Research on Direct Instruction: 25 Years Beyond DISTAR

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To Carolyn Richmond who introduced a new teacher without any knowledge of curriculum to DISTAR 25 years ago and to my co-author for his stubbornness for enduring so much criticism over the years (and my first bout of writer's block)

Gary

To Wes Becker who traded the high road of clinical psychology for the often rocky road of Direct Instruction

Zig

Although I wasn't familiar with either the depth or extent of the Direct Instruction research, I knew that there was a body of research that was not easily accessible to researchers, teachers, or school administrators. I also felt that a comprehensive summary of Direct Instruction would help answer questions that were unanswered by expected sources such as the previously mentioned handbook.

So I called Zig Engelmann and told him that I felt there was a need for a comprehensive meta-analysis of Direct Instruction research. I asked him if he would write a description of DI (which evolved into the first three chapters of this book). He agreed and I began compiling the data for the meta-analysis. After restarting three times (thanks to two defective laptop computers), I completed the meta-analysis and was stunned at the results. Because I teach research courses, I know that very few popular educational programs actually work and that the effect sizes of those that are reputed to be effective are small. The DI meta-analysis revealed the largest effect sizes that I had ever seen.

For years I have told my university students about the importance of making research-based decisions, rather than accepting slogans that support passing fads, which constantly resurface with new names (like "whole language" or "learning styles"). I hope that this book facilitates research-based decision-making. And for those who say their suggested program is better, my response is "No theories–Let me see your proof."

I am indebted to many people for their efforts on this book. Tami Clarke and Linda Meller, my exceptional graduate assistants, collected most of the Direct Instruction articles (a major effort). My good friend Dana Crawford provided long-distance sanity during the beginning of this book. Jennifer Hileman and my sons Nathan and Joel Adams were supportive and patient when I was obnoxious and impatient. B. Keith Lenz not only provided valuable feedback about the book, but also is a great professional and personal friend. The other people who deserve recognition are Sherry Smith, Ericia Eden, and Susan Martin (the excellent Engelmann-Becker Corporation staff) who often received unfair emotional outbursts by both authors as the authors worked out disagreements during countless drafts of this book.

Gary L Adams

Table of Contents

Introduction

Direct Instruction is a system of teaching that attempts to control all the variables that make a difference in the performance of children. The system assumes that if children have IQs of 60 or more, they can be placed in Direct Instruction programs that will permit them to master the content at a reasonable rate. A further assumption is that when the student is placed properly and taught properly, acceleration is possible. Acceleration is achieved by teaching more than the student would be expected to master in a given time frame. If the student exceeds the traditional rate of mastery every day in each subject, after a year or more, the students' performance will significantly surpass that of other students who started at the same level and apparently had the same capacity to learn.

At the core of the Direct Instruction system are instructional sequences, which are different from traditional sequences, not only in more observable features but in the way they were designed and developed. The key difference is the extent to which the programs are field tested before publication and revised on the basis of student performance. All details of the programs are referenced to the performance of students and teachers.

The expectations for performance of Direct Instruction students are precise, expressed in terms of the number of lessons students are projected to master by the end of the school year. If students do not meet expectations, the Direct Instruction system assumes that the fault does not lie with the students, but with the delivery system. The Direct Instruction creed is **if the student has not learned, the teacher has not taught.**

This creed is reflected in the recommended training and monitoring that teachers receive and in the basic structure of the school administration. The assumed purpose of the school administration is to support the students' learning. Specific provisions in the school administrative operating plan should assure that problems of student performance are identified in a timely fashion and solved. Furthermore, the system assumes a moral responsibility to correct faults in the operating plan. To solve student-performance problems is to serve as an advocate for the students by providing them with opportunities that they would not have if they lack academic skills and knowledge.

CHAPTER 1

Teaching: The Roots of Direct Instruction

What is Direct Instruction?

When teachers, administrators, and university professors discuss Direct Instruction, there is usually confusing (and often loud) disagreement. A major reason for the disagreement is that educators are not describing Direct Instruction in the same way. The result is a nonproductive discussion.

Direct Instruction is not teacher-directed instruction

The most common confusion is that Direct Instruction is simply teacher-directed instruction, the opposite of the so-called "child-centered" approaches (such as the open classroom or discovery method) in which the teacher is supposed to act as a facilitator for students. Traditional teacher-directed instruction is not Direct Instruction; it is just direct teaching or teacher-directed instruction.

Direct Instruction is not direct instruction (di)

More specific descriptions of direct instruction are provided by Rosenshine (1986), Stallings (1987), and others. These descriptions refer to behavioral features that characterize a highly structured system of teacher-student interactions. Rosenshine's description of direct instruction incorporates many variables that correlate with student achievement (variables such as group responses, corrections, and pacing). It refers to the amount of "engaged time" (time that the student responds to specific tasks presented by the teacher) and the rate of student responses. (See Rosenshine, 1986 for more details.)

Direct Instruction is Direct Instruction (DI)

A third meaning of direct instruction is the one used in this book and the one that served as the basis for the descriptions of direct instruction formulated by Rosenshine and Stallings. This conception of direct instruction was originated by Siegfried Engelmann and his colleagues at the University of Illinois in 1964. At that time, the approach was referred to as *direct-verbal instruction*, which was described in the book *Teaching Disadvantaged Children in the Preschool* by Carl Bereiter and Siegfried Engelmann (1966). More than 60 instructional programs subsequently developed by Engelmann and his colleagues are Direct Instruction (DI) programs. The first series of reading and arithmetic programs (1968-69) carried the name DISTAR, an acronym that originally stood for: Direct Instruction System for Teaching Arithmetic and Reading. (With the introduction of *DISTAR Language,* the meaning of the acronym changed to: Direct Instruction System for Teaching and Remediation).

The Direct Instruction techniques and sequences developed by Engelmann and his colleagues consist of two types:

1. Direct Instruction techniques and sequences that set standards (by documenting what students can achieve) and
2. Commercial Direct Instruction sequences and materials that are designed for use by people who have not been trained directly by Engelmann and his colleagues.

The latter category includes the published commercial instructional programs that Engelmann and his colleagues have developed.

Direct Instruction techniques and sequences that set standards

In his early work, Engelmann conducted various studies that challenged dogma about how much students could learn and what sorts of teaching led to specific achievements of students. These studies included:

- teaching preschool advantaged and disadvantaged students to read (Bereiter & Engelmann, 1966),
- teaching both disadvantaged and advantaged preschoolers formal operations (as described by Piaget) before expected developmental phases (Engelmann, 1967d),
- teaching sophisticated mathematical problem-solving procedures to disadvantaged preschoolers (Engelmann, 1970),
- teaching both hearing and deaf subjects to hear through tactual vibration (Engelmann & Rosov, 1975),
- teaching absolute pitch to preschoolers and school-age students (Williams & Engelmann, 1989),
- teaching a variety of behaviorally disordered students and adults (autistic, highly non-compliant, etc.) (Engelmann & Colvin, 1983), and
- teaching older remedial students sophisticated math, language, and reasoning skills (Engelmann & Carnine, 1991).

All these demonstrations verified that students could learn far more than had been anticipated or achieved through traditional methods. The studies showed that the cause of the unpredicted outcomes was "unique teaching;" that is, the only reason the outcomes were beyond what had been observed earlier was that the teaching met a more rigid set of criteria.

To achieve this level of success, teachers needed to be thoroughly trained. Unfortunately, no conduit existed for providing the training. Colleges of education and school districts were certainly not adequately staffed or amenable to conducting the type of training required to train highly skilled technicians.

Commercial Direct Instruction programs

The second type of direct instruction sequences–those packaged as commercial instructional programs–are based on the demonstrations of what could be achieved through expert teaching. Although the pre-publication teaching sequences served as prototypes for some of the published programs, the published programs are different from the prototypes in many ways. These differences derive largely from attempts to design the sequences so that other teachers could achieve significant outcomes without possessing some of the teaching skills that characterized the teaching provided in the prototype demonstrations. In other words, one objective of these programs is to provide the user with training that shows clearly how to teach all the components that lead to a complex skill, such as reading or performing specific math operations. The programs typically do not try to teach as much or as fast as the original demonstrations did. They often use sequences of examples and response forms that are quite different from those in the original teaching

demonstration. These deviations result from field testing different versions of instructional sequences. The goal of the field testing is to shape the programs so teachers with average or below average teaching proficiency and minimum training in Direct Instruction presentation techniques can use the programs to teach so **all** students learn successfully.

In many ways, the published programs are a substitute for teacher training. If it were possible to first train teachers in the content and the techniques of communicating new content to students, the instructional programs would be designed quite differently than they are. They would provide general directions and general cautions, rather than the scripted presentations that describe everything the teacher should say and do. The programs have all the details simply because they must closely guide the teacher and simultaneously teach the students. Also, research disclosed that teachers who did not use scripted presentations were not uniformly successful.

Perspective on Effective Teaching

To teach effectively, a teacher must present specific examples of what is being taught and must say something about them. The teacher then tests the students to see if the information has been communicated. (The test is a set of questions or tasks.) The sequence is effective when the pacing is relatively fast, so the students are able to see how the various demonstration examples are the same and how they are different. (The slower the presentation of the examples, the greater the probability that students will forget the earlier examples and therefore won't be able to compare them with later examples, and may not learn the concept being taught.)

Direct Instruction programs assist teachers by specifying good examples, with short and efficient wording for each example, and by arranging the examples in an effective sequence. The teacher must still teach: present the examples; execute the wording; and most importantly, respond to students by reinforcing correct responses and providing corrections and repetition of items the students miss. The program, however, relieves the teacher of some of the many details that are involved in effective teaching.

DI programs are submitted for publication only if the pre-publication tryouts are effective. On at least four occasions, entire programs have been scrapped after pre-publication work. On more than a dozen occasions, the pre-publication work dictated changes so extensive that the third pre-publication version of these programs contained less than 10% of the content from the first version. Although the work required to develop these programs is extensive, the authors believe that programs can't serve as useful tools unless they are validated through actual field testing and revision on the basis of teacher and student performance.

Results from using Direct Instruction

Possibly the most significant feature of the commercial Direct Instruction programs is their success with the full range of teacher and student populations. DI interventions have been shown to produce superior performance with preschool, elementary, and secondary regular and special education students and adults. They have produced superior results with various minority populations, including non-English speakers. The DI model has spawned a great deal of research and has been used in many comparative studies. Chapter 5 documents that students receiving Direct Instruction consistently outperformed comparison groups in these studies.

The relative efficiency of DI was most dramatically documented by the US Office of Education comparison of 13 different educational model sponsors (e.g., Open Education and Behavior Analysis) in Project Follow Through (which taught disadvantaged students in grades K through 3). This study involved more than instructional material. The sponsor of each educational model implemented the model in different community sites. The goal was to show which educational approach produced the best results. Twenty-one community sites selected the Direct Instruction model. DI trainers arranged appropriate schedules and worked with the teachers on management

and grouping of students, as well as on the various details of pacing, corrections, reinforcement, and executing instructional remedies.

As Chapter 6 shows, Direct Instruction students outperformed the students included in all other Follow Through models. The DI students excelled in all subjects – reading, arithmetic, spelling, and language. For these outcomes to occur, the DI methods had to be many times more efficient than those used by the other sponsors, given that some sponsors focused on reading, for example, and devoted far more time teaching reading than the DI teachers did. The additional time and effort did not result in reading performance as high as that of Direct Instruction. Also, no other models came close to Direct Instruction in teaching math or language skills. DI students also had the most positive self-images of any students, even though the focus of some models was to improve students' self-images (based on the belief that improved self-images would result in improved academic performance).

DI's emphasis on acceleration

The reason that Direct Instruction is more effective than comparison models has to do with the logical relationship between teaching and student performance. The principal objective of effective instruction is to accelerate the performance of the students. Acceleration is possible only through efficient practices. Unless the program is able to teach more in less clock time and less time on the calendar (induce more skills, teach at a faster rate, and achieve more substantial generalizations), acceleration will not occur. Furthermore, if students are consistently accelerated in a skill, such as math, they will become relatively "smart" in math compared to students who have not been accelerated. Given that accelerated teaching is possible, it follows that well-designed instruction has the potential to make students perform more intelligently and become more capable of academic learning than their demography (e.g., income level and ethnic group) would suggest.

The Direct Instruction orientation toward acceleration implies that the effort must focus heavily on the teaching of generalizations, not rote learning. Generalizations represent efficiency, whereas rote learning represents inefficiency. For example, during 15 minutes the teacher may be able to teach students three rote items or one generalization. The generalization permits the students to respond to many items. The work on rote items, in contrast, produces performance on only the three items the teacher taught. Therefore, the teaching of the generalization is far more efficient than the teaching of the rote items.

It does not follow that instruction involves only generalizations. Students need some rote information (such as the names of the letters, the names of days of the week, etc.). This teaching is addressed through DI programs, but in a way that makes the learning relatively more effective. This economy is achieved by "grouping" the items to be taught in a way that will lead to faster mastery and by "distributing" the practice over a number of lessons rather than trying to teach all the information on a particular topic in a single session.

Another economy of Direct Instruction is achieved by buttressing against the more probable difficulties the students will experience in learning the concept or skill being taught. Direct Instruction sequences attempt to anticipate specific problems the teacher and students may encounter and provide instruction that reduces severity of the problems. The more likely problems have been identified in prototype versions of the DI programs, but not all difficulties that students will encounter are effectively avoided in DI sequences. Some must be solved through repetition, reinforcement, and additional review.

As the Project Follow Through comparison study showed, DI students excelled in cognitive performance as well as basic academic skills. The sponsors that claimed to induce cognitive processes (e.g., High Scope) not only failed to match the Direct Instruction performance in cognitive skills; they didn't effectively teach higher-order skills. Most of what these sponsors taught were rote skills.

Also, the Follow Through comparison study showed that Direct Instruction programs provided for the greatest individualized instruction. If acceleration occurred across a wide range of teachers and students, the instructional sequences must have provided for extensive individualization. The content (the concepts, facts, and generalizations) was reliably transmitted in a full range of contexts, to the slower learners as well as those who require less-precise teaching.

Direct Instruction Programs

Appendix A provides a list of commercially published Direct Instruction programs with descriptions of each program.