increasing trend lines within the phases. (The end of the school year precluded longer phases.) Possibly, the increased difficulty of the material may have resulted in the additional reteaching time leading to enhanced student performance.

Table 4 presents the percentage of items completed for each experimental phase for each subject and for the group. When the percentages for A phases (Traditional) are compared with the percentages for B phases (Teacher Net), the traditional phases showed the highest percentages of items completed. The percentage of items completed during Traditional phases increased from 93, 98 to 99; and during Teacher Net phases increased from 81, 93 to 95.

However, the *differences* in percentages of items completed between Traditional and Teacher Net phases decreased over the course of the study: 12, 5, and 4, respectively. Thus, the decreasing differences between items completed during the Teacher Net and Traditional phases showed that *the students became more facile using the computer key pad* as the study progressed. In future research students could become proficient with entering their answers on the Teacher Net key pads *before* beginning the study.

Maintenance Test Results

One week following the end of the study, a maintenance test on the last two sets of problem types was administered. Table 5 shows the individual and group results on the maintenance test. The group averaged 58% on the type of items presented during the Traditional condition as compared to 76% on the type of items presented during the Teacher Net condition. Using the Wilcoxon Sign Rank Test, these results showed a significant difference at the .03 level.

Both group means represent an increase following termination of the intervention. The traditional group mean for phases A'_2 and A'_3 was 54.5%, and increased slightly to 58% on the maintenance test. The Teacher Net group mean for phases B'_2 and B'_3 was 66% and increased to 76% on the maintenance test.

The maintenance test results must be interpreted with caution. If the Teacher Net worksheets were easier than the Traditional worksheets and the maintenance test was constructed similarly, the difference in group means, favoring Teacher Net, may simply further reflect a difference in content difficulty.

Accuracy in Scoring

During the Traditional condition, (teacher-directed, student-scoring), the mean reliability for the group accuracy data was 96.7% with a range of 96.3% to 97%. Reliability between the teacher-scored worksheets and the computer diagnostic summary averaged 95.6% with a range of 93% to 99%. It seems that errors are no more likely to occur in entering responses on a keypad than in listening to a teacher read answers and marking wrong responses.

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Table 3

Mean Percent of Attempted Problems Correct

Subject	A	B	A¹	B¹	A¹	B¹
1	97	92	46	65	52	85
2	75	85	35	36	55	52
3	72	66	29	56	62	67
4	66	44	44	72	65	79
5	87	78	88	58	-*	-*
6	94	99	63	75	80	88
7	83	87	69	76	59	88
Group Mean	82	78.7	53.4	62.6	62.2	76.5

*Indicates student moved and was dropped from study.

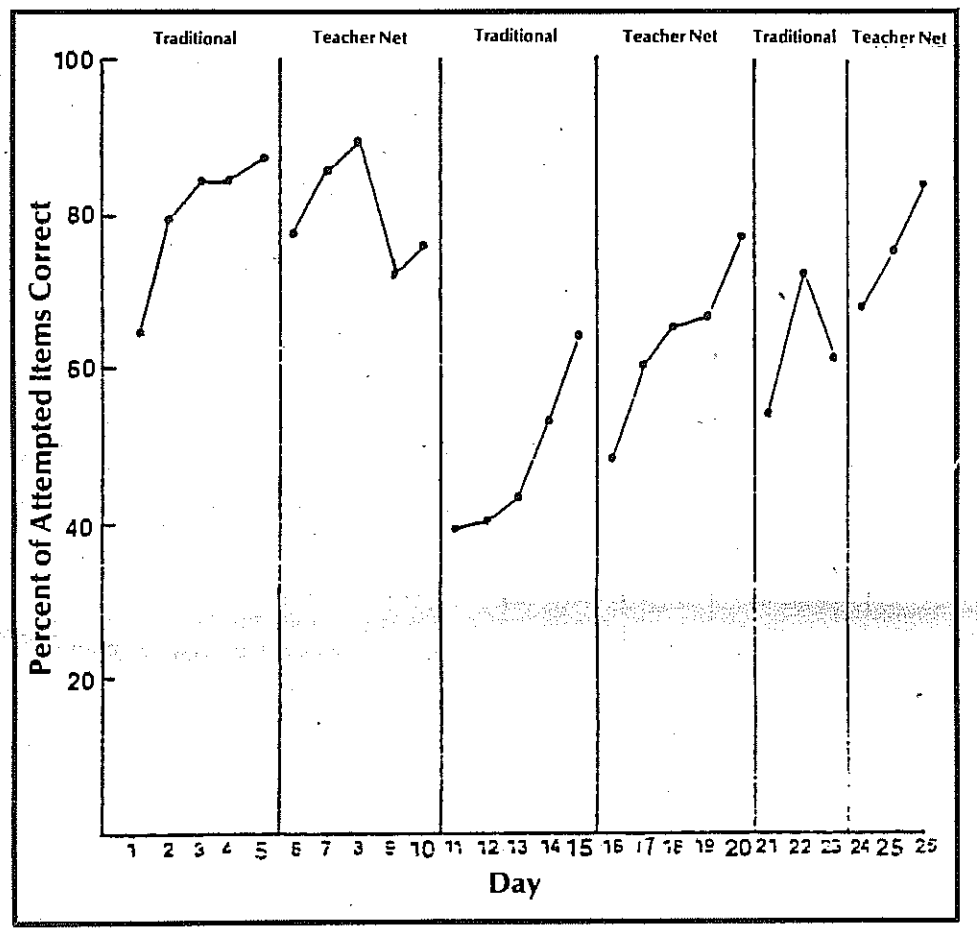

Figure 2. Percent of Attempted Items Correct on Math Independent Worksheets by a Group of Remedial Students. N=6.

Table 4

Percent of Items Completed Per Phase

Subject	A	B	A¹	B¹	A¹	B¹
1	100	100	100	97	100	100
2	84	60	100	82	100	88
3	100	79	93	89	100	92
4	76	74	96	89	100	93
5	97	98	100	100	-*	-*
6	96	93	98	100	100	100
7	96	62	100	95	98	95
Group Mean	93	81	98	93	99	95

*Indicates student moved and was dropped from study.

Student Attitudes toward Instruction

On the consumer satisfaction questionnaire, the students indicated that they felt they had learned equally from both treatment conditions and that they did not feel differently about working with or without the computer. It may be that the overall mastery learning structure of the instruction (i.e., specific directions, timed seatwork, reinforcement) employed in this study accounts for the students' attitudes. Several students' responses during the course of the study further indicated satisfaction with the instructional procedures in general; "I didn't miss anything in the school assembly by being here" or "Can't you spend more time on teaching?" (extend the three-minute reteaching time).

This last comment about teaching time may reveal a limitation of the study, at least with respect to the Teacher Net condition. Although reteaching time during Teacher Net phases was markedly higher than during Traditional phases, the reteaching time rarely exceeded two minutes and perhaps was *too limited* to provide an effective remediation.

The scoring, diagnosis and maintenance of student independent work at the classroom level is a complex undertaking. Preparation of diagnostic summaries as well as routine scoring are costly in terms of the time needed to perform them and the attention diverted from the direct delivery of instruction to students. Without rapid access to student performance data, teachers may find it difficult to continuously monitor student progress, to diagnose skill deficits and to provide reteaching. A computer-monitoring system, such as Teacher Net, can perform these functions and relieve teachers of much paper work so that they can concentrate on the more substantive task of efficient, effective instruction. The results of the study show that computer monitoring increases time the teacher has available for reteaching.

The full development and impact of how technological innovations can increase student performance, however, imply the need for further research. The classroom setting is a complex environment requiring more extensive research for developing effective and efficient technologies such as Teacher Net. If Teacher Net's potential utility is realized, many additional uses need to be studied in the future, for example, in testing, in getting student feedback during a lecture, reading comprehension, etc.

Table 5

Descriptive Data — Individual and Group Means in Percent Correct on Maintenance Test

Subject	Traditional	Teacher Net
1	58	83
2	58	75
3	50	83
4	50	67
5	-*	-*
6	67	83
7	67	67
Mean	58	76

*Student moved

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College Reading

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me." One of her students that began with an "ugly" attitude stated that he loves reading out loud now even though he used to hate it. Another student with speech impediment now consistently volunteers to read first. These examples seem to be representative at least of attitudes at the end of the first ten weeks of instruction.

There is a feeling that the students in the lower level are making a great effort to increase their reading skills and the *Corrective Reading Program* is allowing them to experience success. Whether this balance between experiencing success, but making reasonable progress toward the goal of entry level skills for college will prevail remains to be seen. The gulf between these students' present level and the goal is a wide one. The successful crossing will depend on student motivation, university administration's and faculty's patience and support, and effective and efficient instruction with strong leadership of the College Reading Program. The obstacles may be too great. But we are willing to make the effort and realize that even if we cannot get these students to their ultimate goal, we will have improved their reading ability and thus have provided a more realistic opportunity for higher education.

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MICROCOMPUTERS IN TEACHER EDUCATION

Samuel K. Miller - Editor

Computers and Writing

Editor's note. This is the second part of a two part series on Computers and Writing *by Samuel K. Miller. Part 1 covered history. Part 2 covers the microcomputer era.*

Research and Popular Beliefs About Writing with a Computer

During the past five years a number of articles on the computer's potential for improving students' writing skills have appeared in journals and magazines. Uses of the computer for this purpose can be classified under four general categories: (1) computer-prompted idea generation, (2) text analysis, (3) computer-assisted instruction, and (4) word processing. The following sections summarize the research and popular beliefs about these applications of computers.

Computer-Prompted Idea Generation

Several researchers (Burns & Culp 1980; Woodruff, Bereiter & Scardamalia, 1981) have developed and tested interactive computer programs to assist students in composition. The programs generally use the computer to develop ideas or an outline for writing by presenting a series of questions or "prompts."

Woodruff, Bereiter, and Scardamalia's program includes prompts such as "Do you have an opinion on this topic?" and "Have you told the reader how you knew about this reason?" Results from this study indicate that the students found the programs interesting and helpful; however, frequent intervention by the computer tended to slow the composition process and the quality of the students' writing did not noticeably improve.

Burns (1984) devised computer programs that utilized questioning strategies based on classical rhetoric or the art of constructing persuasive arguments. He reported that

> "in the experiments using these programs, students had more ideas about their topics, for all the quantitative gains were significant over a control group. But when these same students were asked to organize their ideas into some 'arrangements,' their arrangements were not significantly better than the control group's arrangements. Arrangement for these students did not develop naturally for lots of ideas. In fact, too many ideas made the arranging task more difficult and more time consuming" (p. 25).

Research about computer-prompted writing is limited; however, the belief that computers can successfully assist students in developing topics about which to write has created a market for a number of commercial software programs. Some of the more popular programs at the elementary and middle school levels are described below.

STORY MAKER, a program published by Bolt, Beranek, and Newman, Inc. (1981), engages students in a creative story writing exercise by allowing them to select options from story segments provided by the program.

PLANNER is one of six different programs for use with the QUILL writing program published by D.C. Heath (1984). The program helps students take notes, write their ideas, and organize their thoughts.

STORYTREE, published by Scholastic Inc. (1984), is a creative writing program that allows students to create stories with multiple endings. The program presents a series of prompts to help students create mystery or adventure stories that contain chance events and branch to a variety of endings.

The limited research indicates that computer-prompted idea generation does not necessarily promote better writing; however, such programs can imitate many of the prewriting "routines" employed by teachers. These routines, summarized below by Burns (1984), will undoubtably be refined as researchers continue to apply computer technology to writing instruction.

> "1. A program can ask the question.
> 2. A program can clarify the question.
> 3. Good software can define the dimensions of the question.
> 4. The software can call attention to the essay's purpose.
> 5. It can purposefully distract (for incubation's sake).
> 6. It can rephrase the question.
> 7. It can create random metaphors.
> 8. Invention programs can offer research questions.
> 9. A program can print a copy of the dialogue so a student can later evaluate the answers" (p. 22).

Computer Text Analysis

Can computer programs be developed that will criticize and correct student essays? Hertz (1983) and Lawlor (1984) have investigated the use of text analysis programs that assist writers and their teachers. The present work in computer text analysis is in the developmental stage, and virtually no research exists about such programs.

Sophisticated text analysis programs such as WRITER'S WORKBENCH developed at Bell Laboratories (1980) and IBM's EPISTLE (1980) program have been used primarily with adult writers. WRITER'S WORKBENCH critiques writing on the basis of rules derived from two writing style guides, while the EPISTLE program searches for fourteen common writing errors that it has been programmed to recognize. Hertz (1983) pointed out deficits in the performance of both programs. Discussing the EPISTLE program first and the WRITER'S WORKBENCH next, Hertz noted:

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Computers and Writing

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"Though its designers would eventually like to be able to ask the machine what a passage it has just read is about, they have had their hands full so far just trying to get the syntactic analysis to work. (p. 62)

The editors of *Discovery Magazine* had the clever idea awhile back of submitting for judgement the Gettysburg Address and the first paragraph of *A Tale of Two Cities*. The WORKBENCH was not pleased. It ordered Lincoln to shorten his sentences — an average of 26.7 words in length — to something closer to 15. 'Your document,' the WORKBENCH advised him, 'contains many more complex sentences than is common for this type of text.' But Lincoln got off lightly compared to Dickens, whose sentences proved to be 100% 'complex' " (p. 63).

Hertz and other experts in the field believe that using a computer to critique writing may be impractical because many writing tasks cannot be reduced to a finite number of widely accepted rules. Programming a computer to check written work for spelling and grammatical errors is a fairly straightforward task and a number of programs are available for these purposes. Such programs may, in fact, allow teachers to spend more time critiquing the content of their students' writing instead of the mechanical errors. However, effective programs that evaluate a writer's style and creativity may never be perfected because many aspects of evaluating writing depend on subjective judgement.

Computer-Assisted Instruction

Instructional games, drill-and-practice, and tutorials are all examples of programs categorized as computer-assisted instruction (CAI). Rubin (1983) examined descriptions of 317 language arts programs listed in a comprehensive software category and reported that the majority of CAI programs for language arts focus on letter, word, or sentence themes. Letter theme programs require students to manipulate text at the letter level (e.g., require a student to race the computer to type the next letter in the alphabet); word theme programs require students to work with isolated words (e.g., select the correct antonym for a word from a list of alternatives); and sentence theme programs require students to work with phrases or sentences (e.g., divide a group of words into several sentences). Doyle (1983) and other experts in computer-assisted writing instruction regard such programs with disdain.

"The carryover of these exercises is highly questionable. There are few software programs that retain the dignity and wholeness of the reading and writing process, and enhance the learning necessary to master this process" (p. 144).

Research about the instructional effectiveness of CAI and its potential for improving students' writing skills is limited. Forman's (1982) comprehensive search of the literature on CAI reported that "the number of methodologically sound evaluations of the effectiveness of computer assisted instruction are rare and conclusive results are difficult to find" (p. 38). Kulik (cited in Emmett, 1983), in another comprehensive summary of CAI research, reported that the results of 250 out of 300 research projects had to be dismissed because of "crippling methodological flaws" (p. 103).

However, the few well-designed studies that do exist indicate that CAI may have some potential for improving writing, if writing is viewed as the acquisition of discrete skills rather than as a comprehensive process. The literature suggests some general conclusions that can be drawn regarding the effectiveness of CAI in the learning process. These conclusions, drawn principally from the work of Gleason (1981), Forman (1982), Kearsley, Hunter, and Seidel (1983), and Atkinson (1984), are summarized below.

1. CAI either improved learning or showed no difference when compared to traditional instructional methods.
2. CAI's effect on achievement occurred regardless of the type of CAI used, the type of computer system, the age of the students, or the type of instrument used to measure achievement.
3. When CAI and traditional instruction are compared, CAI improved achievement or showed no difference in less time.
4. Students have a positive attitude toward CAI.
5. Drill-and-practice and tutorial CAI appear to be most effective with low-ability students.
6. The effectiveness of CAI is increased when a classroom teacher is actively involved with the students.
7. The effectiveness of CAI is increased when it is used to review material that the students are familiar with.

Word Processing

A number of researchers and teachers are interested in the use of word processing as an aid to writing instruction. Bradley (1982) investigated the use of word processing with sixth grade students to complete sentence combining tasks and reported that students: (1) completed the tasks with ease, (2) were motivated to write, and (3) were not seriously limited by a lack of typing skills.

Piper (1984) studied the use of word processing with fifth graders to complete sentence combining and story expansion activities. The results of the study indicated that students who used a word processor improved in writing ability as measured by factors of writing maturity.

Reports about the use of word processing with students of all ages are consistently positive; however, the reports primarily consist of case studies rather than experimental research. Examples of such studies include reports that: (1) learning disabled students, age seven to sixteen, began writing enthusiastically when allowed to use a word processor (Kleiman & Humphrey 1982); (2) college students appear to edit and revise their work more frequently when using a word processor (Levin & Doyle, 1983; Marcus & Blau, 1983; Schwart, 1982); and (3) language impaired children of all ages were able to communicate with the use of a word processor linked to a speech synthesizer (Meyers, cited in Trachtman, 1984).

Shostak (1984) reported that students write more with a word processor and have a better attitude toward writing, "but there is no clear cut evidence yet that students are writing better" (p. 9).

A review of the literature indicates that research about word processing and writing instruction is limited; however, there is no lack of opinion about the subject.

"I believe that the computer as writing instrument offers children an opportunity to become more like adults, indeed like advanced professionals, in their relationship to their intellectual products and to themselves" (Papert, 1980, p. 31).

"The computer helps with this whole process of adding and deleting information — a process that is such a hump for young and old writers to get over. You can take your manuscript and really chew it up without ruining the look of your printed page" (Graves, cited in Green 1984, p. 22).

"Because children learn according to their own needs and not according to a predetermined sequence of skills, tests may not show improved performance. However, by asking students to print out copies of compositions they have saved on disk over a period of time, the wonders of improved writing will become apparent" (Schantz 1983, p. 62).

"Computers can make copy look so nice: centered headings, footnotes in proper forms, margins justified, etc. And now more and more programs are coming to help writers eliminate punctuation errors, misspellings, and even improve style. Consequently, there is a danger of what I call 'smokescreen revision' — the tendency to think that nice appearances cover up flaws in meaning, and that facelifting changes are a substitute for changes in meaning" (Schwartz, 1982, p. 29).

Popular opinion about the use of computers in composition instruction has generally been directed at the beliefs listed below.

1. The use of computers in composition instruction should not focus on drills and exercises about spelling, grammar, etc. (Papert, 1980; Schwartz, 1983).
2. To facilitate the use of a word processor students should receive formal instruction in keyboarding (typing) skills (Kisner, 1984).
3. The process approach to writing should be followed when using a word processor for composition instruction (Green, 1984; Rubin, 1983; Schwartz, 1982).
4. Software developers should emphasize the development of programs that lead students through important steps in the writing process (Rubin, 1983).
5. A word processing program for use with students should have a limited number of commands (Bradley, 1982).

These beliefs, frequently mentioned in computer journals and magazines, help to explain why programs such as THE BANK STREET WRITER and QUILL have been well-received by educators. THE BANK STREET WRITER, published by Scholastic, Inc. (1982), is an easy-to-use word processing program that has been purchased by schools across the United States. QUILL, published by D.C. Heath (1984), is a set of microcomputer-based writing activities that emcompasses all aspects of the writing process.

Summary

It is evident that research about teaching writing with a computer has only begun to emerge. No magical algorithm exists for ensuring effective writing instruction with or without a computer. What does exist is an array of opinion, theory, and developmental research predicated on educators' experiences with traditional writing instruction and programs written for large mainframe computers.

Researchers recognize that writing with a computer is technically different from writing on paper with a pencil, pen, or typewriter. It is likely that recent developments in computer composition instruction will eventually alter the questions researchers ask about writing and even the definition of writing itself. Questions such as "Can results obtained from non-computer writing research be generalized to writing with a computer?" or "Will students who receive composition instruction with microcomputers write as well as students who use mainframe computers?" pose only two of the many difficult problems researchers will need to resolve in the future.

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Use of Computers to Aid the Handicapped

Personal Computers & Special Needs
By Frank G. Bowe
Published by Sybx, Inc.
Berkeley, CA, 1984

Personal Computers & Special Needs is a well written book by an individual who is hearing impaired himself. Dr. Bowe is nationally recognized for his expertise on the uses of microcomputers for the disabled and uses the computer to successfully deal with many of his own personal barriers. A major focus of this book deals with ways that the computer can enhance the opportunities of disabled people concerning employment, education, and independent living.

A unique feature of this book is that the author uses concrete examples to illustrate his points. Under the employment section, Bowe refers to an individual who is so paralyzed that he cannot even move his neck. This person is hired by the National Institute of Health (NIH) and works five hours each day, five days a week as a computer assistant. As a computer assistant, he is able to write and document computer programs for NIH through a Voice Data Entry System. The author sites several other examples of how computers have helped disabled individuals in employment. One of the major comments made by these disabled people is that the computer takes away their traditional stereotypes and gives them an elevated identity.

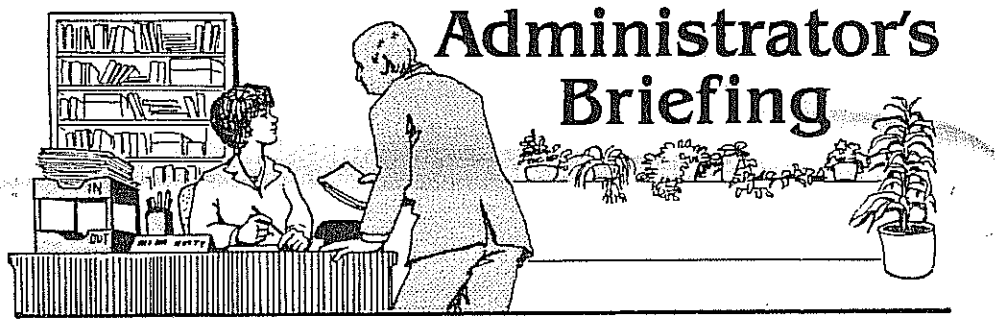
Microcomputers in special education are fulfilling needs ranging from using Zygo switches as input peripherals, to help children with cerebral palsy communicate, to using LOGO to help children with learning disabilities attend to task. The microcomputer, for example, has opened avenues for dyslexic children who have previously been diagnosed as mentally retarded. Some of the important requirements in teaching disabled students are the large amounts of time, effort and patience involved. The computer can patiently present a concept over and over, time after time. In addition, the computer can expand a student's horizons which is vital to their education.

Independent living is the final way Bowe talks about how the computer can enhance opportunities for disabled people. With the computer, a disabled person is capable or will be capable in the near future of such things as electronic banking, electronic shopping, retrieving and storing information, and handling other everyday tasks that otherwise would take an enormous amount of time or effort. There are information systems which diabled individuals living alone can patch into and get help with a wide variety of tasks.

There are, however, several problems related to the state of the art of microcomputers and their uses for the disabled. There is a lack of hardware and software to meet the special needs of many disabled people. Additionally, whatever computerware there is, it usually is not compatible with the user's computer. Voice synthesizers, for example, require large amounts of memory and they also cannot be used with copyrighted software. Bowe calls for those concerned for disabled users to shop around and make sure that the equipment being bought is compatible.

This book is written at the novice level and is aimed at friends, relatives and teachers of disabled people. This book should be useful to those who think the computer may be helpful for a friend, but are not familiar enough with them to know how they can be used. Bowe's book also gives a general overview of the uses of computers in special education and would be an important resource to anyone interested in this area. Prices and other purchase information of both hardware and software are also included.

Reviewed by Dan Boomer



School Improvement and the Planning Papers

By Stan Paine, Principal
St. Alice School, Springfield, Oregon

School improvement is a complex and time-consuming process. It can often seem overwhelming when one confronts the realities of organizational dynamics and change processes. But systematic planning can make the process appear more logical and desired outcomes seem more attainable. We take planning processes for granted in such complex matters as budget-making; they can also serve us well in the complex endeavor of school improvement.

School improvement planning is perhaps best thought of as a long-range process of one year cycles building toward outcomes which may be three to five years away. That is, we should ask oursleves (and others), "What do we want our schools to be like in two, three, or five years?" and, given those outcomes on which we agree, "What can we do this (or next) year to move toward those outcomes?". This latter question must then be followed up with such queries as, "What tasks will allow us to reach these year-end goals?", "Who is to be responsible for performing these tasks?", "By what date should these tasks be accomplished?", "How should these tasks be carried out?", and "What resources will be required to accomplish these tasks?". These questions would be addressed anew on at least an annual basis.

School improvement planning efforts should consider several elements. At St. Alice School, our school development efforts include: (1) an educational excellence plan, incorporating elements adopted from the professional literature and goals submitted by members of the school community; (2) a curriculum plan, including an implementation schedule for direct instruction programs, subject area guidelines taken from research findings (e.g. daily composition assignments), and computer integration recommendations; (3) a school-wide instructional plan, including time allocations for subjects by grade level, a master schedule, and grouping-placing guidelines; (4) an extra-curricular plan, detailing how the basic curriculum is to be supplemented with after-school activities; (5) a school-wide conduct code and discipline plan, outlining expectations for student conduct and positive and negative consequences; (6) staff performance plans for all employees, indicating individuals' goals which enable organizational ac-

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Teaching "Exceptions" to Rules to Learners with Handicaps

By Richard W. Albin
Robert H. Horner
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Whether teaching academic subjects or community-based adaptive behaviors, teachers frequently find themselves teaching rules for performance. These rules describe the relationships between stimulus conditions and the behaviors that those conditions should control. Sometimes the rule is simple: "Cross when the walk light says walk." Sometimes it is not so simple: "Cross when there are no oncoming vehicles on the to-be-crossed street within 11 seconds of the intersection in either direction, no vehicles turning in either direction from the parallel street, no cars about to pull away from the curb, and no cars about to exit the parking lot at the intersection." Because rules are one method of transferring or generalizing competence across situations, they have long been a focus of education. However, accompanying any effort aimed at teaching rules is the realization that there are frequently "exceptions" to rules. Exceptions may add considerable spice to life, but they complicate the process of good teaching. This article describes how exceptions arise in community-based instruction, and it provides some guidelines we have applied in using direct instruction to teach exceptions to people with severe handicaps.

In academic subject areas teachers have long dealt with problems related to teaching exceptions such as irregular tenses, silent letters, and unique spellings. Teaching such exceptions rarely creates major logistical problems for teachers. In fact, exceptions in academic subjects are so well identified that teachers, textbook writers, and curriculum developers have had ample opportunity for preplanning in teaching them. Due to the relative recency of emphasis on teaching community-based adaptive behaviors to individuals with severe handicaps, neither the situations in which exceptions arise nor the procedures for dealing with them are as well documented. Yet being able to teach both basic rules for performance and exceptions is essential if learned skills are to be truly functional in community environments that are marked by their variability. Direct Instruction procedures designed to teach general case skills provide the technology for such teaching (Engelmann & Carnine, 1982; Horner, Sprague, & Wilcox, 1982).

The general case has been taught when, after instruction on some tasks in a particular class, any task in that class can be performed correctly (Becker & Engelmann, 1978). General case instruction begins by defining an instructional universe, or the set of situations in which responding is desired after instruction. The class of stimuli that should control responding is then defined and teaching examples that sample the range of variation in that stimulus class are selected. Through the selection and sequencing of these teaching examples, the similarities among members of the stimulus class and the boundaries that differentiate members from nonmembers of the stimulus class are taught.

Sources of Exceptions in Community Based Instruction

In teaching community-based, adaptive behaviors to students with severe handicaps, the teacher defines the instructional universe and then selects teaching examples. Both this definition of the instructional universe and the teacher's ability to present teaching examples play substantial roles in determining the exceptions that will have to be taught. It is within the control of the teacher to minimize or eliminate potential exceptions by the universe that s/he selects for instruction. For example, in preparing to teach street crossing, if the teacher chooses to define the instructional universe narrowly (e.g., "The student will cross First and Main", or "The student will cross all 5 streets on the route between home and school."), the class of stimuli controlling street crossing is minimized. This in turn may minimize the amount of variation that must be represented in the teaching examples. If, on the other hand, the instructional universe is defined broadly (e.g., all streets in the community), the controlling stimulus class will be larger, will likely contain more variation, and will increase the likelihood of exceptions.

It would seem then that teachers might always take care to select "exceptionless" stimulus classes for instruction. For example, a teacher interested in training vending machine use to high school students is faced with a broad range of potential stimulus and response variation. Teaching a student to use only the machine in the school lounge or teaching only soft drink machines with vertical coin slots that are activated by pressing a panel with the brand logo on it would minimize exceptions and result in easier teaching. Unfortunately, it would *not* result in a very functional behavior. Too many nontrained vending machines would remain unavailable to this student after instruction. If generalized skills are to be functional in the community, teachers will be faced with the necessity of working with an instructional universe containing many types of examples. In teaching vending machine use, it is more likely that our teacher will select a broader, more functional instructional universe, e.g., all vending machines in the city. Such a universe includes several types of machines, and therefore increases the possibility of having to teach exceptions.

Teachers of community-based skills often find that not all teaching examples can be presented with equal ease. Logistical restrictions may force teachers of community-based skills to treat some members of the instructional universe as exceptions. Analysis of an instructional universe may show that some members occur at low frequency in the learners' natural environment or that some members pose logistical problems in their presentation. For example, exceptions during street crossing training may be low frequency streets such as six-lane highways, difficult to program situations such as waiting at a green light if an emergency vehicle is approaching, or situations in which irrelevant stimuli (e.g., construction workers) interfere with correct responding. All of these situations pose problems in selecting and sequencing of teaching examples and are therefore best dealt with as exceptions.

Teaching Exceptions

In preparing to teach exceptions, teachers should first ask themselves whether or not the exception will occur often enough to justify spending valuable teaching time preparing for it. Some exceptions (e.g., crossing streets where road construction is occurring) may be better left unaddressed. A decision regarding what is an exception that should be taught and what is one that should not be taught will depend upon the needs of the learner and on the environment in which that learner will be performing. Such a decision must always consider whether the resultant learning will be functional. Exceptions that are frequent enough to negate the functional nature of a skill or activity must be taught.

Once it has been determined that an exception(s) must be taught, here are four guidelines that we have found useful:

1. *Teach the general case first.* That is, teach with a range of "nonexceptional" examples to establish the basic "rule" that should control performance. The inclusion of exceptions makes it more difficult to learn the rule. After you have established responding to the "common" examples in the stimulus class, but before performance becomes overly stipulated to those "common" examples, introduce teaching examples that include exceptions.

2. *Keep the basic rule you plan to teach as simple as possible.* Do not try to "eliminate" exceptions by teaching a complicated basic rule with many conjunctive conditions. It is true that a rule describing the stimulus-response relationships relevant to a particular instructional universe may be made broad enough to encompass all members of a large universe. Doing this, however, may create such a complicated "rule" that attempting to teach it as a whole right from the start results in more problems than dealing with the exceptions. Logistical and efficiency concerns in selecting and presenting teaching examples make it desirable to start with a simpler basic rule.

3. *Provide sufficient trials to teach an exception.* Because exceptions are usually low frequency situations, they create some teaching difficulties relating to the logistics of presenting sufficient teaching examples. Often a teacher must *manipulate the teaching environment to artificially increase the frequency of the "exceptional" situations.* This may involve teaching in a different location where the "exception" exists naturally (e.g., traveling to a section of town where a mid-block pedestrian crossing can be included among the teaching examples), or having a confederate create the "exception" (e.g., having a confederate on a motorcycle create enough trials to teach waiting in the presence of oncoming motorcycles). With either procedure, the aim is to provide a sufficient number of trials so that the exception is learned.

4. *When teaching exceptions, intersperse regular teaching examples with the "exceptional" teaching examples.* This insures that the learner cannot predict the occurrence of "exceptional" conditions and simply develop a new stipulated behavior. If multiple exceptions must be taught, introduce them sequentially, allowing sufficient trials for each one to be learned in turn. As trials on each new exception are begun, continue to intersperse trials from all previously learned situations.

For community skills to be *functional* they must be performed across the range of situations a student will encounter. This natural range includes a lot of "exceptions." Therefore, it is an academic exercise to teach skills that are not responsive to exceptions. The measure of success for academic programs for students with severe handicaps is effective student performance in community settings (Brown et al., 1976; Wilcox & Bellamy, 1982). To settle for less not only shortchanges students, it also represents a failure to fully utilize existing best-practice teaching procedures.

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Planning Improvement Continued from Page 14

complishments; (7) a volunteer plan, specifying how volunteers will be recruited, trained, and deployed to enhance the efforts of staff in serving students and parents; (8) an inservice training plan to develop the skills of both staff and volunteers; (9) a marketing and public relations plan, detailing how we will promote the mission of the school and enhance our working relationship with our constituents and the general public; and (10) an evaluation plan, describing how we will evaluate the various facets of our efforts.

The school improvement planning process should involve as many people as possible. More involvement slows down the process but strengthens people's commitment. Teachers, parents, administrators, boards, and students all have important perspectives on what the school should become and how and when that can heppen. Because of the time required, planning should begin in the fall or early winter for the following school year. We have found a consensus decision-making model (as opposed to a parliamentary one) most consistent with our values and most effective in identifying directions we want our school to take. We have also found that offering rationales for our proposals and sharing the collective wisdom of the group greatly facilitates the process.

Planning for improvement can take place at any level in a school — classroom, department, building, or system. If you perceive that others you work with are not yet ready to initiate formal planning for school improvement, you can still begin in your own realm. But if planning for improvement is approached collaboratively, rather than competitively, you may be pleasantly surprised to find considerable support and enthusiasm for the promise it holds — not only for your students and their parents, but also for you and your professional satisfaction.

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