# EFFECTIVE School Practices

VOLUME 18, NUMBER 2 PRICE $5.00 FALL, 1999

FOCUS: STUDENT RESEARCH IN DIRECT INSTRUCTION
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ADI

## Philosophy of *Effective School Practices*

1. Teachers are responsible for student learning.
2. The curriculum is a critical variable for instructional effectiveness.
3. Effective teaching practices are identified by instructional research that compares the results of a new practice with the results of a viable alternative.
4. Experiments should not be conducted using an entire generation of Americans. The initial experimentation with a new practice should be small in scale and carefully controlled so that negative outcomes are minimized.
5. A powerful technology for teaching exists that is not being utilized in most American schools.

*Effective School Practices* is published quarterly by the Association for Direct Instruction. The mission of the Association for Direct Instruction, as stated in the by-laws, is to promote the improvement of educational methods.

The name *Direct Instruction* originated with the highly effective instructional model first developed by Zig Engelmann in Project Follow Through during President Johnson's Great Society legislation. Although the evaluation of Project Follow Through showed the Direct Instruction model to be far more effective than the other models on every identified outcome, education in America remained generally unchanged.

A few educators, impressed by the extraordinary results of the original Direct Instruction model and the programs that were developed as DI evolved, formed the Association for Direct Instruction in 1981.

Today, this organization is a vanguard in promoting school practices that have been validated as effective through the use of the scientific method in educational research.

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ANNUAL SUBSCRIPTION RATES: $20 U. S.; $25 (U. S. currency or equivalent) Canada; $30 Europe; $40 airmail to Europe.
(ISSN 1068-7378).

Editor ..... Bonnie Grossen
Assistant Editor ..... Jocelyn Warren
Proofreading and Typing .. Jocelyn Warren
Layout ..... Bryan Wickman
Printing ..... Springfield News

http://www.adihome.org

# A View from Askance

## A Teacher Education Proposal

**Bob Dixon,**
**Board of Directors, Association for Direct Instruction**

In the last issue of *Effective School Practices*, I wrote about some of George W. Bush's education policies—some policies I like, and thought that ADI members might be interested in, irrespective of your political affiliations. A short time ago, all the candidates were in Washington State, trying to drum up votes for our recent primary election here. For fun, I went to see both Al Gore and George W. Bush. (Don't write to me if you support someone else—I'd have gone to more events if I'd been able to.)

Well, I liked what George W. Bush had to say. He says he doesn't want to leave any child behind. (That makes him sound like an ADI member in good standing.) He says he likes phonics, and so do I (except I'm not too keen on very poorly taught phonics). He says he likes charter schools, and so do I. They are—first and foremost—public schools, and I like the idea of a free education. My own daughter goes to a public school. I like the idea of allowing some public schools to try new things in a



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controlled manner.

Without question, there is controversy surrounding the extent to which George W. has been successful in Texas. I won't even get into that right now. But I will say this: I prefer a governor who at least *talks* about not leaving any kids behind over a governor who buys into the notion that many kids are destined to failure. When is the last time that a credible presidential candidate spent a great deal of time even just *talking* about the injustices of a two-tiered society, and the need to focus on giving *all* children the opportunity to participate fully in the American dream?

In the interests of equal time, however, I really liked what Al Gore had to say about education, too. He didn't spend a lot of time on education, but he addressed two very important issues: higher pay for teachers, and smaller class sizes. I *really* like the idea of smaller class sizes. Oddly, research doesn't show much benefit for smaller class sizes, but the actual benefits are so obvious that one has to question the research. I do. I think it is extremely difficult to do good experimental research on class size and adequately control for all the potential variability inherent in such research. The research I've seen just simply doesn't control variability well, and thus, isn't of much interest.

And I *really* like the idea of higher pay for teachers. But now I'm going to venture into a little controversy: a substantial unknown number of teachers deserve huge salary increases, while some unknown number of teachers really ought to find work elsewhere. Al Gore no more qualified himself on teacher salaries than George W. Bush did on phonics.

If I were King of the World, I would give *all* teachers a very generous pay increase right this minute, to make sure that the at least the best teachers were getting what they are worth. But if I were King of the World, I would—simultaneously—make a few modifications in teacher education, to ensure that more and more new teachers really did belong in classrooms.

*Change teacher education*

Simple. However, I suppose it is quite possible to change teacher education, and still not solve many problems. I have a few specifics in mind.

*1. Classroom Management.* In my ideal teacher education program, first term freshmen would start right out with ten hours of classroom management. They would take a five hour course and a five hour practicum, simultaneously. I know: that leaves just about enough time for English 101. Fine with me.

The first five-hour course would be a survey course. What would keep this survey course from being just an exercise in theoretical speculation, however, would be the in-class practicum. Students could immediately try applying what they learn.

Students would then take another five-hour management class the second term, along with another five-hour practicum. During the second term, the course would focus more on the details of implementing research-based classroom management systems. Students would quickly see that—as it happens—research-based approaches correlate quite highly with what works.

After two terms, ten hours of classroom instruction, and ten hours of practica, regular education students would be expected to meet a very high minimal level of classroom management competence. Obviously, they will not have been prepared for teaching during the practica, but that's not a problem. There are ample non-teaching opportunities to apply classroom management in any school, on the playground, in the cafeteria, on busses, and even within classrooms in conjunction with "aide-like" activities.

Students who don't meet the high minimal level of classroom management competence can be given some additional opportunities to do so, but my point is that no one should get very far within a teacher education program without being able to convincingly and repeatedly demonstrate the ability to effective manage large groups of students in the "normal" range of regular classroom behavior across widely varying demographics. Some regular education students in some schools will have worse behavior difficulties than some special education students in some schools. I don't think that the professors would have to kick students out of the program. What freshman who discovered that he or she really couldn't manage kids would really *want to stay* in a teacher education program?

By the most unusual coincidence, I know of a place with perhaps the nation's greatest wealth of classroom management specialists: in and around the University of Oregon. Not to name names or anything like that, but the best are Rob Horner, Geoff Colvin, George Sugai, Randy Sprick, and their protégés. There are really good ones elsewhere, to be sure. A great number of them, to be honest, are in special education departments. Some aren't affiliated with universities at all. The easiest way to spot one is to look for someone who will walk into any classroom, any time, anywhere, and immediately turn around the behavior of even the most disabled of students with behavior disabilities.

There would be advanced management classes for those who aspire to work in certain areas of special education, including working with students who have severe cognitive disabilities and those with severe emotional and/or behavioral problems. Also, classroom management would become a major criterion for evaluating the performance of aspiring teachers in *all* their various teaching practica.

2. *Content Area Study.* In this area, I don't necessarily agree with the desire to hire the "best and the brightest" as teachers. My own order of priorities is: (1) the person can manage kids, (2) the person can teach, and (3) the person has a moderately strong, rigorous academic background.

I'm not playing down the importance of content knowledge. Bear with me. In my program, *teacher education candidates would receive their content training through the appropriate university department.* That is, the education department would not offer courses in "teaching language arts in the elementary school" and "teaching reading" and "teaching mathematics" and the like. Teacher education candidates would take their mathematics courses from mathematics professors in the mathematics department. My rationale is that prospective teachers don't need a math educator's view of math; they need a mathematician's view.

There is no separate "reading department," but there is an English department, and a good English department has courses in English language and linguistics. All elementary teacher candidates should be required to take one or two introductory-level linguistics courses because of the critical nature of reading and language arts in the elementary school. These are just *content* courses.

Teaching reading, *per se*, would be covered in the teaching courses and teaching practica (below). Potential history teachers would take history courses from the history department. And on and on.

My assumption is that content courses taught in regular university departments (as opposed to irregular education departments) are sufficiently rigorous (and accurate) to ensure that students who don't always get A's will still learn enough to be useful in teaching. *Maybe* a straight-A student in mathematics will want to become a teacher, and maybe that person can acquire the critical classroom management skills and teaching skills, and maybe that person will want to pass up a lucrative career as an electrical engineer/computer scientist, and that's fine with me. But the reality is that a person with a B average in mathematics courses offered through a *bona fide* mathematics department will know a heck of a lot of math.

3. *Teaching Courses and Practica.* This comes relatively late in the game—say, the junior year. All those students who have really mastered effective classroom management and who have begun to acquire solid content knowledge are now in a good position to learn to teach content effectively. As with classroom management, I'd mandate course work and practica, in approximately equal doses.

The courses would start with survey work. That itself is tricky, but prospective teachers ought to acquire a reasonably neutral understanding of major philosophical controversies in education. Just the facts, inasmuch as that is possible. There *was* a guy named John Dewey. He *was* out of his mind. (Oops. Sorry. Like I said, this isn't easy.)

Okay, I won't make too big of a deal out of the survey. There would be instructional design classes. I would mandate that mostly because that is a course I would like to teach. However, I do think it would be useful for teachers to have a fair amount of knowledge and skill in this area. We can't expect Zig to do *everything*. Courses, in general, would focus upon *solving problems*. Students would get very little coursework on what to do when everything is going great. *What, exactly, should you do when a child isn't getting it?* That would be a major theme of all the teaching classes.

Again, the teacher education candidates would have ample opportunity to demonstrate their skill and knowledge where it counts: in classrooms. We'd give a education student a modest group of kids who can't add or subtract, then monitor *the kids* to see if they're getting it.

That's pretty much it. I don't think this has to be too fancy.

How would we implement something like this? I have no idea, really. I mean, in general, a state legislature could pass a law requiring education departments in public universities to implement a program like this. I just don't have a clue about how to get a Governor or a state legislature even interested in thinking about it.

No, I take that back. I do have one idea: send in Doug Carnine! As amazing as it seems to most of us—and certainly all "old time" DI people—Doug actually talks to governors and state legislators on a regular basis, and they listen to him. He's really spoiling our self-image as outsiders. That's a self-image I can live without.

I've really, *really* tried to be positive. I'm really, *really* trying to reform myself. It's a good thing, too, or else I would really have some terrible things to say about education departments—in general. If I

weren't constraining myself thus, I would probably say something like, "taken as a whole, education professors are little more than a bunch of arrogant dilettantes who don't know their ...." Well, I *am* constraining myself, so—never mind.

Bryan Wickman, who has—one way or another—been sort of my boss for the last twenty-five years chastised me once for knocking education professors. I think I called them the bottom of the educational food chain, or something like that. It was before I started constraining myself. He started naming people like Sara Tarver and John Lloyd and Marcy Stein and Tim Slocum and on and on and on: a Who's Who of fantastic professors across the country, and across Canada and Australia as well (including three in Great Britain). Well, for the record, I'M NOT TALKING ABOUT THEM.

Because I'm constraining myself, I wish that *someone else* would take on the education department establishment. I can't do that without being overly negative, so all I can do is make suggestions. Why not go after these people? They have absolutely no constituency (aside from themselves) at all. Even professors in other university departments despise them. *Time* once referred to education departments as "the longest running joke" in just about any university, anywhere. No one will defend them because what they do is absolutely indefensible. *ALL* the blame for failure in the schools rests upon the shoulders of education departments. All of it.

At least that's what I think that *someone* ought to be saying. Personally, and much more charitably, I happen to think that most education professors are very nice people with very good intentions, but who through no fault of their own just happen to be incredibly dumb.

Anyway, I feel very non-partisan: let's pay teachers very well, reduce class sizes considerably, not let any kids fall behind, focus on the economically disadvantaged, and use (good) phonics to teach reading. ◆

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## *Plan now to attend an ADI Conference*

The Association for Direct Instruction is proud to announce dates and locations for summer Direct Instruction training. The sessions offered at these conferences will provide you with the training you need to be successful with your students. Sessions are designed for both beginning and experienced teachers, as well as sessions for administrators and staff development specialists.

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July 23–27, 2000 • Eugene, Oregon • Hilton Eugene Hotel and Conference Center

5th Midwest Direct Instruction Conference
August 2–4, 2000 • Chicago, Illinois • Holiday Inn Mart Plaza

16th Atlantic Coast Direct Instruction Conference
August 7–9, 2000 • Baltimore, Maryland • Baltimore Sheraton North

# The Importance of Student Participation in Direct Instruction Research

**Timothy Slocum**
**Benjamin Lignugaris/Kraft**
**Utah State University**

This issue of *Effective School Practices* focuses on research conducted by undergraduate and graduate students. The primary role of research is to produce knowledge that can be used to improve practice. The articles in this issue of *Effective School Practices* certainly attest to the fact that student research can further our understanding of education in practical ways—from program effectiveness, to teacher preparation, to systems change within school districts. But research conducted by students is special because of its additional benefits. When undergraduate and graduate students engage in research, the process of conducting research can have important effects on the researchers themselves.

First, research activities promote a general data-based orientation in which important outcomes are identified and valued. It also promotes a healthy skepticism about claims regarding educational practice. Researchers tend to ask for empirical evidence, weigh that evidence and state qualified conclusions. They put little faith in unsubstantiated claims. These attitudes are all too rare in education (at all levels). Involving future educators in research and strengthening their empirical orientation can help to counter the "educational fads" that are all too common to our field.

Second, for those students who go on to a career in classroom teaching, the experience with research promotes a deep understanding of Direct Instruction programs, effective teaching practices and a data-based orientation to daily teaching. Direct Instruction programs offer the best instructional design and delivery systems available. Students must have a clear understanding of the design and instructional delivery system to teach naïve users such as peer tutors or paraeducators to use the programs effectively. Moreover, the programs will not be maximally effective unless the teacher is continually monitoring pupil progress and actively making decisions about acceleration, firming, and changing placements. Finally, students who are researcher practitioners quickly learn that broad measures such as standardized tests and local curriculum-based measures are needed to strengthen conclusions about the effects of school and district wide Direct Instruction implementations. Students involved in Direct Instruction research often learn these skills and develop the attitudes necessary to initiate and lead instructional change in their schools and districts.

*Involving future educators in research and strengthening their empirical orientation can help to counter the "educational fads" that are all too common to our field.*

Third, conducting research as a student may be an initial step toward a career in a college or university. In the past, Direct Instruction has not received broad support from university teacher preparation programs. In fact, the small number of teacher educators knowledgeable about Direct Instruction is limited to a few universities. This has had negative implications for both research and teacher preparation. Involving students in Direct Instruction research may launch a career of meaningful research on Direct Instruction and broaden the community of Direct Instruction researchers. Students' research experiences may also lead toward careers in teacher preparation and inservice training. Thus, the number of teacher educators who understand Direct Instruction will increase, and more preservice teachers will receive a positive message regarding Direct Instruction and the principles of effective teaching on which it is based. In sum, student research experiences may open doors to new careers and broaden the community of Direct Instruction researchers and practitioners.

Direct Instruction is successful in part because the program authors, consultants, teacher trainers, administrators, and teachers keep a clear focus on the effectiveness of their practices. Appropriately, this important focus is reflected in the majority of

articles in this issue. Our ultimate goal, student learning, depends on the interplay of numerous factors in a complex educational system. These include, whether Direct Instruction is supported in a school or district, whether personnel are well trained, and whether a mix of personnel including teachers, paraprofessionals, and student-tutors are utilized in appropriate ways. The articles in this issue examine many of these factors. Even with highly effective implementations, Direct Instruction cannot be maximally effective unless we build bridges to other ideas and practices. Important bridges include understanding how Direct Instruction programs correspond to common tests and how the ideas of Direct Instruction correspond to other theories of education and learning. Several of the articles in this issue explore how these bridges can be built.

Improving student learning is the bottom line of the public enterprise we call education. Burnette and her colleagues report student outcomes from a school that allowed teachers to choose to implement *Spelling Mastery* or to use a more traditional whole word approach. Teachers who chose *Spelling Mastery* produced higher achievement than those who retained the whole word approach. This evaluation also exemplifies some of the complications of evaluating instructional programs in schools. Burnette et al. carefully describe these difficulties and leave us pondering several fruitful areas for future research.

Small homogeneous groups are ideal for Direct Instruction. However, if classroom teachers are the only personnel who deliver instruction, this ideal can be difficult to achieve. When specific instructional roles are delegated to paraprofessionals and/or peer-tutors, teachers gain flexibility in grouping and shift their role from teaching relatively few pupils to instructionally managing a great many pupils. Keel, Fredrick, Hughes, and Owens describe and evaluate a system in which paraprofessionals implement *Reading Mastery* and *Corrective Reading* in six schools. Students in this program showed sharply accelerated growth in overall reading skills (word identification and comprehension) during the course of this program. Short, Marchand-Martella, Martella, and Ebey take this approach a step further in their report of a program in which high school students use *Corrective Reading* with their peers. This group of researchers previously reported on the gains made by students in this peer tutoring system. In the current article they report on instructional processes, and affective and achievement outcomes for the tutors. The tutors delivered the programs well and accurately monitored progress. In addition, many of the tutors showed substantial gains in vocabulary. In sum, these researchers provide convincing demonstrations that the instructional structure and curriculum sequence in Direct Instruction programs is sufficiently powerful for relatively naïve individuals to successfully implement with minimal training.

Often, the most difficult challenges for Direct Instruction is not teaching children, but convincing teachers and administrators that Direct Instruction programs offer a solution to their instructional challenges. Bessellieu, Kozloff, and Nunnally describe how a successful implementation *of Reading Mastery* and *Language for Learning* with three teachers in one school can lead to school-wide and eventually district-wide implementation of those programs. This case study highlights a wide variety of factors that came together to produce change. An environment conducive to Direct Instruction adoption was created by statewide legislation for school accountability. The student researcher built personal relationships with teachers and principals, convinced influential teachers to support the programs, provided high quality technical assistance, and videotaped successful and appealing implementations. Most importantly, Bessellieu et al. used pupil success to generate teacher interest and build a larger and larger community of Direct Instruction users.

Effective teacher preparation is, of course, one of the foundations of quality implementations of Direct Instruction. Flett and Snider evaluate the effectiveness of a well-established series of summer Direct Instruction workshops. They follow-up on the attitudes and practices of teachers who complete these workshops over the course of 10 years. They found that workshop graduates maintained positive attitudes toward Direct Instruction and an impressive 64% of graduates continue to use Direct Instruction. Further, these authors explore some of the factors that may promote use of Direct Instruction after this kind of intensive summer training. They found that unavailability of materials and lack of administrative support appear to be major barriers to implementation.

To expand and institutionalize Direct Instruction implementations we must understand how the progress checks and mastery tests within the programs relate to more general tests of student learning. If we understand this relation, we can predict how our students will perform on the general tests. Herzog and her colleagues explore this issue. They compare student performance on grade level placement, oral reading rate and oral reading accuracy in the *Reading Mastery* program to performance of these

same students on the Qualitative Reading Inventory II. They found that the two measures yield generally similar results for grade placement and oral reading rate but not for reading accuracy. These authors provide a model for future correlational research with other outcome measures commonly used in local school districts.

Effective teaching, such as that produced by Direct Instruction, has implications for theories of human learning and performance. Drawing connections between Direct Instruction practices and these theories may provide an important avenue for communication with those who have little knowledge of Direct Instruction and who have misconceptions about it. In addition, these connections with theory may enable us to see Direct Instruction in a new light. Neul and Drabman attempt to untangle the connections between the aims of Direct Instruction and a well-established theory of intelligence. They draw connections between the theoretical model of intelligence and the concrete tasks taught in Direct Instruction programs.

In viewing the diversity of articles in this issue one cannot help but be impressed with the interesting and important directions in which our field is developing. It is a hopeful sign that students have contributed to this body of work. We look forward to seeing these bright young scholars continue to develop their work and to provide future contributions to *Effective School Practices.* ◆

Guest Reviewers for this Special Issue:

Charalambos Cleanthous, Eastern Washington University
Tara Ebey, Washington State University
David Hatfield, Eastern Washington University
Marion Tso, Eastern Washington University
Kathleen Waldron-Soler, Washington State University

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# A Comparison of *Spelling Mastery* and a Whole-Word Spelling Approach Across Elementary Grades in a Title 1 School

**Amber Burnette, Daniel Bettis, Nancy E. Marchand-Martella, Ronald C. Martella, Marion Tso, and Tara L. Ebey**
**Eastern Washington University**

**Linda McGlocklin, Susan Hornor, and Becky Cooke**
**Mead School District**

*Abstract: The efficacy of* Spelling Mastery *(Dixon & Engelmann, 1999) was examined in an across-grade implementation as compared to a district approved whole-word spelling approach. Students in grades 1-6 in a Title I school were included in this study. Teachers selected either the* Spelling Mastery *curricula or the whole-word approach for use in their classrooms across 1 academic year. Pre and post data were collected using the Test of Written Spelling-Third Edition (TWS-3) (Larsen & Hammill, 1994). Analysis of correct letter sequencing (Shapiro, 1996) was conducted on the pre- and posttest words spelled on the TWS-3 for all students. Results indicated grade 1 students also achieved the greatest mean change and effect size on the TWS-3. However, calculations of correct letter sequences of predictable and unpredictable words indicated little difference between students in the* Spelling Mastery *spelling program and students in the whole-word spelling program. Based on the results of this investigation, issues for future research are discussed.*

Spelling is an essential part of elementary school curricula. Despite the importance of spelling in today's classrooms, spelling instruction is often based on memorization of relatively short lists of weekly words that are frequently unrelated (Dixon, 1991a, 1991b, 1993; Henry, 1993; Kearney & Drabman, 1993; Laurita, 1990). This whole-word spelling approach is insufficient alone because it does not require students to master the spelling of words and depends on students learning to spell through self-instruction (Dixon & Engelmann, 1999). This approach often decreases students' ability to generalize spelling to writing because it focuses on visual memory rather than sound-symbol correspondence, prefixes, suffixes, word bases, and spelling rules (Dixon, 1991b).

Another approach to spelling instruction involves phonemic spelling. Phonemic spelling includes sound-symbol correspondence. Encoding phonemics teach the diverse spelling patterns of sounds and provide students with a strategy that is useful when sound-symbol relationships are reliable (Henry, 1993). However, the English language has a multitude of words in which the sound-symbol relationships fail. For these types of words, the sounds can be depicted by several letter sequences. Therefore, sound-symbol generalization is achievable with encoding phonemics yet over-generalization can occur (e.g., when the letters "ph" are written in place of every "f" sound in spelled words) (Dixon 1991b). In order for students to be precise writers they must gain the knowledge of encoding phonemics as well as morphemic patterns because the English writing system consists of both approaches (Treiman, Cassar, & Zukowski, 1994).

Morphemic approaches teach students to spell units of words and how to put the units together to form other words. Unlike words spelled using encoding phonemics, morphemic patterns are usually

*Despite the importance of spelling in today's classrooms, spelling instruction is often based on memorization of relatively short lists of weekly words that are frequently unrelated...*

spelled the same way in every word that contains them, a process which promotes generalization to other areas of writing (Bruck & Waters, 1990; Dixon & Engelmann, 1999). Unfortunately, the predominately taught whole-word and encoding phonemic approaches fail to teach essential morphemic patterns and strategies found in the English writing system (Henry, 1988). The question of which approach is an effective approach to spelling is no longer focused on either/or but rather, as Dixon (1991b) remarks, involves capitalizing on the strengths of each approach to achieve dependable generalizations. That is, which approach should be used is not the focus but rather how all three approaches can be used so that predictable and unpredictable words can be successfully spelled in all areas of writing.

An effective spelling program should incorporate whole-word, encoding phonemics, and morphemic patterns. This program should provide students with the knowledge that spelling is neither random nor disorganized, while at the same time provide them with pertinent skills, strategies, and rules for spelling (Templeton, 1989). Additionally, such a program should use a cumulative process to teach the skills, strategies, and rules so that mastery of skills is achieved (Dixon & Engelmann, 1999).

One program that combines whole word, encoding phonemics, and morphemic patterns is *Spelling Mastery* (Dixon & Engelmann, 1999). *Spelling Mastery* is a Direct Instruction program that uses a cumulative process to teach skills, strategies, and rules throughout the curricula to promote spelling mastery. Initially, students learn basic strategies, frequently utilized words, encoding phonemics, and irregular words (Dixon, 1991b). Students then move to morphemic patterns and rules as well as generalizing spelling into other areas of writing (Adams & Engelmann, 1996; Dixon, 1991b). Although this curriculum introduces all three spelling approaches throughout the levels while promoting mastery and generalization, there is a paucity of investigations using *Spelling Mastery* as compared to other spelling approaches or programs.

The purpose of this study was to examine the efficacy of *Spelling Mastery* in an across-grade implementation as compared to a whole-word approach in a Title 1 school. The specific research questions in this study were: Does *Spelling Mastery* have a greater effect on elementary school students' spelling performance as compared to a district-approved whole-word approach? Are even greater improvements in students' spelling over time on predictable and unpredictable words found when correct letter sequences in words are analyzed?

## Method

### Setting and Participants

***Setting.*** This study took place in a Title I elementary school within a large, rural school district in the Pacific Northwest. The elementary school had a total enrollment of 525 students. Approximately 33% of the enrolled students received free or reduced lunch.

Instruction took place in the general education classrooms. Instructional sessions were conducted for approximately 15-20 min a day, 5 days per week. The general education teachers presented the instruction to their assigned students.

***Participants.*** Of the 525 students enrolled in the school, 261 were male and 264 were female. Of the students, 94% were classified as Caucasian, 2% as Native American, 2% as Hispanic, 1% as Asian American, and 1% as African-American.

All students enrolled in the school from grades K-6, excluding 13 students in the Developmental Learning Center and 66 students in Kindergarten classrooms ($n$=79), were included in this study. Thus, a total of 446 students participated in this investigation. The school contained 17 classrooms: three 1st grades, three 2nd grades, one combination of 2nd and 3rd grade, two 3rd grades, three 4th grades, three 5th grades, and two 6th grades. Of these, all of the 1st grade, two 2nd grade, the 2nd and 3rd grade combination, two 4th grade, and all 5th and 6th grade classrooms implemented *Spelling Mastery* (based on teacher choice). The remaining 2nd grade, two 3rd grade, and one 4th grade classroom used the whole-word approach to spelling (based on teacher choice). Thus, 76% of the school used *Spelling Mastery* and 24% of the school used the whole-word approach.

### Curricula

Two programs were used at this school—*Spelling Mastery* (Dixon & Engelmann, 1999) and a district approved whole-word approach.

***Spelling Mastery.*** This program consists of six levels—Levels A-F (Dixon & Engelmann, 1999). Students in 1st grade were placed in Level A; students in 2nd grade and in the 2nd-and 3rd grade combination classroom were placed in Level B; and students in 4th grade were placed in Level C. Both 5th and 6th grade students were placed in skill-based groups within their classrooms. Students in 5th grade were placed in Levels C or D, and students in 6th grade were placed in Levels C, Level D, or Level E. Level F was not used in this study.

Level A consists of 60 lessons and is designed for 1st-grade students. Students receive practice in

sound-symbol correspondence (e.g., /t/ = t), and writing irregular words (e.g., what, many). Weekly tests are provided in the teacher's guide.

Level B consists of 120 lessons and is designed for 2nd-grade students. Students review material learned in Level A and practice writing in order to facilitate a transition from writing spelling words in isolation to writing them in context. Weekly tests are provided in the teacher's guide.

Level C consists of 120 lessons and is designed for 3rd-grade students. The first 50 lessons provide review and elaborate on phonemic concepts (e.g., /a/ = ay). The remaining lessons gradually begin to shift from phonemic concepts to morphemic concepts (e.g., ing—walking; talking; sitting) that will help students to spell multisyllabic words. Tests are provided every fifth lesson.

Level D consists of 120 lessons and is designed for 4th-grade students. The students receive less teacher-directed activities and are provided with more independent work. Morphemic rules are now being applied (e.g., con + ed = conned). Tests are provided every fifth lesson.

Level E consists of 120 lessons and is designed for 5th-grade students. The students are introduced to a greater number of structural rules (e.g., contractions) and non-word bases (e.g., tion). The lessons have a higher level of difficulty and a greater number of words are taught. Tests are provided every fifth lesson.

Instructional materials consisted of a teacher presentation guide (based on each program level) for each participating teacher, student workbooks, and paper and pencils.

### Whole-Word Approach

A whole-word approach to spelling was approved by the district; however, the words were compiled by individual grades and teachers within each school. There were no specified lists of words or specified curricula that were recommended by the district. The words compiled by individual teachers were aligned with the states' essential academic learning requirements and were based on material taught throughout the year. Instructional materials consisted of teacher-produced word lists, paper, and pencils.

### Dependent Variables and Dependent Measures

Two assessments were used before and after the implementation of the spelling programs across 1 academic year.

*Test of Written Spelling-3 (TWS-3).* The Test of Written Spelling, 3rd edition (TWS-3) (Larsen & Hammill, 1994) was administered at the beginning and end of the academic year. The TWS-3 consists of two subtests—Predictable Words and Unpredictable Words. Each subtest includes 50 words. Predictable words are words with spellings that are anticipated using phonemic patterns, whereas unpredictable words are words with spellings that are not anticipated and cannot be spelled using phonemic patterns.

Three undergraduate students (examiners) in special education from a local university administered the TWS-3 to the participants. The test was group-administered in each classroom in each grade level. These examiners followed a scripted format when presenting the test. They first dictated the word to be spelled in isolation, read a sentence that contained the word, and then said the word to be spelled once more in isolation. Basals were disregarded in this study because of the group administration procedures used (as recommended in the TWS-3 manual).

Predictable words were administered until a ceiling was met (i.e., five consecutive words spelled incorrectly). This subtest was followed by administering the unpredictable words subtest until a ceiling was met (i.e., five consecutive words spelled incorrectly). Students in first grade were orally administered 10 words in the first administration of the test, then all tests were gathered and the examiners scored each test. At the next administration, all of the students who had not met a ceiling at the first administration were taken aside in a smaller group in the classroom. The students were then orally administered 10 more words (i.e., #11-20). Again the examiners gathered the tests and scored them. Those students who had not met a ceiling at this point were taken aside in the classroom and individually administered the remaining words as before until a ceiling was met.

The process was the same for the second through sixth grade classrooms with the exception of the number of words administered at each session before gathering the tests and correcting began. Students in second and third grade were orally administered 20 words at the first administration. If a ceiling had not been met at the second administration, those students were then orally administered 10 words. Finally, these students were individually administered the remaining words until a ceiling was met. Again, examiners closely observed the students spelling in order to determine when to stop administering the test. The fourth through sixth grade classrooms were administered 25 words at the first administration. The tests were then gathered

and corrected. At the next session students who had not met a ceiling were taken aside in a smaller group and orally administered the remaining 25 words.

The test took approximately 30 min to administer and was conducted over a 2-week period in September and then again in May. Standard scores served as the dependent measure. Effect sizes were calculated to determine the effects of the *Spelling Mastery* curricula as compared to the whole-word approach (Adams & Engelmann, 1996). To calculate effect sizes a pooled standard deviation was computed using pretest and posttest standard deviations in place of experimental and control group standard deviations. After a pooled standard deviation was computed, Hedges' formula ($M_1$ - $M_2$ / *SD* pooled) was utilized to calculate effect sizes (Martella, Nelson, & Marchand-Martella, 1999).

***Correct letter sequencing.*** Correct letter sequencing (Shapiro, 1996) was conducted on the pretest and posttest of the TWS-3 for all students to determine how closely misspelled words resembled words spelled correctly. This analysis was done to determine small improvements in a student's spelling (e.g., *bed*—there are four correct letter sequences, *b* is the first correct sequence, *be* is the second correct sequence, *ed* is the third correct sequence, and *d* is the fourth correct letter sequence; if the student spells *bed* as *bid*, *b* is one correct letter sequence, *bi* is an incorrect letter sequence, *id* is another incorrect letter sequence, and *d* is a correct letter sequence, thus the child spelled the word with 2 out of 4 correct letter sequences). Errors included: (a) letter reversals (e.g., *b* written as a *d*); (b) words that did not correspond to the correct number (e.g., the word *bed* was the second word dictated and the word *let* was the third word dictated but the student omitted the word *let* and wrote the word *bed* on the third line and all other words aligned with their correct numbers, two errors would be counted), unless all words dictated did not align with the correct numbers, (e.g., the student began writing the words on the 2nd line and wrote the dictated words in order, no errors would be counted); (c) words that were illegible to the scorer, such as a word that contained indistinguishable letters (e.g., scribbles, vowels and consonants put together which did not resemble the word administered); (d) doubled letters (e.g., *pille* is written when the correct word is *pile*, the word has five correct letter sequences and the letter sequence *le* is not counted as correct because of the double *l*); (e) incorrect sequences (e.g., *able* is spelled *abel*), (f) omissions (e.g., *storm* spelled as *stom*); and (g) additions (e.g., *us* spelled as *use*).

Each word was analyzed by counting the number of correct letter sequences within that word. The number of correct letter sequences obtained from all the words completed were then added together and then divided by the total number of possible correct letter sequences of all the words completed (i.e., number of correct letter sequences of completed words/ total number of correct letter sequences of completed words). A percentage of correct letter sequences was then obtained. Once each individual student's percentage of correct letter sequences was calculated, percentages for each classroom were obtained. Classroom percentages were determined by adding all students' percentages and dividing that overall percentage by the total number of students within the classroom. After classroom percentages were determined a percentage for each grade was calculated by the spelling program used in that grade level.

### Instructional Procedures

As noted previously, two instructional approaches were implemented.

***Spelling Mastery.*** *Spelling Mastery* was implemented in 13 classrooms. Prior to implementation, the teachers who chose to use the *Spelling Mastery* spelling program were provided with a 1-hr training session that included instruction on script delivery, effective error correction procedures, pacing, specific praise statements, and the importance of mastery. The training session was provided by a national Direct Instruction consultant paid by Science Research Associates (SRA).

***Whole-word approach.*** Four classrooms used the whole-word approach. There was no training provided for this spelling approach since teachers selected words to use on their own. Teachers individually composed spelling lists that aligned with Washington state's essential academic learning requirements based on material taught throughout the year.

### Interrater Agreement

The first author was the primary rater. She was a graduate student receiving a master's degree in special education. Another graduate student in special education served as the secondary rater for purposes of interrater agreement. Interrater agreement was calculated on correct letter sequencing of predictable and unpredictable words on the TWS-3.

The secondary rater examined every fourth student (arranged in alphabetical order) in each classroom of each grade level (e.g., if there were 24 students in one classroom of grade 1, the correct letter sequences were examined for students 4, 8, 12, 16, 20, and 24). The secondary rater calculated indi-

vidual students' correct letter sequences. The number of correct letter sequences for each student was then compared to the number of correct letter sequences calculated for each corresponding student by the primary rater to arrive at an interrater agreement percentage. For example, if the primary rater calculated 10 correct letter sequences out of 12 possible and the secondary rater calculated 8 correct letter sequences out of 12 possible, the interrater agreement percentage would be 80% (8 divided by 10 and multiplied by 100).

The mean interrater agreement for each grade was as follows: grade 1 = 99% (range 91% to 100%), grade 2 = 97% (range 84% to 100%), grade 3 = 97% (range 49% to 100%), grade 4 = 99% (range 99% to 100%), grade 5 = 100%, and grade 6 = 100%. The mean interrater agreement across all grade levels was 99%.

## Results

### Test of Written Spelling-Third Edition (TWS-3)

Table 1 shows the mean standard scores across grade levels in the *Spelling Mastery* program and the whole-word approach on the TWS-3 administered before and after implementation. Performance of grade 1 on the TWS-3 had a mean standard score change of 30 and an effect size of 2.88. Grade 2 in the *Spelling Mastery* program achieved a mean standard score change of 17 and an effect size of 1.33. A mean change of 13 with an effect size of 1.09 occurred for grade 2 in the whole-word approach. Performance of grade 3 in the *Spelling Mastery* program indicated a mean standard score change of 10 with an effect size of .76. Grade level 3 using the whole-word approach received a mean change of 8 and an effect size of .50. A mean standard score change of 10 resulting in an effect size of .66 occurred for grade 4 in the *Spelling Mastery* program. Grade level 4 in the whole-word approach achieved a mean change of 3 and an effect size of .21. Grade 5 mean standard score performance changed by 4 and an effect size of .34. Finally, grade 6 in the *Spelling Mastery* program achieved a mean standard score change of 6 with an effect size of .52.

### Correct Letter Sequencing

***Predictable words.*** Table 2 shows the percentages of correct letter sequences of predictable words for grade levels in the *Spelling Mastery* program and whole-word approach calculated on the TWS-3 for both pre- and posttest administrations. Calculations of correct letter sequences of grade 1 on the Predictable Words subtest of the TWS-3 indicated a mean percentage correct change of 59% and an effect size of 3.49. Grade 2 in *Spelling Mastery* had a mean percentage correct change of 15% and an effect size of 1.30. Grade 2 of the whole-word approach had a mean percentage correct change of 19% and an effect size of 1.33. Grade 3 in *Spelling Mastery* achieved a mean percentage correct change of 4% and an effect size of .62. Grade 3 of the whole-word approach achieved a mean percentage correct change of 5% and an effect size of .67. A mean percentage correct change of 5% with an effect size of .98 for grade 4 in *Spelling Mastery*. Performance of grade 4 of the whole-word approach indi-

**Table 1. Pretest and Posttest Standard Scores across Grade Levels on the Test of Written Spelling-Third Edition (TWS-3) for *Spelling Mastery* and Whole-Word Spelling programs.**

| Grade Level | Program | Pretest | Posttest | Mean Change | Effect Size |
|---|---|---|---|---|---|
| 1 | *Spelling Mastery* (*N*=53) [*SD*=] | 69 [6.65] | 99 [13.90] | 30 | 2.88 |
| 2 | *Spelling Mastery* (*N*=47) [*SD*=] | 82 [11.64] | 99 [13.76] | 17 | 1.33 |
| | Whole Word (*N*=21) [*SD*=] | 83 [10.90] | 96 [11.45] | 13 | 1.09 |
| 3 | *Spelling Mastery* (*N*=22) [*SD*=] | 97 [14.35] | 107 [11.88] | 10 | .76 |
| | Whole Word (*N*=44) [*SD*=] | 85 [17.82] | 93 [13.96] | 8 | .50 |
| 4 | *Spelling Mastery* (*N*=40) [*SD*=] | 92 [14.03] | 102 [16.24] | 10 | .66 |
| | Whole Word (*N*=20) [*SD*=] | 93 [18.81] | 96 [8.01] | 3 | .21 |
| 5 | *Spelling Mastery* (*N*=68) [*SD*=] | 93 [12.26] | 97 [11.28] | 4 | .34 |
| 6 | *Spelling Mastery* (*N*=54) [*SD*=] | 92 [11.50] | 98 [11.49] | 6 | .52 |

**Table 2. Pretest and Posttest Percentages of Correct Letter Sequences of Predictable Spelling Words on the Test of Written Spelling-Third Edition (TWS-3) for *Spelling Mastery* and Whole-Word Spelling Programs.**

| Grade Level | Program | Pretest | Posttest | Mean Change | Effect Size |
|---|---|---|---|---|---|
| 1 | *Spelling Mastery* (*N*=53) [*SD*=] | 69 [23.36] | 99 [4.94] | 30 | 2.88 |
| 2 | *Spelling Mastery* (*N*=47) [*SD*=] | 66% [14.96] | 81% [6.38] | 15% | 1.30 |
| | Whole Word (*N*=21) [*SD*=] | 63% [19.44] | 82% [5.37] | 19% | 1.33 |
| 3 | *Spelling Mastery* (*N*=22) [*SD*=] | 82% [7.60] | 86% [4.93] | 4% | .62 |
| | Whole Word (*N*=44) [*SD*=] | 79% [9.11] | 84% [5.35] | 5% | .67 |
| 4 | *Spelling Mastery* (*N*=40) [*SD*=] | 83% [5.59] | 88% [4.52] | 5% | .98 |
| | Whole Word (*N*=20) [*SD*=] | 83% [6.88] | 88% [3.32] | 5% | .93 |
| 5 | *Spelling Mastery* (*N*=68) [*SD*=] | 84% [14.13] | 86% [5.17] | 2% | .19 |
| 6 | *Spelling Mastery* (*N*=54) [*SD*=] | 88% [4.62] | 89% [3.53] | 1% | .24 |

**Table 3. Pretest and Posttest Percentages of Correct Letter Sequences of Unpredictable Spelling Words on the Test of Written Spelling-Third Edition (TWS-3) for *Spelling Mastery* and Whole-Word Spelling Programs.**

| Grade Level | Program | Pretest | Posttest | Mean Change | Effect Size |
|---|---|---|---|---|---|
| 1 | *Spelling Mastery* (*N*=53) [*SD*=] | 20% [19.24] | 69% [8.26] | 49% | 3.31 |
| 2 | *Spelling Mastery* (*N*=47) [*SD*=] | 59% [16.18] | 73% [8.91] | 14% | 1.07 |
| | Whole Word (*N*=21) [*SD*=] | 61% [13.03] | 73% [9.35] | 12% | 1.06 |
| 3 | *Spelling Mastery* (*N*=22) [*SD*=] | 73% [7.31] | 82% [5.49] | 9% | 1.39 |
| | Whole Word (*N*=44) [*SD*=] | 68% [12.96] | 78% [7.16] | 10% | .96 |
| 4 | *Spelling Mastery* (*N*=40) [*SD*=] | 78% [9.20] | 83% [6.75] | 5% | .62 |
| | Whole Word (*N*=20) [*SD*=] | 80% [9.56] | 82% [6.16] | 2% | .25 |
| 5 | *Spelling Mastery* (*N*=68) [*SD*=] | 82% [8.26] | 85% [4.77] | 3% | .45 |
| 6 | *Spelling Mastery* (*N*=54) [*SD*=] | 82% [7.27] | 85% [5.51] | 3% | .47 |

cated a total mean percentage correct change of 5% and an effect size of .93. Grade 5 in *Spelling Mastery* was calculated to have a mean percentage correct change of 2% and an effect size of .19. A mean percentage correct change of 1% and an effect size of .24 were shown for grade 6 in *Spelling Mastery*.

***Unpredictable words.*** Table 3 shows the percentages of correct letter sequences of unpredictable spelling words across grade levels using *Spelling Mastery* and the whole-word approach to spelling, calculated on the Test of Written Spelling-Third Edition (TWS-3) for both pre- and posttest administrations. Calculations of correct letter sequences for grade 1 determined a total mean percentage correct change of 49% and an effect size of 3.31. Analysis of the unpredictable words of grade 2 in *Spelling Mastery* indicated a mean percentage correct change of 14% and an effect size of 1.07. Grade level 2 of the whole-word approach had a mean percentage correct change of 12% and an effect size of 1.06. Grade 3 in *Spelling Mastery* showed a mean percentage correct change of 9% and an effect size of 1.39. Grade level 3 of the whole-word approach achieved a mean percentage correct change of 10% and an effect size of .96. Unpredictable words for grade 4 in *Spelling Mastery* indicated a mean percentage correct change of 5% and an effect size of .62. Performance of grade level 4 of the whole-word approach indicated a total mean percentage correct change of 2% and an effect size of .25. A mean percentage correct change of

3% and an effect size of .45 occurred for grade 5. Unpredictable words for grade 6 indicated a total mean percentage correct change of 3% and an effect size of .47.

## Discussion

The results of this investigation demonstrated that the spelling skills of students exposed to *Spelling Mastery* greatly improved in the primary grades. This finding is especially important given the paucity of large-scale demonstrations of the efficacy of the *Spelling Mastery* program. Additionally, since there is a dearth of investigations comparing *Spelling Mastery* to other spelling approaches, particularly the traditional whole-word approach, the comparisons made in this study are interesting and timely.

Although only small differences were found between *Spelling Mastery* and whole-word instruction, one must consider the type of reading instruction provided to these students. For example, all students in first and second grade received instruction using the *Reading Mastery* (Engelmann & Bruner, 1995) curricula. This reading program includes a spelling component as part of the instructional package. Therefore, students in second grade who had whole-word spelling instruction were receiving spelling training through the *Reading Mastery* program. Additionally, most students in the third grade were exposed to *Reading Mastery* the previous 2 years. One-third (one class) of the students in third grade continued to be exposed to *Reading Mastery*. Considering the data in this investigation, it is possible that by the time students reached fourth grade, the effects of *Reading Mastery* were less evident since one-third of the students (one class) were exposed to *Reading Mastery* and the other students were 1 year removed from *Reading Mastery*. Therefore, it is possible that the use of *Reading Mastery* in the second grade made the students similar in performance regardless of the type of spelling instruction used, and that the possible effects of *Reading Mastery* were less evident in grade 3 and grade 4 (for TWS-3 scores and unpredictable words).

Although the results of this investigation were positive, several weaknesses are present. First, since there was no control group, cause-and-effect statements cannot be made in regard to the effects of *Spelling Mastery*. Second, since students were not randomly assigned to *Spelling Mastery* or whole-word classes nor were students' spelling skills shown to be equivalent at the beginning of the investigation, a direct comparison of the differential effectiveness of *Spelling Mastery* and whole-word approaches must be made with caution. Third, since spelling and reading skills are closely aligned, having students exposed to different reading instruction formats and curricula makes firm conclusions on the differential effectiveness of the spelling programs difficult. For example, students in one class may have received *Spelling Mastery* in addition to whole-language reading, while students in a whole-word spelling instruction classroom may have received *Reading Mastery* and vice versa. Fourth, teachers in this investigation who used *Spelling Mastery* received 1 hr of training provided by a national Direct Instruction consultant; however, the National Alliance of Quality Schools (1995) recommends 6 hrs of training in a preservice program for the *Spelling Mastery* curricula. Fifth, since the teachers who used the whole-word instructional method did not receive any training, it is difficult to make comparisons among classes since the teachers had different experiences in spelling instruction training. Sixth, there was no information gathered in regard to the number of lessons that each class completed in the *Spelling Mastery* program. In addition, no information was taken to indicate whether instruction of the whole-word spelling approach was consistent across classes, therefore it is difficult to make comparisons. Finally, this investigation did not include criterion tests to make direct comparisons between *Spelling Mastery* and whole-word instruction. Dixon and Engelmann (1999) note that separate criterion tests should be developed to answer the following question, "Which program achieves its objectives most successfully and uniformly?" (p. 80). Dixon and Engelmann note that these tests can be used in concert with a standardized test.

While there were several methodological weaknesses, it must be pointed out that this investigation was a school-wide implementation of *Spelling Mastery*. Therefore, the investigation was conducted within the confines of an applied public school setting. The internal validity of the investigation was weak but the external validity was a strength.

Based on the findings of this investigation, several areas for future research are indicated. First, the differential effects of reading methods on the type of spelling instruction used should be determined. Second, since reading instruction can impact spelling skills and perhaps the effects of different spelling methods, it is important to determine if there are differential effects of the *Spelling Mastery* program for students who are exposed early on to *Reading Mastery* but are transitioned to a whole-language classroom for reading versus students who were enrolled in whole-language reading instruction early

on but transition to *Reading Mastery* classrooms. Third, more methodologically rigorous designs (e.g., control group designs) should be attempted in the future. Finally, more appropriate curriculum-based measures should be used as outlined by Dixon and Engelmann (1999). ◆

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*Author Note:* This project served as the research paper requirement for the first author as part of her master's program in special education at Eastern Washington University.


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# Using Paraprofessionals to Deliver Direct Instruction Reading Programs

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*Abstract:* Reading Mastery *and* Corrective Reading *were used by paraprofessionals to deliver reading instruction to small group of students in six schools in a small urban school district. One group of 17 students was followed for 2 consecutive years; a second group of 65 students was followed for an additional 2 years. Pretest and two posttest administrations of the Woodcock Reading Mastery Test-Revised were completed to determine students' reading grade level and rate of reading gain prior to and across 1 and 2 years of instruction using DI reading programs. The rate of reading gain prior to the implementation of DI reading was compared to the rate of reading gain during DI instruction using dependent one tailed t-tests with Bonferroni corrections for each grade level. Statistically significant differences in rate of gain were found for Total Reading for 1 year of DI instruction for the first group of students and for Grades 1 and 4 for the second group of students. Additional analyses comparing Total Reading Normal Curve Equivalents showed statistically significant differences for 1 year of DI instruction for the first group of students and for both 1 and 2 years of DI instruction for the second group of students.*

Direct Instruction reading programs (e.g., *Reading Mastery, Corrective Reading*) have been shown to be highly successful in teaching reading to students who are at risk for school failure and to students with disabilities (Fredrick, Keel, & Neel, in press; Polloway, Epstein, Polloway, Patton, & Ball, 1986; Snider, 1990). Unfortunately, having effective programs available for use in the classrooms and training teachers to implement these programs are not enough. Teachers have heavy demands placed on their time and seem to be asked to do more every year. How then are they to devote the time necessary to implement research-based programs consistently so that all students succeed?

*As we require paraprofessionals to be better trained than ever before and give them more academic responsibilities to help meet the needs of our ever-increasing population of students at risk for school failure, it seems reasonable to investigate the extent to which paraprofessionals can successfully implement research-based reading programs.*

This high demand for instructional time, coupled with high populations of students at risk for school failure, has supported the hiring of many paraprofessionals in recent years. Pickett (1996 as cited in French, 1998) reports that more than half a million individuals in the U.S. are employed as educational paraprofessionals. Many paraprofessionals are employed in settings serving large numbers of students who are at risk for school failure such as Title I (LeTendre, 1998). These paraprofessionals often share the cultural and linguistic characteristics of the communities in which they work, providing a strong link between the home and the school (Miramontes, 1990).

Some researchers suggest that paraprofessionals are the most misused, yet potentially valuable assets available to educational systems (Johnson, Lasater, & Fitzgerald, 1997). Typically, they are asked to perform clerical tasks such as grading papers, creating bulletin boards, and making copies of materials for classroom use (Lamont & Hill, 1991 as cited in French, 1998); however, Wadsworth and Knight (1996) and Miramontes (1990) suggest that, with proper training and coaching from the classroom teacher, the paraprofessional should be given increased instructional responsibilities, providing students who are at risk for school failure with increased instructional support. Courson and Heward (1988) report that paraprofessionals can be used to provide small group instruction in special educa-

tion to increase the number of active student responses through activities such as choral responding and using response cards. Although French (1998) indicated that paraprofessionals are indeed serving increased instructional roles, this type of service delivery is not founded on a solid research base (Jones and Bender, 1993).

As we require paraprofessionals to be better trained than ever before and give them more academic responsibilities to help meet the needs of our ever-increasing population of students at risk for school failure, it seems reasonable to investigate the extent to which paraprofessionals can successfully implement research-based reading programs. The purpose of this study was to determine the effectiveness of using paraprofessionals to deliver DI reading programs to elementary students considered at risk for school failure.

## Method

### Students and Setting

Two groups of students participated in this study. Students who scored below the 50th percentile on the ITBS Advanced Reading were selected for participation in these groups. Beginning in Fall 1995, Group 1 served as a pilot for the study and included 14 first-grade students and 19 second-grade students in two elementary schools in a small urban school system. Group 1's reading progress was monitored for 2 school years. At the end of the second year, 6 first-grade (now second-grade) students (43%) and 11 second-grade (now third-grade) students (58%) remained in the system. Beginning in Fall 1996, Group 2 included 57 first-grade students, 77 second-grade students, 42 third-grade students, 54 fourth-grade, and 21 fifth-grade students in six elementary schools in the same school district. Group 2's reading progress also was monitored for 2 school years. At the end of the second year, 11 first-grade (now second) students (19%), 17 second-grade (now third) students (22%), 15 third-grade (now fourth) students (36%), and 22 fourth-grade (now fifth) students (41%) remained in the system. The fifth-grade students moved to the middle school during the second year.

### Paraprofessionals

Twenty-five paraprofessionals in the six schools participated in the study. Twelve (48%) of the paraprofessionals had earned bachelor's degrees in fields other than education. Two (8%) paraprofessionals had undergraduate degrees in education. The remaining (44%) paraprofessionals were high school graduates. Fifteen (60%) of the paraprofessionals were African-American; the other 10 (40%) were Caucasian-American.

### Materials

All paraprofessionals used the *Reading Mastery Series, Rainbow Edition, Levels I, II,* and *Fast Cycle* (Engelmann & Bruner, 1995a; 1995b; Engelmann & Hanner, 1995) or the *Corrective Reading Decoding Series, Levels A, B1, B2,* and *C* (Engelmann, Carnine, & Johnson, 1988; Engelmann, Meyer, Carnine, Becker, Eisele, & Johnson, 1988c; Engelmann, Meyer, Johnson, & Carnine, 1988d). Both the *Reading Mastery* and *Corrective Reading* series provide a code-based approach to reading that incorporates phonemic awareness, explicit synthetic phonics, comprehension strategies, and extensive opportunities to practice and reach fluency. Phonemic awareness tasks include rhyming, blending, isolating sounds in words, and segmenting spoken words into sounds (Grossen, 1996). Letter-sound correspondences are taught explicitly as recommended in the research (Adams, 1990; Anderson, Hiebert, Scott, & Wilkinson, 1985; Snow, Burns, & Griffin, 1998). All programs use choral responding, providing students with many opportunities to respond during each reading lesson. The first two authors and several graduate research assistants administered placements tests specific to each program during September 1995 for Group 1 students and during September 1996 for Group 2 students. Instruction commenced immediately after the placement tests were administered with students grouped based on their placement in either *Reading Mastery* or *Corrective Reading*.

### Paraprofessional Training

All paraprofessionals were trained to deliver the DI reading programs by the first two authors. This 2-day training took place just prior to the beginning of each school year and consisted of an overview of DI and specific instruction and practice in the implementation of the *Reading Mastery* and *Corrective Reading* Programs, with emphasis on delivering formats consistently and providing appropriate error correction procedures.

### Assessments

Each year when placement testing was completed, the Word Identification, Word Attack, and Passage Comprehension subtests of the Woodcock Reading Mastery Tests-Revised (WRMT-R) were administered individually by graduate research assistants. In addition to the scores from these three subtests, a Short Scale Total Reading Score was obtained using the scores from the Word Identification and Passage Comprehension subtests. Form G of the WRMT-R was used as the pretest. Group 1 students were pretested in September 1995; Group 2 students were

pretested in September 1996. Form H of the WRMT-R was used for the first posttest for each group, in Spring 1996 and Spring 1997, respectively. Form G was used again for the second posttest for each group, in Spring 1997 and Spring 1998, respectively.

### Instructional Procedures

All students received explicit reading instruction using one of two DI reading programs: *Reading Mastery* or *Corrective Reading*. Students in Grades 1, 2, and 3 received instruction in Reading Mastery. Students in Grades 4 and 5 received instruction in *Corrective Reading*. Paraprofessionals delivered the reading programs in small groups of no more than 8 to 10 students. Instruction took place in the general education classroom, the cafeteria, the library, or a school activity room. Reading instruction using the DI programs was scheduled for 30 min daily. This instruction was in addition to the literature-based reading instruction these students received in their classrooms.

Paraprofessionals were instructed to follow the scripted lessons from either *Reading Mastery* or *Corrective Reading* as practiced during training and to teach each group for the entire 30 min they were scheduled for reading. If they finished a lesson in less than 30 min, they were instructed to begin the next lesson and to stop at the end of any task after 30 min of reading instruction. Paraprofessionals recorded the lesson taught each day on a tracking sheet provided by the investigators.

### Technical Support and Procedural Fidelity

The first two authors and graduate research assistants provided technical support and assessed procedural fidelity by observing reading classes each week. While observing, any difficulty paraprofessionals had implementing the programs was noted and immediate assistance was provided by modeling correct implementation and answering questions. In addition, these observations were used to track paraprofessional and student progress in the program to identify any additional materials needed.

## Results

Pre- and post test data were available for all students in Groups 1 and 2 for 1 year. A second year of post-test data were available for 17 Group 1 students and 65 Group 2 students. Short-Scale Total Reading Scores from the WRMT-R Forms G and H were reported for each group. Because participants were used as their own controls, students' rate of reading gain prior to DI reading was compared to their rate of reading gain during the implementation of DI reading instruction (Snyder-McLean, 1987). Rate of reading gain prior to DI reading was calculated by dividing students' pretest grade equivalent scores by the number of months they were in school before the start of the program. Rate of academic gain during 1 year of DI reading was calculated by dividing students' months of academic gain during the first year of DI reading by the number of months students were in the DI programs. Rate of academic gain during 2 years of DI reading was calculated by dividing students' months of academic gain across 2 years of DI reading by the number of months students were in the DI programs. These rates were calculated for the Short Scale-Total Reading scores of the WRMT-R. Mean results for Group 1 are presented in Table 1. Mean results for Group 2 are presented in Table 2.

**Table 1. Mean Rate of Academic Gain per Instructional Month for Group 1.**

| | Mean rate of academic gain | | |
|---|---|---|---|
| Grade | Prior to DI | During 1 year DI | During 2 years DI |
| 1 | 0.81 | 1.33 | 1.26 |
| | *n*=14 | *n*=14 | *n*=6 |
| 2 | 0.84 | 1.73 | 2.00 |
| | *n*=19 | *n*=19 | *n*=11 |

**Table 2. Mean Rate of Academic Gain per Instructional Month for Group 2.**

| | Mean rate of academic gain | | |
|---|---|---|---|
| Grade | Prior to DI | During 1 year DI | During 2 years DI |
| 1 | 0.86 | 1.19 | 0.78 |
| | *n*=57 | *n*=57 | *n*=11 |
| 2 | 0.93 | 0.94 | 0.556 |
| | *n*=77 | *n*=77 | *n*=17 |
| 3 | 0.83 | 0.91 | 0.45 |
| | *n*=42 | *n*=42 | *n*=15 |
| 4 | 0.79 | 1.19 | .60 |
| | *n*=54 | *n*=54 | *n*=22 |
| 5 | 0.71 | 1.46 | N/A |
| | *n*=21 | *n*=21 | |

A dependent one tailed t-test with Bonferroni correction (Kirk, 1995) was conducted for each grade level to determine if there was a statistically significant difference between the rate of academic gain prior to DI and during 1 year of DI. A second dependent one tailed t-test with Bonferroni correction was conducted for each grade level to determine if there was a statistically significant difference between the rate of academic gain prior to DI and during 2 years of DI. With the Bonferroni correction for the two *t*-tests at each grade level, *t* values have to reach the .025 significance level (.05/2 = .025) to hold the overall .05 significance level.

For Group 1, there was a statistically significant difference for WRMT-R Short Scale-Total Reading for Grade 1 students between the rate of academic gain prior to DI and during 1 year of DI ($t(13) = 3.48$, $p = .004$). There was no statistically significant difference between the rate of academic gain prior to DI and during 2 years of DI ($t(5) = 0.85$, $p = .434$). Statistically significant differences also were found for Grade 2 students between the rate of academic gain prior to DI and during 1 year of DI ($t(13) = 4.23$, $p = .001$) and between the rate of academic gain prior to DI and during 2 years of DI ($t(5) = 2.88$, $p = .016$).

For Group 2, there were statistically significant differences for WRMT-R Short Scale-Total Reading between the rate of academic gain prior to DI and during 1 year of DI for Grade 1 students ($t(56) = 3.18$, $p = .002$), Grade 4 students ($t(53) = 3.08$, $p = .003$), and Grade 5 students $t(20) = 2.02$, $p = .05$). The Bonferroni correction was not used for Grade 5 because only one *t*-test was conducted for this group. No other statistically significant differences between rate of academic gain prior to DI and during 1 year of DI were found. No statistically significant differences were found for any grade levels between rate of academic gain prior to DI and during 2 years of DI.

A second set of analyses was performed for each group to determine if statistically significant differences occurred for WRMT-R Short Scale-Total Reading Normal Curve Equivalents (NCEs). NCEs are recommended for use by the United States Office of Education for reporting and comparing the scores of groups of students (Lyman, 1998). Unlike percentile ranks, NCEs are interval in nature and can be used to calculate and compare means. Mean results for Group 1 are presented in Table 3. Mean results for Group 2 are presented in Table 4.

For Group 1, statistically significant differences were found for Grade 1 ($t(13) = 3.06$, $p = .009$) and Grade 2 ($t(53) = 4.33$, $p < .0001$) between Pretest (Fall 1995) and Posttest 1 (Spring 1996) for WRMT-R Short Scale-Total Reading NCEs. No statistically significant differences were found for NCEs between Pretest (Fall 1995) and Posttest 2 (Spring 1997).

**Table 3. Means for Group 1 WRMT-R Normal Curve Equivalents.**

| Grade | | Pretest | Posttest 1 | Posttest 2 |
|---|---|---|---|---|
| 1 | Mean | 19.00 | 25.57 | 24.00 |
| | *n* | 14 | 14 | 6 |
| 2 | Mean | 24.05 | 32.74 | 24.27 |
| | *n* | 19 | 19 | 11 |

Table 4. Means for Group 2 WRMT-R Normal Curve Equivalents.

| Grade | | Pretest | Posttest 1 | Posttest 2 |
|---|---|---|---|---|
| 1 | Mean | 26.63 | 35.46 | 32.91 |
| | *n* | 57 | 57 | 11 |
| 2 | Mean | 30.12 | 35.91 | 34.53 |
| | *n* | 77 | 77 | 17 |
| 3 | Mean | 24.10 | 30.38 | 32.47 |
| | *n* | 42 | 42 | 15 |
| 4 | Mean | 29.24 | 35.31 | 37.5 |
| | *n* | 54 | 54 | 22 |
| 5 | Mean | 27.48 | 35.38 | N/A |
| | *n* | 21 | 21 | |

For Group 2, statistically significant differences were found between Pretest (Fall 1996) and Posttest 1 (Spring 1997) for WRMT-R Short Scale-Total Reading NCEs for all grade levels. Statistically significant differences also were found between Pretest (Fall 1996) and Posttest 2 (Spring 1998) for all grade levels.

## Discussion

The purpose of this study was to evaluate the effectiveness of using paraprofessionals to deliver DI reading instruction to students considered at risk for school failure. Given the history of excellence with DI instruction (Adams & Engelmann, 1996), these results provide additional evidence of the possibilities for assisting students who are at-risk for academic failure. By providing paraprofessionals with the opportunity to receive training and support using research-based reading programs such as *Reading Mastery* and *Corrective Reading*, these individuals had a positive instructional impact on their students. As suggested in the literature (French,

1998; Miramontes, 1990), well-trained and supervised paraprofessionals can provide effective instruction to students experiencing difficulty in school.

Prior to this study, all reading instruction that students received was based on a more implicit approach to teaching reading and was delivered by the classroom teacher. However, teachers in this small urban system felt overwhelmed by the large number of students considered at risk in reading, and they were interested in determining if additional instruction provided by paraprofessionals would have an impact on student performance. An initial pilot group of first- and second-grade students at two elementary schools was implemented; then the study was expanded to include first- through fifth-grade students at each of the six elementary schools in the system.

*By providing paraprofessionals with the opportunity to receive training and support using research-based reading programs such as* Reading Mastery *and* Corrective Reading, *these individuals had a positive instructional impact on their students.*

It is important to address the issue of student turnover in the two groups of students before discussing the results. During each year of the study, grade-level groups lost 40% or more of the students. The largest loss was for first- and second-grade students in Group 2. Although the loss of students from Year 1 to Year 2 in each of the groups was large, it was not surprising given the population of the school district. All of the schools serve a large, highly-mobile population of students living in poverty. For some schools, the turnover in students is as much as 30% from the beginning to the end of 1 school year and as much as 50% from 1 school year to the next. Students frequently withdraw from a school only to enroll at the same school again later in the school year. Therefore, only students who were present for the entire school year were included in the data analysis for each year.

Students' rate of academic gain prior to the implementation of DI was compared to their rate of academic gain during 1 year of DI instruction and during 2 years of DI instruction by paraprofessionals. For Group 1 students, statistically significant gains were made for both first- and second-grade students during the first year of DI. These statistically significant gains were maintained for Grade 2 students who received DI instruction for 2 full years. There was a notable loss of students from the first year to the second year of the study, and the statistically significant gains were not maintained for Grade 1 students who participated for 2 full years. Although the changes in rate of academic gain for 2 full years of DI were not statistically significant, the remaining students actually performed in a similar manner. For first grade, the mean rate of academic gain after 2 years of DI was very similar to the mean rate of gain for 1 year of DI. The lack of statistical significance is accounted for in the lower number of degrees of freedom in the second comparisons. The Grade 1 students who received 2 full years of DI instruction continued to make gains at about the same rate as they did during the first year of implementation. These results are consistent with an earlier study of urban first- and second-grade students taught by teachers (Fredrick et al., in press)

For Group 2 students, statistically significant gains were made for first-, fourth-, and fifth-grade students; no statistically significant gains were made for second- or third-grade students. The lack of statistically significant change for second- and third-grade students is surprising. No factors were identified among the students, paraprofessionals, or schools that explain this lack of effect. Again, there was a notable loss of students from the first year to the second year of the study, and the statistically significant gains were not maintained for students who participated for 2 full years. Unlike the Group 1 results, the lack of statistical significance cannot be explained simply by the loss of students, although this may have been a contributing factor.

Despite the lackluster changes in rate of academic gain, there were statistically significant differences for nearly all groups when we compared NCE scores. For Group 1 students, there were statistically significant differences between NCE scores from Pretest to Posttest 1 for both first-and second-grade students. For Group 2 students, there were significant differences between NCE scores from Pretest to Posttest 1 for all grade levels and from Pretest to Posttest 2 for all grade levels. Thus, Group 2 students who participated in 2 full years of DI maintained their gains on NCE scores, even though these gains were not maintained for rate of academic gain. Because NCE scores are normalized test scores, no statistically significant differences should be evident across test adminstrations. Because students are compared to their normative peer group at each testing, their standing within the group should remain relatively the same as each group grows older and receives similar amounts of instruction, suggesting that significant changes in NCE scores are

*Given the statistically significant increase in students' relative standing compared to their peers, it seems reasonable to suggest that paraprofessional-delivered DI programs provided a robust intervention for students at risk for school failure.*

evidence of some extraordinary change. The U.S. Department of Education's recommendation to use NCE scores to report research gains appears to support this idea (Lyman, 1998). Given the statistically significant increase in students' relative standing compared to their peers, it seems reasonable to suggest that paraprofessional-delivered DI programs provided a robust intervention for students at risk for school failure.

Several limitations of the study can be identified. First, students served as their own controls rather than using a separate control group. When the idea for the Group 1 pilot study was suggested to administrators, it was presented as an opportunity to improve the reading skills of students who had performed poorly on standardized tests. Based on previous research, it was expected that a positive effect on reading achievement for these students would be found; therefore, the administration was not comfortable withholding instruction from some students to implement a control group. Given the success of the Group 1 pilot, it is not surprising that school administrators were anxious to assist as many students as possible. Second, subject mortality was significant in both groups of students, a limitation that likely affected the results for the second year of DI implementation. While this is a significant problem, it is not unusual given the highly-mobile, inner-city system participating in the study. Students in this high-risk situation require the most powerful interventions we can provide within a short period of time (Kameenui, 1993). The results of the first year implementation with both groups appear to support the efficacy of using paraprofessionals to deliver DI reading programs to students in this high-risk population.

Other threats to internal validity were considered as well. Because we used two measures that might be considered stable over time without a signficant change in instruction (rate of academic gain and NCE scores), it is unlikely that maturation was a threat to the validity of this study. If students simply matured across time, it is likely that they would have maintained approximately the same rate of academic gain across time and maintained their relative position within the norm group on NCE scores. Even if a statistical regression effect was in operation, it is unlikely that students would improved their relative standing with their peers across two posttest administrations. Since students served as their own controls selection did not pose a significant threat to validity. Testing was addressed as a threat by using different forms of the same test and administering the tests at intervals of 8 months to a year.

With regard to external validity, it is always problematic with regard to generalization from research participants to other target populations (Martella, Nelson, & Marchand-Martella, 1999). However, a significant data base exists regarding the effectiveness of DI programs with students who are at risk for academic failure and for those who have disabilities (Adams & Engelmann, 1996); the current study focuses on one new aspect of DI—instructional delivery by paraprofessional educators. One threat to ecological validity that may impede the generalization of these results to other target populations is that of experimenter effects, or the success of the individuals delivering the independent variable. More than 50% of the paraprofessionals employed in the schools participating in the study held undergraduate degrees. This higher level of education may have impacted the performance of these individuals in delivering the DI reading instruction; however, observation of individual paraprofessionals did not indicate any notable differences in their ability to deliver the DI reading programs accurately.

Given these results and the history of excellence associated with DI reading instruction, it seems plausible that paraprofessionals providing reading instruction using research-based reading programs can have a significant impact on the performance of students considered at risk for school failure. The first year results are especially impressive given the tyranny of time faced by students who are at risk for educational failure (Kameenui, 1993). Often schools hire paraprofessionals based on numbers of students—that is, keep class sizes smaller and hire an additional teacher or let class sizes get a little larger and hire paraprofessionals to help teachers in the classrooms. With paraprofessionals in the classroom, the teacher and paraprofessional could each teach a reading group simultaneously. Such a coordinated effort would reduce the amount of off-task time typically found for students working independently while the teacher is working with one reading group. Future research might address the impact of both

teachers and paraprofessionals using DI reading instruction within the classroom, and methods for maintaining initial gains across time with students in highly-mobile environments.

Several researchers (French, 1998; Miramontes, 1990; Wadsworth & Knight, 1996) have suggested that paraprofessionals given adequate training and support can provide effective instructional services to students. By providing the paraprofessionals in this study with the opportunity to received training and support using research-based reading programs such as *Reading Mastery* and *Corrective Reading*, these individuals had a positive instructional impact on many students. Although much more research is warranted to determine the extent to which paraprofessionals can serve an instructional role (Jones & Bender, 1993), this study provides a small, but important, beginning. It is our speculation that if paraprofessionals are to be effective in an instructional role, this is more likely to occur with a highly structured instructional program such as DI. ◆

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# The Benefits of Being High School Corrective Reading Peer Instructors

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*Abstract: The advantages of serving as peer instructors using the* Corrective Reading program *(CRP) (Engelmann, Hanner, & Johnson, 1989) with high school students at risk for school failure were examined. Data were collected before and after delivery of the CRP using the Gates-MacGinitie Reading Tests (vocabulary and comprehension subtests). Data were also collected on how accurately peer instructors collected data and on their satisfaction with delivering the program. Students receiving peer-delivered instruction also completed satisfaction surveys. Results showed that the peer instructors who scored below grade level on the vocabulary pretest of the Gates-MacGinitie increased to at or above grade level on the posttest; they exhibited stable performance on the comprehension subtest. Those peer instructors who scored at or above grade level on the Gates-MacGinitie exhibited stable performance from pre to posttest assessments across both subtests. Implications for further research are discussed.*

Reading is an important part of elementary school curricula and serves as an important foundational skill for all other academic areas. Despite the emphasis placed on reading in the elementary years, many of America's youth lack the necessary basic reading skills to keep up with their peers. As a result, many students enter high school with reading skills far below that which is needed to complete the basic graduation requirements. The National Center for Education Statistics (1999) reports that in grade 8 only 33% of the students meet or exceed the requirements to read at a proficient level and in grade 12 only 40% of the students are able to work at a level that meets or exceeds the skills needed to complete their grade. Performance at the proficient level was identified by the National Assessment Governing Board as "the level that all students should reach" (National Center for Education Statistics, p. 21). Thus, 67% of the students entering high school and 60% of high school seniors are unable to show mastery in reading skills and may be at risk for academic failure. Because of statistics like these, it is no wonder that reading is the number one academic area in which most students experience difficulties (Kameenui & Carnine, 1998).

There are two possible reasons for the low reading skills of many students. First, many teachers at the secondary level have not had the training needed to teach reading. Second, these teachers do not have the time or scheduled opportunity to work one-on-one with students. Unfortunately, after students leave the elementary grades, they are not typically offered reading as a separate area of instruction unless they qualify for special education services. Thus, it is assumed that students have mastered reading prior to entering high school. If reading skills are not remediated, performance in content area classes such as science or history suffers (Buehl, 1998). Innovative approaches are needed which focus on remediating reading deficits in high school.

*Sixty-seven percent of the students entering high school and 60% of high school seniors are unable to show mastery in reading skills and may be at risk for academic failure.*

One effective technique for improving reading skills involves peer-delivered instruction. Peer-delivered instruction has been shown to be effective for increasing students' academic performance (Cushing & Kennedy, 1997; Delquadri, Greenwood, Worton, Carta, & Hall, 1986; Greenwood, Carta, & Hall, 1988). For example, Maheady, Sacca, and Harper (1988) found that class-wide peer tutoring was equally effective for both students with mild disabilities and those without disabilities. Results

showed immediate increases in weekly test scores on social studies tests during the tutoring program. In another study, peer tutoring was compared to instruction typically delivered by teachers and was shown to produce superior weekly achievement effects for inner-city students (Delquadri et al., 1986). Delquadri and colleagues reported that the rate of words read per minute doubled during class wide peer tutoring. Peer tutoring procedures have been demonstrated to be even more effective than conventional, teacher-mediated procedures due to immediate opportunities to respond, immediate feedback, high mastery/fluency levels, and rates of content coverage (Greenwood et al., 1988).

Interestingly, few investigations have focused on the effects of peer-delivered instruction on the instructors themselves, especially at the secondary level. Cushing and Kennedy (1997) looked at the academic effects on students serving as peer instructors for students with disabilities in general education classrooms in an intermediate school. Three indicators (i.e., academic engagement, coursework performance, and social validity) were used in this investigation involving three peer instructors. The peer instructors assisted their students with curricular adaptations, assignment completion, and social facilitation. Positive benefits for peer instructors were shown on all measures. At the elementary level, Marchand-Martella and Martella (1993) measured the effects of students with mild disabilities serving as peer instructors for grade school students with moderate disabilities when teaching first aid skills. Results showed that the peer instructors were able to provide effective modeling, error corrections, and praise, and could collect reliable data on the performance of their students. Further investigations on the benefits of peer instruction on the instructors themselves are needed at the secondary level.

Another effective method for remediating reading deficits involves the *Corrective Reading* program (CRP), which is based on the Direct Instruction model (Engelmann, Hanner, & Johnson, 1989). The CRP is designed to help students in grades 3 through 12 who have deficits in decoding and/or comprehension. The scripted format of the CRP enables instructors to present the material in an effective manner, even if they lack teaching experience. Students from a wide variety of backgrounds and levels of intelligence have exhibited improved reading performance after completing the program (Coulter, 1997; Grossen, 1999). The CRP has been compared to many instructional methods in various settings (Carnine, Silbert, & Kameenui, 1997). For example, Gregory, Hackney, and Gregory (1982) compared two groups of sixth graders with low reading skills and found that the CRP group made higher gains than the comparison group in both decoding and comprehension. Additionally, Kasendorf and McQuaid (1986) found that students participating in *Corrective Reading* showed that in a typical school year, students made gains in comprehension and decoding. Unfortunately, little research has been done on CRP at the secondary level with the exception of Harris, Marchand-Martella, and Martella (in press).

In the Harris et al. (in press) investigation, peer instructors taught high-school-age students who were reading at least two grade levels below their current grade. The peer instructors delivered the CRP and conducted timed repeated readings. Results of this study showed that students who received peer-delivered instruction improved their reading performance as much as 4 years during an average of 60 days of instruction. This investigation focused on one high school with a limited amount of peer instruction provided for high school students at risk for school failure. No data were taken on comprehension during this study. This investigation did not include an analysis of the effects of the program on the peer instructors themselves.

To date only one investigation, Harris et al. (in press) has been found combining peer instruction with the CRP. However, we have found no investigations determining the effects of using the CRP on the peer instructors themselves. Therefore, the purpose of this study was to analyze the effects of peer-delivered instruction using the CRP on the students serving as peer instructors.

## Method

### Setting and Participants

***Setting.*** This study took place in an urban high school located in the Pacific Northwest. The high school enrolled 1,760 students. The percentage of students who received free and reduced lunch was 19%.

Instruction took place in a classroom in a portable on the high school campus. Students sat across from each other at 10 individual tables separated by room dividers. Instructional sessions were conducted 5 days per week; there were two periods during the school day in which instruction was provided. Each period was 50 min in length. For each period, the general education teacher was present for each instructional session. This teacher had 28 years of teaching experience; she had 6 years of experience using peer instructors and the CRP in her classroom.

***Selection and training of peer instructors.*** In

return for being instructors, students in the 11th and 12th grades were given the opportunity to earn one high school credit for the year and two college credits per quarter for a total of six college credits for the year. Students were solicited from honors English classes and through teacher and guidance counselor contacts. Seven peer instructors were in the 12th grade, while four of the peer instructors were in the 11th grade. Of those peer instructors selected for participation, 10 were female and one was male.

Extensive training of peer instructors was not required due to the scripted nature of the program. Prospective peer instructors were trained in a 2-hr session during the fall semester by a professor at the university offering college credits. She had extensive experience in the training of Direct Instruction programs for in-service and preservice teachers. Training was conducted as follows. First, students were introduced to the Direct Instruction (DI) model. This introduction discussed what DI is and why it is important in teaching reading to students in need of remediation. Next, students learned about the CRP, descriptions of the various levels of CRP, what materials were needed to conduct the program, and other information idiosyncratic to the CRP curriculum. Then students were guided through a lesson using Lesson 26 from Decoding C and Lesson 13 from Comprehension B1 of the CRP (Engelmann et al., 1989). The trainer first modeled various exercises in the lesson, followed by guided practice where the high school students chorally responded as teachers with the trainer acting as the student. Feedback (both positive and corrective) was provided. Finally, students were placed in dyads or triads and conducted a novel lesson, taking turns on who was the teacher and who were the students. The trainer also taught the peer instructors how to conduct error corrections and to provide specific praise. Following this lesson format, the trainer explained how to conduct repeated readings and how to collect and record data. Questions were answered at the end of the session. Following this, peer instructors were asked to sign a contract provided by the school. The contract listed their responsibilities and the need for confidentiality.

The supervising teacher assigned peer instructors to students the next day. This teacher and a graduate student in special education (first author) observed these instructors. Corrective and positive feedback was provided on the peer instructors' performance during the observation.

*Selection and placement of students.* The Gates-MacGinitie Reading Tests (MacGinitie & MacGinitie, 1992) levels 7/9 (Form K) were administered to the entire ninth grade class at the beginning of the academic year. Students were identified for participation when their grade equivalent on the vocabulary subtest was 2 or more grade levels below current placement. The program was voluntary for students, and the class was taken as an elective. Students who volunteered to participate were administered the decoding placement test found in the CRP series guide. One student was also administered the comprehension placement test (Engelmann et al., 1989).

The CRP program has four levels of decoding and comprehension: A, B1, B2, and C. Placement of students tested included: one in Decoding B1, four in Decoding B2, and six in Decoding C. One student completed Decoding C and was started in Comprehension A. Of the 11 students who completed the program, three were male and eight were female. All of the students were Caucasian and freshmen level.

### Curriculum and Materials

For students who have difficulty reading words in isolation as well as connected text, Decoding B1 would be appropriate. In addition to receiving practice from reading words from sentences, students also receive practice from reading words from lists (Engelmann et al., 1989). Materials at this level include a teacher book, separate workbook answer key, non-consumable student book, and consumable workbook. This level contains 60 lessons.

Decoding B2 focuses on increasing fluency and the correct identification of similarly spelled words. Students placed in this level most often have difficulty reading words in context and tend to make mistakes due to inaccurate guesses (Engelmann et al., 1989). Materials for level B2 include a teacher book, separate workbook answer key, non-consumable student book, and consumable workbook. This level contains 65 lessons.

Decoding C focuses on decoding multi-syllabic words as well as increasing fluency. Students placed in the level of the decoding strand typically have difficulty reading material from their content-area textbooks (Engelmann et al., 1989). Materials used for this level are a teacher book, separate workbook answer key, non-consumable student book, and consumable workbook. There are 125 lessons in this level.

Comprehension A focuses on oral language skills: inductions, deductions, analogies, vocabulary building, inferences, recitation behavior, and common information (Engelmann et al., 1989). Students placed in this level of the comprehension strand are typically poor comprehenders who understand English. Materials consist of a teacher book and a separate

student workbook. There are 60 lessons in this level.

In addition to the curriculum, digital stopwatches, data collection sheets (timing sheets), and pencils were used. At the beginning of each instructional session, peer instructors collected a stopwatch, a folder containing the student's data sheet, a presentation book for the appropriate student placement level in the program, and two student books for the appropriate student placement level in the program.

### Dependent Variables and Measures

*Gates-MacGinitie.* The Gates-MacGinitie Reading Tests, levels 7-9, Forms K and L (MacGinitie & MacGinitie, 1992), were administered at the beginning and end of the academic year, respectively, for the peer instructors. The alternate form reliability of this assessment is .91. The Gates-MacGinitie Reading Tests include two subtests-vocabulary and comprehension. On the vocabulary subtest, peer instructors were given 20 min to respond to 45 multiple-choice questions. Peer instructors were required to read a short sentence in which one word was underlined and choose a synonym for the underlined word from a list of five words found below the sentence. On the comprehension subtest, peer instructors were given 35 min to read 14 passages and respond to 48 multiple-choice questions. Peer instructors read a passage and answered approximately two to five questions related to that passage. Group test administration was conducted, in most cases, over 2 days. Grade equivalent scores on the Gates-MacGinitie Reading Tests for vocabulary and comprehension served as the dependent measures. Median grade equivalents were calculated across pre and post administrations of the Gates-MacGinitie Reading Tests.

*Direct observations.* Direct observations of the peer instructors were completed twice per quarter to provide feedback to the instructors and collect data on interobserver agreement. During the observation the first author watched the peer instructor-student interactions and recorded the number of words read correctly across timings. The total number of errors for the 2-min timing and all subsequent 1-min 20 s timings were also recorded. Total words correct were calculated by subtracting the number of errors from the number of words read. Interobserver agreement was calculated on the number of errors observed by peer instructors during the initial 2-min timed reading. The smaller number of words was divided by the larger number of words and multiplied by 100 to get a percentage of total agreement for total correct words and total number of errors.

*Surveys.* Two surveys were given twice during the course of the study. At the beginning of the study both peer instructors and students answered a survey asking them to rate their students' and peer instructors' performances, respectively. Both surveys consisted of seven questions. The first six questions included a scale of 1 to 5 (1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always). The seventh question was marked as agree or disagree. Table 1 shows the specific questions addressed on the surveys.

*Lessons completed.* Peer instructors recorded the number of lessons completed by their students across levels of the CRP. The number of instructional days across levels of the program was also assessed.

*Daily journals.* Peer instructors completed daily written journals at the end of each lesson. The peer instructor described how the lesson went and his or her feelings about areas in need of improvement. The journals were reviewed and initialed by the first author on a weekly basis.

### Peer-Delivered Instruction (Decoding)

Each lesson in the decoding strand of the CRP is divided into two basic skill areas: word attack and story reading. Word attack concentrates on individual sound identification and reading words in isolation. Story reading focuses on reading words in context and answering questions about what is read.

*Word attack.* Before moving on in the lesson, students were required to read all words correctly in the word attack section. For example, students were first asked to say an underlined sound in a word and then to read the word (e.g., washed). Students were also asked to read words as sight words. Students were occasionally required to provide definitions for selected words from the story, depending on lesson scripts. When students incorrectly identified a sound or word reading component during the lesson, an error correction procedure was followed. For example, the instructors: (a) provided the correct answer (e.g., "That word is *because*."), (b) told the students to repeat it (e.g., "What word?"), (c) spell it (e.g., "Spell *because*."), (d) say the word (e.g., "What word did you spell?"), and (e) resume reading at the beginning of a row or column (e.g., "Starting over.").

*Story reading.* Following the word attack exercises, students were instructed to read the lesson story that contained the words in the word attack exercise. While reading, the peer instructors asked comprehension questions as noted in the script. When students answered comprehension questions correctly, they were praised. If they answered incor-

Table 1. Student and Peer Instructor Surveys

| Student Survey | Average Pre | Post |
|---|---|---|
| 1. Does your tutor correct errors in word boxes? (range) | 3.4 (2-4) | 3.0 (2-4) |
| 2. Does your tutor correct errors (if any) made in timed reading? (range) | 3.3 (2-5) | 3.0 (2-4) |
| 3. Does your tutor pay attention when you are reading from material? (range) | 3.8 (2-4) | 3.5 (2-4) |
| 4. Does you tutor pay attention when your are completing workbook pages? (range) | 3.6 (2-5) | 3.1 (2-5) |
| 5. Does your tutor have a good attitude? (range) | 4.7 (4-5) | 4.6 (3-5) |
| 6. Does your tutor work to the bell? (range) | 3.9 (3-5) | 4.0 (3-5) |
| 7. Do you feel that you have been appropriately placed in the program? | all agree | all agree |

| Peer Instructor Survey | Average Pre | Post |
|---|---|---|
| 1. Does your student make errors in the word boxes? (range) | 4.0 (2-5) | 4.6 (3-5) |
| 2. Does your student make errors in the timed readings? (range) | 4.1 (2-5) | 4.2 (2-5) |
| 3. Does your student have trouble pronouncing underlined words? (range) | 4.2 (4 -5) | 4.7 (4-5) |
| 4. Does your student take more then ten tries to reach the required number of words on 2-minute timings? (range) | 4.7 (3-5) | 4.7 (2-5) |
| 5. Does your student have a good attitude in class? (range) | 4.8 (4-5) | 4.7 (3-5) |
| 6. Does your student work from bell to bell (range) | 4.2 (3-5) | 4.3 (3-5) |
| 7. Do you feel that your student has been appropriately placed in the program? | all agree | all agree |

*Note:* 1 = never; 2 = rarely; 3 = sometimes; 4 = often; 5 = always

rectly, the peer instructors directed the students back to the paragraph containing the answer, had them reread the passage, and would then pose the question to the students again. If the students responded correctly the second time, they were praised. If word attack errors occurred at any time while reading the story, the peer instructors provided the correct response (e.g., "That word is *because*."), had the students repeat the word, and then had the students reread the sentence containing the error.

During story reading, students were instructed to stop reading at the end of each section (sections were marked in student book). Upon completion of each section, the peer instructor asked the student scripted comprehension questions. The peer instructors recorded if comprehension questions were completed independently (I) (i.e., students needed no prompting or help from peer instructor), with help (H) (i.e., students were asked to refer back to the text), or not at all (X) (i.e., no answer was given by the students).

***Timed repeated reading.*** After reading the story, students were given 2 min to read as fast and as accurately as they could. The criterion for repeated readings of the same story became the number of words read correctly in 2 min. Students were required to read the number of words read in 2 min in 1 min 20 s with no errors (self-corrects were not counted as errors). This is a 33% reduction in the initial time allowed for story reading or a 150% increase in reading speed. In order for students to meet this criterion, repeated readings were often required. Once the criterion of 1 min 20 s with no errors was met, the students moved onto the next lesson, and the process was repeated. In between each repeated read, the peer instructors reviewed the words missed by the students by telling them the words missed and by having the students correctly say the words. In cases when students made a decoding error during the repeated readings, error correction procedures were used. These procedures were done after timed readings and consisted of the instructors telling the students the correct word (e.g., "That word is *redwood*. What word?") and having the students repeat the correct word back to the instructors (e.g., "redwood").

### Peer Delivered Instruction (Comprehension)

The comprehension strand consisted of two sections: oral work and the workbook. The initial part of the lesson required the students to give oral responses to questions presented orally by the peer instructors. Upon completion of the oral section of the lesson, the students completed a workbook assignment related to the lesson that was presented.

## Results

### Gates-MacGinitie Reading Tests

Table 2 shows the performance of the peer instructors on the Gates-MacGinitie Reading Tests. On the vocabulary and comprehension subtests, stable performance was noted across the 11 peer instructors from pre to posttest assessments. However, for the five peer instructors who scored below grade level on the vocabulary pretest (range = 8.5 - 10.5), all scored at or above grade level on the posttest.

### Direct Observation

The average interobserver agreement for the number of words read in the 2-min timed reading across peer instructors and observations was 99.7% (range = 98-100%). The average interobserver agreement for the number of errors observed in the 2-min timed readings across peer instructors and observations was 92.7% (range = 75-100%).

### Surveys

*Peer instructor.* As shown in Table 1, stable performance was shown from pre to post assessments across the seven questions as noted by the peer instructors as the rated their students.

*Students.* Table 1 also shows stable performance from pre to post assessments across the seven questions as noted by the students as they rated their peer instructors.

### Lessons Completed

The average number of lessons completed by peer instructors with their students was 109.5 (range = 78 - 122) across all levels (B1 - C) and both strands (decoding and comprehension) of the CRP. One student who completed Decoding B1 finished 115 lessons. The average number of lessons completed for Decoding B2 was 95 (range = 78 - 103). The average number of lessons completed for Decoding C was 117 (range = 79- 122). For the only student placed in Comprehension A, 111 lessons were completed. The average number of days of instruction provided by the peer instructors was 152 (range = 139 - 160). In addition, the average number of lessons completed per day was .6 (range = .5 - 2).

### Daily Journals

Review of daily journals showed overall positive comments reported by the peer instructors. Students were reported as working hard and improving in skill level as the program progressed. Examples of journal entries: "The lessons went well, it took only a few tries. Still working on correcting during her reading, but it is still hard for her." One student wrote, "Student did a really great job and had a positive attitude. I was really happy with the work he put in today." Another student reported, "Excellent day. Needs to work on not omitting words and not mumbling but read many more words then usual and did it in one of the shortest amounts of time ever."

## Discussion

While many studies have been done on the effects of peer instruction on students being tutored, few studies have addressed the effects on being a peer instructor on the student delivering the intervention at the secondary level. Cushing and Kennedy (1997) reported that positive effects of being a peer instructor were found with peers instructing students with disabilities in general education at the intermediate level. Marchand-Martella and Martella (1993) collected data on the instructional behaviors of grade school peer instructors with mild disabilities teaching first-aid skills to students with moderate disabilities and found that the instructors could effectively model, correct errors, provide praise, and reliably collect data. This study adds to the literature showing that academic gains are possible for students serving as peer instructors at the secondary level.

Several positive results of this investigation were noted. First, participation as a peer instructor was effective and improved the reading performance of the students who were below grade level. During a typical school year students'

**Table 2. Gates-MacGinitie Reading Test Results For Peer Instructors**

| | Vocabulary | | Comprehension | |
|---|---|---|---|---|
| | Pretest | Posttest | Pretest | Posttest |
| Below Grade Level ($N$ = 5) | 10.5 (8.5 - 10.5) | PHS (12.6 - PHS) | PHS (9.5 - PHS | 12.3 (10.5 - PHS) |
| At or Above Grade Level ($N$ = 6) | 12.9 (12.6 - PHS) | PHS ( 12.6 - PHS ) | PHS (10.5 - PHS) | PHS (12.3 - PHS) |
| Total ($N$ = 11) | 12.6 (8.5 - PHS) | PHS (12.6 - PHS) | PHS (9.5 - PHS) | PHS (10.5 - PHS) |

*Note:* PHS = Post High School

reading skills are expected to improve approximately 1 grade level. Peer instructors in this study who scored below grade level on the pretest of the Gates-MacGinitie Reading Tests showed an increase of over 3 grade levels in the area of vocabulary. This effect is larger than the typical 1-year growth seen without the intervention.

Second, direct observations of the peer instructors showed that the lessons were being taught correctly and that data were recorded reliably. Third, in the survey results, students indicated that their peer instructors were following the correct instructional procedures. This finding held up over the course of the year as shown by comparison of beginning of the year surveys and those taken at the end of the year. All of the peer instructors and students agreed that they were appropriately placed in the program. Peer instructors indicated that their students were successful as they progressed through the program. These findings indicate that the students and instructors were working well together. Daily journals kept by the peer instructors also reported the success of the students over lessons. Entries in the journals showed that the general attitude of the peer instructors was positive with a great deal of praise written as the students' skills increased. Additionally, the high number of lessons completed by the instructors and students is another indicator of the effective interaction of students and instructors.

Finally, the classroom teacher reported that social outcomes were observed. Over the course of the year peer instructors reported gaining confidence in their skills in working with students. Students reported that they discovered social skills they did not know they possessed. Although this result is not substantiated by systematic data collection, it does point to an important area of investigation in the future.

Despite the positive aspects of this investigation, several limitations exist. First, a single-group pretest, posttest design was used. Further research should be done that includes a control group to increase experimental control and to show that using the CRP has significant effects on their reading and social skills as compared to high school students not serving as instructors. Second, no data were collected on the generalized effects of serving as a peer instructor in other settings. Additional research should be conducted to determine if the positive effects carry over into the other classes taken by the peer instructors. Finally, it is not known if the gains shown in the measures used would be reflected in other tests such as college entrance exams. Further research should be conducted to investigate the possibility that improved performance on such measures as the SAT is possible. ◆

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*Author Note:* This project served as the research paper requirement for the first author as part of her master's program in special education at Eastern Washington University.

# Stages of a Direct Instruction Adoption

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*Abstract: The paper describes a pilot implementation of Direct Instruction (DI) curricula* (Reading Mastery *and* Language for Learning) *in an elementary school serving a disadvantaged, transient population in Cape Harbor County, North Carolina. The authors anticipated that success in one school might foster adoption of DI in other Cape Harbor County schools. Less than 1 year after the pilot implementation began, 20 of 22 elementary schools in Cape Harbor County instituted DI curricula; 8 of these schools utilized the DI curricula school-wide.*

## Overview of the School

Riverside Elementary School is in a lower socio-economic area near the Dram Tree River in a mid-sized, Southern coastal city. The area has been home to longshoremen and factory and marine construction workers. Riverside has 24 certified teachers and 14 paraprofessionals in general and special education, Title One, technology, music and art. Riverside has 365 children in kindergarten through fifth grade. Forty-one percent of the children are minority; 78% receive free or reduced lunch; and most housing is federally subsidized through Section Eight. Seventeen percent of the children are in Programs for Exceptional Children; 12% are on medication for attention problems. Student turnover last year was 66%.

*Less than one year after the pilot implementation began, 20 of 22 elementary schools in Cape Harbor County instituted DI curricula; 8 of these schools are utilizing the DI curricula school-wide.*

At the beginning of the 1998-1999 school year (the year this project was conducted), 52% of kindergartners scored below the 50th percentile on the Developmental Indicators for the Assessment of Learning-Revised (DIAL-R). In the spring of 1998, 37% of third, fourth, and fifth graders scored at Level I or II (the lowest of four levels) on the North Carolina End-of-Grade reading and math tests. The previous year (1997-1998) the school was within several points of being designated "low performing" under the North Carolina ABC (accountability) program

## Stages of Implementation

Nine stages were followed to implement Direct Instruction (DI) programs at Riverside Elementary School and subsequently throughout the school district.

### Stage 1. Initial Discussions With the Principal

A chance encounter led the first author and the principal (third author) to discuss DI as a way to raise students' achievement and life chances. In August 1998, the first author and the principal began planning a pilot DI implementation with one class in each grade (kindergarten, first, and second grade).

### Stage 2. Establishing a Close Relationship with the Principal and Staff

For two days a week for 2 months, the first author assisted a new Riverside teacher for children labeled behaviorally and emotionally handicapped in the classroom. The first author modeled instruction of appropriate classroom behaviors (e.g., appropriate interaction with the teacher and peers) and coached the teacher to use these methods. Students' behaviors improved and the teacher began using the methods on her own. This assistance demonstrated the first author's commitment to the staff, children, and school, as well as her judgment and skill.

**Stage 3. Discussion of the Pilot Project with Staff**

An important activity in this stage was viewing a videotape of the implementation of *Reading Mastery I*, Lesson 154, in a kindergarten class at Grange Elementary School. Prior to the use of DI, the students at Grange Elementary School had very low reading achievement. Prospective volunteer DI teachers and their assistants, the Title1 (Reading Recovery) teachers, the Language Arts Coordinator, and principal of Riverside Elementary watched this videotape. Watching the videotape allowed these individuals to become familiar with DI and demonstrated skill changes that students and teachers might experience as a result of using DI. Immediately after the viewing, the group planned DI implementation for Riverside Elementary School (e.g., placement testing, sharing teacher kits, cross-grade grouping).

**Stage 4. Testing Students and Ordering Materials**

DI placement tests (5-10 min per student over 3 days) indicated the starting level and lesson for each student in classes slated for the implementation. The first and second authors assisted with placement testing. Using student's scores, teachers created skill groups, decided who would teach which curriculum, and ordered materials.

**Stage 5. Pre-Implementation Meetings**

After testing, teachers met alone and later with all three authors and principal. During these meetings, the teachers decided they wanted their own DI kits. They also decided to use all of the take-homes included in the DI curricula to maximize the program's effectiveness. Finally, the group selected the teacher with the most DI experience to serve as the lead DI teacher.

**Stage 6. Pilot Implementation**

After materials arrived and lessons began, the teachers met often to discuss progress. They told the first author they would call on her as needed. This phase lasted 10 weeks (from the second week of January 1999 to April 1999).

**Stage 7. School-Wide Implementation**

Near the end of the school year, the principal and teachers shared information with the whole school regarding the progress of students involved in the DI program. They reported that DI had a) improved student's attention and students' achievement in decoding and comprehension, b) reduced lesson planning time, and c) increased the skillful involvement of teacher assistants (teacher assistants had their own DI groups). As a whole, the school decided to implement *Language for Learning* and *Reading Mastery* curricula school-wide the following year.

In early March 1999, placement tests were given to all students. The Reading Recovery teachers volunteered to do most of the work. After placement testing, the whole school met again to discuss the school-wide implementation. The same videotape of kindergartners reading fluently at Granger Elementary was shown and major features of DI were identified. The teachers implementing DI described how their teaching and students had benefited. By the end of the summer of 1999: a) all children had been tested and grouped for *Language for Learning* (kindergarten and first grade), *Reading Mastery* (all grades), and *Corrective Reading* (fourth and fifth grades); b) teachers had attended training workshops; and c) materials had been ordered.

**Stage 8: Dissemination of Results**

As previously stated, after 10 weeks (late March 1999), the principal and teachers using DI reported significant changes in student progress. Data had been collected on the following variables: student achievement (measured by comparing students' entry placement test level with their placement test level assessed approximately 3 months later); teachers' skills assessed via direct observations guided by the Direct Instruction Diagnostic Checklist (Vitale, 1998); and the formation of classroom learning communities (examined via direct observation during lessons). Data collection was not intended to test the effectiveness of DI, but to determine what data and findings that would convince the principal and other teachers (and other principals, teachers, and district administrators) to implement DI on a wider scale. In retrospect, the findings served as a catalyst for district-wide adoption of DI.

***Students' achievement.*** Riverside Elementary teachers reported the following academic improvements:

1. Seventy-three percent of kindergartners (16/22) in *Language for Learning* placed at a higher level of the curriculum at the posttest.
2. Comparison of placement posttest scores of kindergartners who had received *Language for Learning* with placement test scores of kindergartners in the two classes that had not received *Language for Learning* showed that a) 91% of DI kindergartners (20/22) placed at lesson 41, b) 25% (6/24) and 27% (6/22) of kindergartners in the two non-DI *Language for Learning* classes placed at lesson 41, and c) 50% (23/46) of the non-DI kindergartners placed at lesson 31.

3. Seventy-six percent of kindergartners (16/21), who began in *Reading Mastery I* or *II*, placed out of *Reading Mastery I* and *II*, and into the more advanced *Fast Cycle* curriculum at the posttest. In contrast: a) 64% (14/22) of kindergartners in one class that had not used DI, placed in *Reading Mastery I* (none in *Reading Mastery II* or higher); and b) 50% (12/24) of kindergartners in the other non-DI class placed in *Reading Mastery I*, lesson 11.
4. Sixty-three percent (10/16) of first graders in *Reading Mastery* placed at higher lessons in the curriculum at the posttest.
5. Of the 17 second graders who began in *Reading Mastery II*, 53% (9/17) placed out of *Reading Mastery II* and into *Reading Mastery III* ; one student placed in *Reading Mastery IV*, and one in *Reading Mastery V*. In contrast, 77% (33/43) non-DI second graders placed either in *Reading Mastery I* or *II*.

***Teachers' skill.*** Changes in teachers' skills were observed in the following areas identified by Vitale (1998): a) securing attention before giving task signals; b) watching all students in the group while presenting tasks; c) correcting the group for less than 100% proficient group response; d) seating low performers in direct line of vision; e) presenting the entire lesson without skipping tasks; f) presenting tasks in the correct sequence; g) requiring that students give the correct response throughout the task; h) presenting tasks so all children can see and hear; i) using signals whenever specified; j) sustaining a brisk pace; k) maintaining student attention by varying voice inflection; l) requiring students to respond in normal voices; m) correcting most errors; and n) providing transition statements between tasks (e.g., praise).

***Direct Instruction learning communities.*** DI is understood as a form of communication that helps students learn complex knowledge systems (Engelmann & Carnine, 1991). However, one of the first findings was marked change in social behavior. The following examples reflect the development of learning communities: a) quickly and quietly coming to the group lesson area when signaled; b) precise attention to teachers' signals (e.g., "Get ready" or "Your turn"); c) precise attention to the behavior of other students—especially distinguishing on-task and off-task behavior and more and less proficient behavior; d) decrease in off-task behavior; e) increase in helpful behavior, such as changing position so that other students can see the teacher or the book she is holding; f) enthusiasm about lessons; g) covertizing the turn-taking sequences and the "rules" for their operation. Students' tacit knowledge of the rules of instruction was revealed when substitute teachers deviated from the prescribed method their teachers used. For example, students would say, "You gotta get us ALL to say it," "We get to read a whole thing (points to a column of words) by ourself," "JT said it wrong. Make him do it again. He said 'Oh.' It's 'Ah.'" In other words, the format of DI lessons fosters the skills and sentiments that students and teachers need to participate competently in them. Lessons are not understood as one-way teacher "transmission" of information or even as reciprocal exchange of information, but as a learning community with a shared understanding of aims, values, skills, norms about appropriate behavior and the roles of students and teacher.

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### Stage 9. Facilitating District-Wide Adoption

The following steps describe progress from the one-school pilot project at Riverside to district-wide adoption of DI.

***Involving other principals.*** The Executive Director of Elementary Education, a long-time supporter of DI, encouraged the principal at Riverside Elementary to share her findings with the principal of Moonstone Elementary, whose population was similar to Riverside's. The principal of Moonstone asked the first and second authors to recommend curricula to improve reading in her third through fifth grades. The authors: a) recommended *Corrective Reading;* b) helped test children; c) provided initial training to third through fifth grade teachers who would be using *Corrective Reading;* d) helped order materials; and e) provided more training when *Corrective Reading* began (1 month prior to the end of the school year). The teachers and principal were excited about rapid changes in their children. At this point, the principals of Moonstone and Riverside advocated wider adoption of DI during informal meetings with other principals; the first author advocated wider adoption of DI in district meetings for principals and assistant principals.

*Accountability legislation.* Results of the pilot projects at Riverside and Moonstone were especially compelling to administrators in the context of North Carolina's ABC Accountability Model, which established proficiency and growth objectives in reading and math for every school. Schools who met objectives (measured by End-of-Grade tests) were eligible for monetary rewards and special recognition. Schools not meeting objectives were designated as "low-performing" and were eligible for grants and technical assistance. If a school did not meet objectives by the end of the *next* year, the school may have been taken over by a state assistance team. Superintendents were under similar pressure to raise achievement levels in their whole districts. Discussions with teachers, principals, and district administrators revealed that the ABC's strongly encouraged them to use the extensive student, class, and school data provided by the state to select more effective curricula and train teachers as soon as possible, so they could meet state-mandated objectives.

*A DI position.* In April 1999, the first author was hired by Cape Harbor County schools as lead teacher in DI. This enabled her to discuss DI with all of the elementary school principals and with hundreds of teachers.

*Additional focus on minority students.* The Executive Director of Elementary Education, was strongly committed to decreasing large discrepancies in the achievement of disadvantaged and advantaged children in some elementary schools. With funds from a Matching Incentive Grant (from The University of North Carolina at Wilmington and the county), the two first authors and The Executive Director began a pilot implementation of *Language for Learning* and *Reading Mastery* in two affluent schools with large discrepancies in their students' achievement. DI was now in schools serving both disadvantaged and affluent children. This created the increasingly accurate impression that DI was "everywhere in the county." Principals of non-DI schools subsequently asked the first author for information about DI.

*A taste of district-wide adoption.* The Executive Director of Elementary Education now offered to pay for DI materials in any summer school classes that chose them. Twenty-one of 22 elementary schools opted for DI. There were now 43 classes (and almost 500 students) using DI during the summer of 1999.

*District-wide training.* A DI Conference, sponsored by SRA/McGraw-Hill, The Watson School of Education at University of North Carolina at Wilmington, and Cape Harbor County schools, was held in June 1999, just after schools opted to use DI in the summer, but just prior to the start of summer school. This conference gave teachers a better understanding of DI's history and effectiveness and made teachers more familiar with lessons.

*Growing adoption.* Through the summer of 1999, the first author gave presentations at meetings for principals and assistant principals, language arts coordinators, and elementary school faculties. Almost invariably, meetings were followed by requests for help instituting DI, which was provided by the first and second authors during the rest of the summer. As of September 1999, following the pilot work at Riverside, 20 of 22 elementary schools in Cape Harbor County are using DI (*Language for Learning, Reading Mastery, Corrective Reading*). Eight schools have begun school-wide implementations or are obtaining DI materials. Twelve schools are using DI curricula in partial implementations.

## Lessons Learned

This paper reports an examination of school reform that began with one school and was gradually expanded to a district-wide adoption of DI. Major lessons learned were as follows:

1. With rare exceptions (such as the principal at Riverside Elementary, the Executive Director of Elementary Education, and the principal of Moonstone), principals, language arts coordinators and reading specialists did not adopt DI based solely on data showing that DI markedly raises and accelerates student achievement. Many persons were heavily invested—personally and organizationally—in holistic curricula (whole language, *Reading Recovery*) and qualitative measures. North Carolina's ABC accountability program (which measures student achievement via standardized, objective tests and rewards schools whose students demonstrate the achievement standards), may have increased the potential value and hence the selection of DI. However, the first two authors neither supported nor criticized the ABC program. They presented themselves as available to help principals select and use curricula enabling them to meet the demands of the ABC's.
2. As stated, most principals and reading/language specialists knew nothing of DI or saw it as an adversary to their philosophy. The authors were fortunate that the most respected *Reading Recovery* teacher became a DI advocate after giving the *Corrective Reading* placement tests and observing a lesson from *Reading Mastery V* at the only other school in Cape Harbor County using DI. She told other language arts coordinators that she thought

DI was superior to Reading Recovery and that she wished her own children had been taught with DI. In other words, it is important to have reputable and influential teachers speak for DI.

3. The videotape showing a class of kindergartners reading with much fluency after only 5 months in *Reading Mastery I* was quite persuasive. The tape demonstrated that DI works quickly, is not "drill and kill," but rather children like it, and that DI is developmentally appropriate for elementary school children.
4. It was important to show principals how instituting DI produces many other changes in school organization and culture (e.g., teachers helping one another, connections among grade levels, common mission, and common definition of effective instruction). In other words, it was important for administrators to hear that along with an effective curriculum, DI fosters school-wide reform.
5. Naturally, the support and assistance of the Executive Director of Elementary Education was important. The first two authors presented themselves and DI as helping her to accomplish her mission, which was to raise district achievement (in light of the ABC's) and to serve disadvantaged and minority children.
6. It was important to go slowly and follow the lead of principals. Given the number of demands they already faced, principals would have resisted any further efforts to tell them how to run their schools. Instead, the first two authors arranged situations (e.g., presentations) that interested principals in learning more about DI, and then (in smaller meetings) to think about how they might implement DI, and then (in school-wide meetings) to prepare their teachers. ◆

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*Author Note:* This paper is based on the first author's Masters thesis at the Watson School of Education, University of North Carolina at Wilmington. Correspondences concerning this article should be addressed to a) Frances Bessellieu, New Hanover County Board of Education, 1802 South 15th Street, Wilmington, North Carolina 28401 (frances_bessellieu@nhcs.k12.nc.us), or b) Martin Kozloff, University of North Carolina at Wilmington, 601 South College Road, Wilmington, NC 28403 (kozloffm@uncwil.edu).


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# Changing Teaching Practices: A Follow-up Study of Participants in a Summer Clinic

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*Abstract: The purpose of this study was to follow-up teachers who had participated in a supervised, clinical experience where they learned to use Direct Instruction (DI). A survey was sent to all teachers who participated in a summer clinic for the past 10 years. The teachers were asked to give demographic information, and to report their perceptions of the clinic, views on DI, and philosophy of education. Results indicated that teachers were generally positive about both the clinic and DI and that 64% currently used DI in their classroom. A comparison of teachers who continued to use DI and those who did not revealed statistically significant differences in grade level that they teach, access to materials, administrative support, attitudes toward DI, and philosophy about inclusion. The authors discuss the relationship of attitudes and beliefs to practice and how to effect long-lasting change in teaching practices.*

Bringing about significant and lasting change in teaching behavior is difficult (Richardson, 1990). This is particularly true of complex, conceptual, and long term change (Duffy & Roehler, 1986). Teachers may appear to change initially, but return to previously-learned and comfortable practices over time (Duffy & Roehler). Direct Instruction (DI) often challenges students' traditional notions of what teaching should be, and many believe that it is contrary to their philosophy of teaching (Becker, 1984). Often teachers' instructional behavior changes temporarily but returns to the status quo as they are continuously exposed to the expectations of the educational establishment. Even when teachers have been involved in successful school-wide implementations of DI, they may revert to less rigorous, traditional methodology in the absence of strong leadership. Nowhere was this more apparent than in the aftermath of Project Follow-Through.

Sociologists have sought explanations for why educational innovations have not been implemented as their designers anticipated. One rather harsh point of view suggests that teachers are less rational and analytic than other college graduates (Lortie, 1975) and they are conceptually simplistic and intuitive (Jackson, 1968). Researchers have looked at school organization to explain teachers' willingness or reluctance to change (Little, 1987) and have observed that there is no reinforcement in the educational establishment for doing a better job of educating children (Hopkins, 1987).

The general movement in education toward constructivism has brought a shift from teacher *behaviors* to teacher *beliefs* (Richardson, 1996). Indeed, much of the research on teacher beliefs has been conducted by math educators who seek to change teachers' thinking to support constructivist methods (e.g., Edwards, 1996). Although some believe that teachers' beliefs and attitudes drive important decisions and classroom practice (Renzaglia, Hutchins, & Lee, 1997), the reverse may also be true; that is, classroom experiences may influence beliefs. There is evidence that supervised experience in the use of DI increases positive attitudes toward using DI (Gersten, Carnine, Zoref, & Cronin, 1986; Gersten & Guskey, 1985; Proctor, 1989). This would suggest that worthwhile change can best be accomplished in teacher education programs by incorporating supervised experiences with Direct Instruction programs.

*Even when teachers have been involved in successful school-wide implementations of DI, they may revert to less rigorous, traditional methodology in the absence of strong leadership.*

"One-shot" training that consists of attending a workshop or course may increase the awareness

level of participants but seldom results in the application of the newly learned skills (Axelrod, Moyer, & Berry, 1990). To the extent that participants do apply new skills on their own, the application seldom lasts longer than three weeks (Fox, 1989). Even when teachers received coaching following a 4-day training on DI materials and were observed in the classroom by trained coaches, almost half demonstrated weaknesses in important behaviors such as giving appropriate reinforcement, firming, and signaling (Smith & McKinney, 1997). In order to move beyond simple awareness of a new teaching method to effective implementation teachers may need to observe achievement gains among their students.

*Even when teachers received coaching following a 4-day training on DI materials and were observed in the classroom by trained coaches, almost half demonstrated weaknesses in important behaviors such as giving appropriate reinforcement, firming, and signaling*

Following a school-wide implementation of Direct Instruction in kindergarten and first grade, teachers were initially hostile to Direct Instruction. However, after a year during which they received coaching and saw student gains in both academics and self concept, most experienced a dramatic change in attitude (Gersten & Guskey, 1985). Guskey (1984) suggested that teachers are likely to change their beliefs only after they gain tangible evidence that an innovative method works. Providing the evidence that can lead to new beliefs is problematic because it requires time and dedication to unfamiliar methods to achieve the results that are the impetus for change. If teachers and their students do not experience immediate success, they may never change their beliefs.

Teacher education programs that promote Direct Instruction face unique challenges. They are more like one-shot inservice training sessions than school-wide implementations. The collegiality, on-going coaching and feedback, and student success that is part of a school-wide implementation is hard to replicate in a university setting, especially when the local school district is hostile to DI. Professors enlighten and prepare preservice teachers to use research-based methods such as DI; however, the teachers quickly backslide once they get into their own classrooms. This phenomena has also been observed by behaviorists who have tried to train and maintain the skills of teachers (Hopkins, 1987). The problem is exacerbated in special education because individual teachers are often isolated from others who share their methods and beliefs. Since DI is seldom used in general education, special education teachers may acquiesce and adopt more conventional curricula.

Many teacher education programs use clinics to give students meaningful experience with Direct Instruction programs. The Department of Special Education at the University of Wisconsin-Eau Claire has long advocated DI in the certification program for learning disabilities. Graduate students take one course in which the text is *Direct Instruction Reading* (Carnine, Silbert, & Kameenui, 1997) and an advanced methods course that includes some study of curriculum design. Graduate students, primarily teachers who are already employed to teach students with learning disabilities on an emergency teaching license, are also required to participate in the summer Learning Enhancement and Progress (LEAP) clinic where they learn to use Direct Instruction programs in a supervised setting. The LEAP clinic is a summer extension of the teacher preparation program. The clinic is available to all school-age children, but most are children from the first through third grades who are having difficulty with reading, written expression, or math. The LEAP clinic operates during the regular 8-week university summer session. The first week is a training session for the teachers, and the last week is reserved for teachers to write their final reports, which are then mailed to parents. School-age children attend and receive instruction during the middle 6 weeks by attending Monday through Thursday for 2 hours each morning. Parents have expressed their satisfaction with the clinic (Conderman, Snider, & Crawford, 1997) and pre and post test data indicate that children make measurable gains in reading, spelling, and mathematics. Despite these positive effects, we were unsure that the 6-week clinic produced significant and lasting change in the way teachers did business in their own classrooms.

The purpose of this study was to determine what, if any, long-term impact the supervised clinic had on teaching practices of the teacher participants. We wanted to find out teachers' perceptions of the clinic experience, whether they still used DI, and what factors influenced whether or not they used DI in their own classrooms.

## Method

### Participants

Participants in the study included all 117 teachers who had participated in the summer LEAP (Learning Enhancement and Progression) clinic from 1988-1998. Participants included primarily teachers who went through the graduate program, however some undergraduate students who had chosen to participate in the summer clinic for their pre-student teaching experience were also involved.

### Survey and Procedures

A survey requesting demographic information, perceptions of the clinic, views on Direct Instruction, and one's philosophy of education was developed by the authors. Five yes/no items and five likert-type items assessed respondents' views about Direct Instruction. These five items were constructed so that a "strongly agrees" indicated a positive attitude toward Direct Instruction. Ten likert-type items probed teachers' philosophy or beliefs about teaching. These items were constructed so that disagreement was compatible with a DI philosophy. Teachers were given space to make open-ended comments about why they did or did not use Direct Instruction programs. The survey was piloted on several teachers who had been in the clinic prior to 1988. The survey was three pages long and contained a total of 30 items.

The survey was mailed to all participants. A graduate student researcher (first author) sent a cover letter that accompanied the survey and also collected the surveys. The cover letter described the purpose of the study, stated that participation was voluntary, and told participants who to contact if they had questions or concerns. The surveys were numbered so that the graduate student researcher could track grade point averages of respondents upon their return. Only the graduate student researcher could identify the respondents. They remained anonymous to faculty. A follow up postcard was mailed two weeks after the survey reminding participants to mail in their survey.

## Results

### Return Rate

Sixty-one of the 117 (52%) surveys were returned completed. Three surveys were returned citing incorrect address.

### Ratings of Helpfulness for LEAP Clinic Activities

All the respondents indicated that their experience in the LEAP clinic had been positive. Teachers were asked to rate a variety of activities in terms of how helpful they were in improving their teaching skills. They indicated that modeling and individual feedback were the most helpful aspects of the clinic. Table 1 displays the mean responses on a scale of 1 to 5 with 1 being a "waste of time" and 5 being "excellent." Eighty-seven percent of the respondents indicated that learning to use DI programs had been very helpful to their career. It was considered to be more helpful than learning how to teach math facts, social skills, design math units, or study skills instruction; although all areas were rated as useful to their future career by over 50% of teachers.

Sixty-four percent of the respondents answered "yes" to the question, "Do you use Direct Instruction programs in your program now?" The remainder of the data analysis sought to determine what differences existed between those teachers who indicated that they currently used DI programs and those who did not.

### Demographics

Table 2 compares the demographic characteristics of DI teachers versus non-DI teachers. There were no differences between undergraduate versus graduate students, years of experience the teachers had at the time they participated in the clinic, or years of experience at the time they answered the survey. Teachers also indicated what grade level they taught. Proportionately more DI teachers (60%)

**Table 1. Ratings of Helpfulness for LEAP Clinic Activities**

| | *M* | *SD* |
|---|---|---|
| Pre-clinic videotapes (behavior management) | 3.7 | .9 |
| Pre-clinic videotapes (DI presentation techniques) | 3.9 | .8 |
| Pre-clinic practice sessions | 3.9 | .8 |
| Pre-clinic training on assessment and placement procedures | 4.2 | .7 |
| Feedback from supervisors | 4.4 | .7 |
| Modeling by supervisors | 4.4 | .7 |
| Learning how to monitor progress | 4.3 | .6 |
| LEAP clinic manual | 3.8 | .5 |
| Working in teams | 4.0 | .8 |
| Practicing the scripts | 4.0 | .7 |

*Note.* Rating scale: 1 = waste of time, 2 = not helpful, 3 = so-so, 4 = helpful, 5 = excellent

Table 2. Demographic Data for DI versus Non-DI Teachers

| | DI Teachers | | Non-DI Teacher | | |
|---|---|---|---|---|---|
| | *n* | % | *n* | % | $x^2$ |
| Undergraduate | 10 | 25.6 | 5 | 22.7 | |
| Graduate | 29 | 74.3 | 10 | 25.6 | .06 |
| Years of experience then | | | | | |
| None | 13 | 33.3 | 8 | 36.4 | 2.5 |
| 1-2 years | 2 | 5.1 | 3 | 13.7 | |
| 3-5 years | 11 | 28.2 | 7 | 31.8 | |
| 5-10 years | 6 | 15.4 | 2 | 9.1 | |
| > 10 years | 7 | 17.9 | 2 | 9.1 | |
| Years of experience now | | | | | |
| 1-2 years | 6 | 15.8 | 3 | 13.7 | 3.5 |
| 3-5 years | 5 | 13.2 | 7 | 31.8 | |
| 5-10 years | 10 | 26.3 | 3 | 13.6 | |
| > 10 years | 17 | 44.7 | 9 | 40.9 | |
| Currently teach | | | | | |
| elementary SPED | 23 | 60.0 | 4 | 18.1 | 13.4** |
| middle/secondary SPED | 13 | 33.3 | 9 | 41 | |
| other | 3 | 7.7 | 9 | 41 | |
| Pull-out instruction | | | | | |
| none | 2 | 5.6 | 4 | 22.2 | 6.9 |
| < 2 hours/day | 4 | 11.1 | 5 | 27.8 | |
| about 1/2 of the day | 11 | 30.5 | 4 | 22.0 | |
| > 1/2 of the day | 19 | 52.8 | 5 | 27.8 | |

*p < .001*

than non-DI teachers (18%), (2 (2) = 13.4, p. < .001, taught special education, especially learning disabilities, at the elementary level. Teachers were also asked to indicate how much "pull-out" instruction they conducted. Although visual inspection of the data suggests that teachers who use DI were engaged in more "pull-out" instruction, the chi-square analysis was not statistically significant.

Grade point averages for teachers who returned the surveys were accessed from their records. There were no statistically significant differences in grade point average (gpa) between DI teachers (x = 3.4) and non-DI teachers (x = 3.5). This data may not be valid, however, because in cases where the undergraduate gpa was unavailable, the graduate gpa had to be used.

### Views on Direct Instruction

Five yes/no questions assessed the availability of materials, administrative and collegial support, and prior experience with DI programs. Table 3 illustrates the number and percent of teachers who responded positively to each item. Twice as many teachers who used DI indicated that other people in their building or district also used DI. Proportionately more DI teachers (45%) than non-DI teachers (8.3%), (2 (2) = 13.48, p. < .001, had administrative support for using DI. Although more DI teachers than non-DI teachers had used the programs before they participated in the clinic, 68% of the respondents indicated that they had no experience with DI prior to the clinic.

Table 3. Percentage of DI versus Non-DI Teachers Who Responded Positively

| | DI Teachers | | Non-DI Teacher | | |
|---|---|---|---|---|---|
| | *n* | % | *n* | % | $x^2$ |
| Is there anyone else in your building/district who uses Direct Instruction? | 34 | 55.7 | 15 | 24.6 | 4.03 |
| Do you have access to Direct Instruction curriculum materials? | 37 | 60.6 | 13 | 21.3 | 12.2** |
| Does your principal or administrator support the use of Direct Instruction? | 27 | 45.0 | 5 | 8.3 | 13.5** |
| Did you use the programs before you participated in the clinic? | 15 | 25.0 | 4 | 6.6 | 2.91 |

** *p < .001*

Table 4. Agreement with Statements About DI by DI versus Non-DI Teachers

| | DI Teachers | | Non-DI Teacher | | |
|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *t* |
| DI programs are very effective. | 4.7 | .5 | 4.09 | .9 | 3.4* |
| Students like DI programs. | 4.0 | .8 | 3.0 | 1.0 | 4.2** |
| It requires a lot of practice and support to do DI well. | 3.9 | 1.0 | 4.1 | .9 | -1.2 |
| I like DI programs. | 4.5 | .6 | 3.7 | .9 | 4.3** |
| The LEAP clinic prepared me to use DI programs. | 4.5 | .8 | 4.1 | .7 | 1.7 |

* $p < .01$
** $p < .001$

The mean and standard deviations of respondents' answers on five likert-type items assessing their attitudes toward DI is presented in Table 4. Circling "5" indicated agreement with the statement and circling "1" indicated disagreement. A t-test for independent samples was performed to determine if there were differences between groups on the likert-type items. There were statistically significant differences between groups on three items. More DI teachers than non-DI teachers thought that DI programs were very effective ($p < .01$), that students liked DI programs ($p < .001$), and that they liked the programs ($p < .001$). Despite these predictable differences between groups, the means on the likert items for non-DI teachers consistently ranged between 3.0 and 4.0 indicating that their feelings about DI were neutral to positive.

### Philosophy of Education

Table 5 gives the means and standard deviations on 10 items that were designed to assess teachers' underlying beliefs about the education of students. There were few statistically significant differences in their views as shown in Table 5. Only their beliefs about the value of inclusion differentiated DI teachers from non-DI teachers ($p < .05$).

Table 5. Agreement with Statements about Philosophy of Education by DI versus Non-DI Teachers

| | DI Teachers | | Non-DI Teacher | | |
|---|---|---|---|---|---|
| I believe... | *M* | *SD* | *M* | *SD* | *t* |
| ...that teachers should be facilitators of learning. | 4.4 | .83 | 4.4 | .80 | .05 |
| ...that home environment influences student learning more than the teacher. | 3.2 | .96 | 3.2 | .87 | .16 |
| ...that students with disabilities should be fully included in general education. | 2.2 | .87 | 2.7 | .99 | -2.03* |
| ...one curriculum is pretty much like another. | 1.5 | .51 | 1.6 | .50 | -1.11 |
| ...teachers should not be held accountable if students don't learn. | 2.5 | 1.07 | 2.5 | .86 | -.47 |
| ...some students with learning disabililties cannot learn to read. | 2.2 | 1.01 | 2.3 | .77 | .75 |
| ... the primary responsibility of a teacher is to be nurturing. | 2.5 | .76 | 2.3 | .77 | -1.00 |
| ... there is no one right way to teach. | 3.8 | 1.08 | 4.1 | 1.0 | -.93 |
| ... that innovative approaches are better than traditional methods. | 2.6 | .89 | 2.8 | .80 | -.93 |
| ... teaching is an art, not a science. | 3.1 | .84 | 3.1 | .89 | -.02 |

* $p < .05$

## Discussion

The data from this survey provide some encouraging news. First, it is indeed positive to know that 64% of the teachers who participated in the summer clinic continue to use DI many years later. It is also encouraging to find out that even those who do not use DI have a fairly benign attitude toward it. All felt that the clinic was a positive experience and they appreciated many aspects of it including the modeling and feedback given by supervisors. The fact that so many teachers found the intense supervision helpful is somewhat surprising since that aspect of the clinic experience created a great deal of apprehension. Apparently time fades those memories and the long-term benefits outweigh the short-term anxiety. Although there were statistically significant differences between DI and non-DI teachers in their attitudes toward DI with the DI teachers being extremely favorable, the non-DI teachers were neutral at worst and positive overall. This is consistent with other evidence that suggests that supervised experience in the use of DI increases positive attitudes toward DI (Gersten et. al., 1986; Gersten & Guskey, 1985; Proctor, 1989).

*The strong administrative support among DI teachers may well be the result of their effective use of the programs. Some principals and administrators develop a positive attitude after they observe students' successes.*

It is also encouraging to have further evidence that teacher education programs can make significant and lasting change in teaching practice. Of the 39 teachers who said that they currently use DI, 24 (61.5%) had never used the programs before they participated in the clinic. This suggests that a supervised, clinical experience can be an effective tool for change.

The differences between DI and non-DI teachers were predictable. It is not surprising that more elementary special education teachers use DI than middle or secondary teachers. These results are consistent with the general misconception that DI is only for elementary students and works better at this level. It is discouraging that this myth persists in light of the continuing academic deficits that many adolescents experience, especially adolescents with learning disabilities (Kavale, 1988). In addition to the myth that DI is not appropriate for secondary students, organizational factors also cause DI to be used less frequently in secondary classrooms. As more and more emphasis is put on assisting students in mainstream classes, less time is devoted to remediating academic skills.

It is also not surprising that teachers who use DI have greater access to the materials. This is more likely a result of their using DI than their reason to begin using it. What is surprising is that 40% of the teachers who used DI indicated that they do not have access to the materials. Perhaps teachers meant that they did not have access to all the materials they would like to have. The alternative explanation is that almost half of the DI teachers must borrow the materials.

DI teachers were much more likely than non-DI teachers to indicate that their principal or administrator supported the use of DI ($p < .001$). However, this is a hard item to interpret. Forty percent of the respondents, 10 DI teachers (26%) and 14 (64%) non-DI teachers, indicated that they didn't know what their principal or administrator thought about DI. Apparently, many teachers, especially non-DI teachers, have never initiated a conversation about curricula. It is hard to know to what extent an administrator's attitudes are a cause or a result of using DI programs in special education. The strong administrative support among DI teachers may well be the result of their effective use of the programs. Some principals and administrators develop a positive attitude after they observe students' successes.

The likert-items that assessed philosophical beliefs did not differentiate between DI and non-DI teachers. The questions were designed so that disagreement with the statements was consistent with the philosophical underpinnings of Direct Instruction. Only one item reached statistical significance. DI teachers were more likely to disagree with the statement, "I believe that students with disabilities should be fully included in general education." However, both means were between 2 and 3 indicating some ambivalence. This is consistent with the demographic data that revealed over 80% of DI teachers were engaged in pull-out instruction for half the day or more. Only about 50% of the non-DI teachers did that much pull-out. It is important to emphasize that DI is not inherently incompatible with inclusion. In fact, school-wide implementations of DI facilitate inclusion. However, none of the respondents worked in a school where the general education curricula were Direct Instruction programs. In the area of Wisconsin where most of the respondents live and work, districts that promote

full inclusion usually require special education teachers to use the general education curricula. This sets up a false dichotomy between DI and inclusion. Therefore, it is not surprising that DI teachers felt more negative about inclusion and engaged in more pull-out instruction. It is interesting to note, however, that both DI and non-DI teachers were aware of the importance of curricula since both groups disagreed with the statement, "I believe one curriculum is pretty much like another."

There are two explanations for the fact that there were few differences between the DI and non-DI teachers in the philosophy of education. The first possibility is that the items were not sufficiently sensitive to actually assess beliefs. Philosophies tend to be elusive and it is extremely difficult to design items that will accurately assess underlying belief systems. Comments on the surveys indicated that respondents thought several items were vague or misleading. Words like "facilitator," "nurturing," "innovative" are loaded with constructivist innuendo, but many teachers who are not constructivist take them at face value as desirable qualities. A second possibility is that teachers' behavior is not driven by a philosophy. Many teachers are unable to articulate a philosophy of education and when pressed, say they are eclectic. For many, "eclectic" is just another way of saying that they don't have a philosophy.

The generalizability of this study is limited by three factors. First, although 52% is a reasonably good return rate, 53 people did not return the survey. It is possible that the teachers who returned the survey were not representative of the entire population. Second, this study did not consider the quality of feedback and coaching by the clinic supervisors. Monitoring student outcomes such as accuracy, number of responses per minute, errors, and on-task behavior has been shown to be a useful tool for supervisors (Gleason, 1997). Student outcomes were not systematically measured in the clinic during all summers. The coaching/supervision model used in the summer clinic involved after-class instructive feedback, however evidence indicates that in-class feedback results in more rapid acquisition of DI presentation techniques (Coulter & Grossen, 1997). It is possible that a more effective coaching/supervision model would result greater changes in teaching practices. A third limitation is that the questions designed to assess teachers' philosophy were not well-worded. Future research of this type must include extensive pilot testing to assure that likert items are sufficiently sensitive to assess differences in philosophy.

Future research should be directed at improving the effectiveness teacher education programs given the time and personnel limitations of universities and colleges. Establishing effective teaching practices among future teachers is a promising avenue to significant school reform. This might include additional research on the effectiveness of different coaching/supervision models. Future research might also evaluate the benefits of follow-up communication such as electronic discussion groups to encourage alumni of the summer clinic to share and reflect. Continued research into the factors that guide teachers' classroom behaviors, such as philosophy and fads; or pragmatic considerations like the availability of materials or administrative support may also help us understand how to promote effective school practices.

In summary, this survey provided a "good news, bad news" scenario. The good news is that it is possible to change teachers' behavior. This study is consistent with the notion that successful experiences with specific instructional practices like DI guide beliefs and attitudes rather than vice versa. Teachers' beliefs, even teachers who did not use DI programs after the clinic, changed as a result of their experiences. For 64%, their teaching methods also changed. The bad news is that providing a supervised, clinical experience with DI is not enough to change all teachers' behavior even if it changes some of their attitudes. Although they apparently experienced some success with DI as indicated by their overall satisfaction, it was not sufficient to change their teaching methods. In fact, 68% of the non-DI teachers said they agreed or strongly agreed with the statement, "DI programs are very effective." The challenge before teacher educators is to prepare prospective teachers so that research and a commitment to what works guide their teaching practices. ◆

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*Author Note: The research for this paper was completed as part of an independent study in the first author's master's program in learning disabilities at the University of Wisconsin—Eau Claire. This research was funded by a University of Wisconsin—Eau Claire Small Research Projects Grant.*

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# A Comparison of Assessment Results Between the *Reading Mastery* Program and the *Qualitative Reading Inventory-II*

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*Abstract: Records of 46 first-grade students were analyzed to compare the data provided by assessments within the* Reading Mastery *program and the Qualitative Reading Inventory-II (QRI-II), an informal reading inventory. Students were enrolled in a large, rural school district. The final administrations of the* Reading Mastery *speed and accuracy checks and the QRI-II were compared by ending reading levels, rate (words per minute), and accuracy (total errors). The results showed a statistically significant correlation between* Reading Mastery *and QRI-II ending reading levels and words per minute. These findings are important because they encourage cross-curricular communication and allow teachers to make more informed placement decisions and better predict students' reading capabilities.*

*Reading Mastery* is a Direct Instruction basal reading program intended for elementary-aged students (Osborn, 1988). The principles underlying the program include the belief that all students are capable of learning to read and that they are taught best when instruction is direct and specific, and when practice and assessment are constant and continuous (*Reading Mastery Overview Guide*, 1996). The program includes *Reading Mastery I-VI* and *Fast Cycle*, an accelerated program combining *Reading Mastery I* and *II*. Each level maintains a unique instructional focus, building upon one another to develop and sharpen reading ability as students progress through the program. *Reading Mastery* is an empirically validated program that includes explicit instruction in decoding, phonemic awareness, sound blending, and deductive reasoning with the use of analogies, big ideas, and vocabulary concepts (*Reading Mastery Overview Guide*).

Numerous investigations have established the effectiveness of the *Reading Mastery* program in helping students learn to read (see Carnine, Silbert, & Kameenui, 1997; *Reading Mastery Overview Guide*, 1996). Such investigations have included those from Project Follow Through, the largest study to date comparing instructional methods for improving academic performance, conducted over 20 years ago (Adams & Engelmann, 1996), to the Accelerated Student Achievement Project (ASAP), a 5-year evaluation focusing on early reading achievement in three Utah school districts (Slocum, 1999).

*While the practice of using standardized measures is traditional in large group research projects, such measures are less useful for classroom practice.*

These studies typically have relied on standardized measures to determine student performance levels. For example, Project Follow Through exclusively used standardized measures as the sole indication of student progress. These measures included the Metropolitan Achievement Test (MAT) and Wide Range Achievement Test (WRAT) for assessing academic performance, Raven's Colored Progressive Matrices for assessing comprehension and problem solving, and the Intellectual Achievement Responsibility Scale and the Coopersmith Self-Esteem Inventory for assessing affective achievement (Becker &

Engelmann, 1978). The ASAP project involved the use of the Woodcock Reading Mastery Test-Revised, the Test of Phonological Awareness, and the Stanford Achievement Test (Slocum, 1999). Other investigations have used similar measures including the Iowa Test of Basic Skills (e.g., Snider, 1990), the Slosson Intelligence Test (e.g., Lloyd, Cullinan, Heins, & Epstein, 1980), the Woodcock Reading Mastery Test (e.g., Kuder, 1991), and the California Achievement Tests (e.g., O'Connor, Jenkins, Cole, & Mills, 1993).

While the practice of using standardized measures is traditional in large group research projects, such measures are less useful for classroom practice. Calfee and Hiebert (1984) discuss the necessity of relying equally on what they describe as the "two tiers of assessment." The first tier refers to external, standardized measures that influence policy, inform public agenda, and serve as a general indicator of student performance as a group. The second tier is considered the more overlooked of the two. This tier includes the internal, informal measures that inform placement decisions and measure student progress on the individual level. Calfee and Hiebert argue for a more balanced use of both types of assessment in the classroom.

Current classroom practice suggests that teachers agree with this view. Placement decisions and measures of daily skill acquisition are commonly based on internal measures such as informal reading inventories (IRIs). In a survey of 125 teachers, Masztal and Smith (1984) found that 54% used IRIs in the classroom. McCabe and Margolis (1988) found similar results. Their survey of teachers showed that 58% preferred IRIs to standardized measures for placement decisions

An IRI typically consists of a series of short passages graded by readability level (McLoughlin & Lewis, 1994). The examiner assesses oral reading fluency and miscues as well as responses to comprehension questions to measure a student's level of comfort in reading the passage. Based on these figures, the examiner then determines whether the student is reading at an independent, instructional, or frustration level. A student's independent level is the reading level at which materials can be read easily with a high degree of comprehension and few decoding errors. A student reading at the independent level can do so without instruction or assistance from the teacher. At the instructional level, reading is more difficult for the student, errors are more common, and assistance is needed from the teacher. A student at the frustration level is reading material that is too difficult. At this level, decoding errors are too frequent and comprehension is too limited for instruction to occur.

During an IRI, a student reads through passages of increasing difficulty until he or she reaches the frustration level. While such levels can be defined by qualitative features such as those described above, they are also determined quantitatively with accuracy formulas. Kirk, Kliebhan, and Lerner (1978) (as cited in McLoughlin & Lewis, 1994) describe the usual accuracy as: independent level—98% to 100% word recognition accuracy and 90% to 100% accuracy in comprehension; instructional level—95% word recognition accuracy and 75% accuracy in comprehension; and frustration level—90% or less word recognition accuracy and 50% or less accuracy in comprehension. While individual IRIs vary widely, they typically share several key features. A student reads without previously practicing the material and his or her reading level is determined by total miscues. Comprehension questions and oral retelling of the story measure a student's comprehension of the passage.

One specific type of IRI is the Qualitative Reading Inventory-II (QRI-II) (Leslie & Caldwell, 1995). Like other IRIs, the QRI-II contains graded passages accompanied by questions that can be used to assess comprehension. In response to recent reading research, the QRI-II has also included many additional features that set it apart from other IRIs (Leslie & Caldwell). For example, each graded level includes both narrative (stories) and expository (factual and informational) reading passages and passages with and without pictures. These features allow the assessor to judge a student's reliance on visual cues and his or her level of comfort and familiarity with different types of reading structures. The QRI-II also provides questions to assess a student's prior knowledge of the content of the passage to determine if comprehension is due to familiarity or true reading skill. The comprehension questions of the QRI-II include questions calling for implicit (answers which must be inferred from the text) or explicit (answers which are stated directly in the text) understanding. A final distinguishing feature of the QRI-II is the distinction made between meaning changing (any errors which change or distort the meaning of the passage) or non-meaning changing (no distortion in the meaning of the passage) errors. These errors are then used to provide total accuracy (all errors) and total acceptability (only meaning changing errors) indexes.

The usefulness of the QRI-II in informing diagnostic and placement decisions is apparent in its many distinguishing features. Despite the measure's pilot research (Leslie & Caldwell, 1995; Leslie &

Cooper, 1993), no research has been done examining how closely the measure compares to reading curricula. In particular, no research has been conducted to determine if student placement on the QRI-II is comparable with placement in the *Reading Mastery* program. Teachers value and respect the placement decisions and diagnostic value of IRIs. Therefore, it seems important to study whether the assessment results of the QRI-II and the *Reading Mastery* program are similar in order to establish efficient and accurate assessment methods for district, school, parent, and student information services and decisions.

## Method

### Participants

*Students.* Records of 46 first-grade students were analyzed. All students were enrolled in a Title I elementary school within a large, rural school district within the Pacific Northwest. The elementary school had a total enrollment of 525 students. Approximately 33% of the students received free or reduced lunches. The students were from two different first-grade classrooms; class A included 22 students and class B had 24 students. These classes were chosen on the basis of record availability. Of the 46 students, 20 were female and 26 were male.

*Teachers.* The teacher of class A had been teaching for 27 years and had been using *Reading Mastery* for the last 10 years. The teacher of class B had been teaching for 11 years and had been using *Reading Mastery* for the last 9 years. Both teachers had been using the QRI-II for the past 2 years. Both teachers used parent volunteers and instructional assistants in administering the speed and accuracy checks and the QRI-II. In both cases, all assistants were trained by the classroom teachers and were observed in practice administrations of both instruments.

### Measures

All assessments were taken periodically throughout the school year based on the requirements for each instrument. For the purposes of this study, only the final assessments were used for analysis to maintain the closest time proximity between the two assessments. All final assessments were taken from early May to early June and were at most 1 month apart.

*Reading Mastery.* *Reading Mastery* data were collected using the speed and accuracy checks provided by the *Reading Mastery* series. These checks consist of *Reading Mastery* stories that are read by a student as a teacher records the total reading time and the number of errors made by the student. *Reading Mastery* data were collected at the prescribed intervals dictated by the *Reading Mastery* program (every 5 lessons in *Reading Mastery I* and *II*). This occurred approximately 5-7 times for each student; again, only the final administration was used for analysis.

Data were collected on the ending reading levels within the *Reading Mastery* program. *Reading Mastery* ending reading level refers to the highest basal level (*Reading Mastery I, II, III* or *Fast Cycle*) in which the student was reading at the time of the final speed and accuracy check. In addition, reading rate (words per minute) was assessed. The number of words read per minute was calculated by multiplying the number of words in the passage by 60 and then dividing this number by the number of seconds it took the student to read the passage. Finally, reading accuracy was assessed. Reading accuracy refers to the percentage of words in the passage that the student read correctly. Reading accuracy was calculated by subtracting the total number of errors from the total number of words in the passage, producing the total number of correct words. This number was then divided by the total number of words in the passage to produce the percentage of words read accurately. Substitutions (any word or nonsense word that was substituted for an actual word in the text), omissions (any complete word omitted by the reader), insertions (any word or string of words that did not occur in the text but were inserted by the reader), self-corrections (any word that was mispronounced but was spontaneously corrected by the reader), and reversals (any words or phrases which were transposed) were recorded as errors. The *Reading Mastery* program does not include any measures of comprehension; thus, no data on comprehension accuracy were taken for this assessment.

*QRI-II.* The QRI-II data were collected using the grade level narrative and expository passages provided by the QRI-II. QRI-II data were collected approximately three times over the course of the year, once in the fall, spring, and end of the school year. These intervals corresponded to fall and spring parent conferences and end-of-the-year progress reports. Again, only the final administration of the QRI-II was used for analysis. Students were assessed individually by reading a story aloud while the teacher timed them and made a written record of all errors. On the QRI-II, students were tested at each grade level until they reached an instructional or frustration level. Typically, students were only asked to read either the narrative or expository passage for the level. Depending on the available

amount of assessment time, students were given both types of passages when possible.

Data were collected on the ending reading levels on the QRI-II. Ending reading level refers to the highest-grade level (pre-primer, primer, first, second, third, fourth, fifth, sixth, or junior high) at which the student was reading at an independent or instructional level at the time of the final assessment. Performances at the frustration level were not used because they did not represent mastery of the material. Within the highest QRI-II level, both narrative and expository passages were analyzed whenever possible; however, for some students, only one or the other was available. Reading rate (words per minute) on the QRI-II was also measured and was calculated in the same manner as *Reading Mastery* reading rate. Finally, reading accuracy was assessed. The QRI-II provides two indices of accuracy—Total Accuracy (includes meaning changing and non-meaning changing errors) and Total Acceptability (includes only meaning changing errors). Total accuracy includes substitutions, omissions, insertions, reversals and self-corrections as errors, while total acceptability does not count reversals and self-corrections as errors because they are not thought to change the meaning of the passage. For the purposes of this study, only total accuracy was analyzed. Total accuracy was calculated by subtracting the number of errors (both meaning changing and non-meaning changing) from the total number of words in the passage to produce the total number of words read correctly. This number was then divided by the total number of words in the passage to produce the percentage of words read accurately. The standardized procedures for administering the QRI-II include self-corrections among the errors used in the total accuracy calculation. Unfortunately, self-corrections were not recorded when the data were gathered for this study, and consequently could not be included in the Total Accuracy calculation. Comprehension accuracy was measured as the percentage of comprehension questions answered correctly by the student, the QRI-II provides all comprehension questions and their answers. The number of correct responses to questions was divided by the total number of responses to questions for the percentage of correct responses (for comprehension).

***Data analysis.*** A correlation model was used to analyze the data since the primary question for this study was assessing the relationship between student's performance on the *Reading Mastery* speed and accuracy checks and performance on the QRI-II. *Reading Mastery* ending reading levels were compared to the QRI-II ending reading levels for each student to assess the overall alignment between the two instruments. Each basal or grade level was assigned a rank order: RMI = 1, RMII = 2, Fast Cycle = 3, QRI-II primer = 1, QRI-II first = 2, QRI-II second = 3, QRI-II third = 4, QRI-II fourth = 5, QRI-II fifth = 6, QRI-II sixth = 7, and QRI-II junior high = 8. For this comparison, a Spearman's rho correlation was used because there were only two variables (RM and QRI-II ending reading levels) with data (grade or basal level) of an ordinal nature (Martella, Nelson, & Marchand-Martella, 1999). The alpha level was set at .05.

Words per minute (rate) on *Reading Mastery* were compared to words per minute on the narrative and expository passages (depending on availability) of the QRI-II using Pearson's product-moment correlations. Total accuracy on *Reading Mastery* and on narrative and expository QRI-II passages were also compared using Pearson's product-moment correlations. The alpha level was set at .05. Total accuracy on narrative and expository passages of the QRI-II were compared to accuracy on the associated comprehension questions using Pearson's product-moment correlations. These variables were compared to assess whether accuracy is correlated with comprehension, and to assess whether that relationship, if present, is different for narrative and expository selections.

## Results

Descriptive statistics were calculated for *Reading Mastery* and QRI-II ending reading levels, words per minute, and total accuracy percentages. *Reading Mastery* had a mean end level of 3.20 ($n$ = 46, $SD$ = .96); the QRI-II had a mean end level of 3.65 ($n$ = 46, $SD$ = 1.68). *Reading Mastery* had a mean words per minute and accuracy of 106.74 ($n$ = 46, $SD$ = 27.86) and 98.93% ($n$ = 46, $SD$ = 9.97%), respectively. The QRI-II narrative and expository passages had a mean words per minute of 63.15 ($n$ = .20, $SD$ = 23.04) and 61.92 ($n$ = 37, $SD$ = 20.81), respectively. The QRI-II narrative and expository passages each had a mean reading accuracy of 97.40% ($n$ = 20, $SD$ = 1.88%) and 97.54% ($n$ = 37, $SD$ = 1.74%), respectively. The QRI-II narrative comprehension questions had a mean of 93.85% accuracy ($n$ = 20, $SD$ = 8.53%), and the expository comprehension questions had a mean of 71.54% accuracy ($n$ = 37, $SD$ = 0.21%).

Spearman's rho correlations showing the correlations between *Reading Mastery* and QRI-II ending reading levels are presented in Table 1. For the full sample, a statistically significant positive correlation was found between students' end level in *Read-*

**Table 1. Correlations between Reading Mastery and QRI-II ending reading levels**

| | | |
|---|---|---|
| Class A ($n$ = 24) | Correlation Coefficient<br>Significance | .48<br>p < .02 |
| Class B ($n$ = 22) | Correlation Coefficient<br>Significance | .76<br>p < .00 |
| All students ($n$ = 46) | Correlation Coefficient<br>Significance | .62<br>p < .00 |

*ing Mastery* and the QRI-II ($r$ = .62). Statistically significant correlations were evident when both classes were analyzed individually (class A, $r$ = .48; class B, $r$ = .76).

Pearson product-moment correlations showing the correlation between students' performance (as measured by words per min) in *Reading Mastery* and the QRI-II are presented in Table 2. For this analysis, narrative and expository QRI-II passages were treated separately to examine the potentially unique correlations for each type of passage. A statistically significant correlation between students' rate in *Reading Mastery* and the QRI-II was found for the entire sample ($r$ = 72 for narrative, and $r$ = .58 for expository) and for class B on both narrative ($r$ = .95) and expository ($r$ = .63) selections. Class A demonstrated a statistically significant relationship between *Reading Mastery* rate and QRI-II rate on expository passages only ($r$ = .53); however, a relationship was evident on narrative passages ($r$ = .57) although it did not reach statistical significance.

**Table 2. Correlations between Reading Mastery rate (words per minute) and QRI-II rate (words per minute) for narrative and expository passages**

| | | QRI-II narrative wpm | QRI-II expository wpm |
|---|---|---|---|
| RM wpm Class A $n$=24 | Pearson correlation<br>Significance | .57<br>p < .05<br>$n$ = 12 | .53<br>p < .02<br>$n$ = 20 |
| RM wpm Class B $n$ = 22 | Pearson correlation<br>Significance | .95<br>p < .00<br>$n$ = 8 | .63<br>p < .01<br>$n$ = 17 |
| RM wpm All students $N$ = 46 | Pearson correlation<br>Significance | .72<br>p < .00<br>$n$ = 20 | .58<br>p < .00<br>$n$ = 37 |

*Note.* The combined number of students in the narrative and expository conditions is not equal to the total number of the students in the class because some students were tested on both narrative and expository passages while other students received only narrative or expository test passages.

Pearson product-moment correlations showing the relationship between total accuracy on *Reading Mastery* and the QRI-II are presented in Table 3. For the entire sample, accuracy in *Reading Mastery* and on QRI-II narrative and expository passages was not significantly correlated ($r$ = .32) and ($r$ = .04), respectively. No statistically significant correlations were apparent when class A ($r$ = .01 for narrative, and $r$ = .17 for expository) and class B ($r$ = .34 for narrative, and $r$ = -.11 for expository) were analyzed separately.

**Table 3. Correlations between *Reading Mastery* accuracy and QRI-II accuracies for narrative and expository passages**

| | | QRI-II narrative accuracy | QRI-II expository accuracy |
|---|---|---|---|
| RM accuracy Class A $n$=24 | Pearson correlation<br>Significance | .01<br>p < .97<br>$n$ = 12 | .17<br>p < .47<br>$n$ = 20 |
| RM accuracy Class B $n$ = 22 | Pearson correlation<br>Significance | .34<br>p < .42<br>$n$ = 8 | −.11<br>p < .68<br>$n$ = 17 |
| RM accuracy All students $N$ = 46 | Pearson correlation<br>Significance | .32<br>p < .17<br>$n$ = 20 | .04<br>p < .81<br>$n$ = 37 |

*Note.* The combined number of students in the narrative and expository conditions is not equal to the total number of the students in the class because some students were tested on both narrative and expository passages while other students received only narrative or expository test passages.

Pearson product-moment correlations showing the relationship between total accuracy on QRI-II narrative and expository reading passages and accuracy on the associated comprehension question (narrative and expository) are presented in Table 4. Narrative comprehension accuracy and narrative reading accuracy were not significantly correlated ($r$ = .21), and expository comprehension accuracy

Table 4. Correlations between QRI-II Reading Accuracy (narrative and expository) and Comprehension accuracy for Narrative and Expository passages

| | | QRI-II narrative accuracy | QRI-II expository accuracy |
|---|---|---|---|
| QRI-II comprehension accuracy-narrative $n$=20 | Pearson correlation<br>Significance | .21<br>p < .37<br>$n$ = 20 | .03<br>p < .92<br>$n$ = 11 |
| QRI-II comprehension accuracy-expository $n$ = 22 | Pearson correlation<br>Significance | −.21<br>p < .54<br>$n$ = 11 | −.08<br>p < .64<br>$n$ = 37 |

*Note.* The combined number of students in the narrative and expository reading conditions are not equal to total the number of the students in the comprehension conditions because some students were tested on both narrative and expository passages while other students received only narrative or expository test passages.

and expository reading accuracy were also not significantly correlated ($r$ = -.08). Narrative comprehension accuracy and expository reading accuracy were not significantly correlated ($r$ = .03), and expository comprehension accuracy and narrative reading accuracy were also not significantly correlated ($r$ = -.21)

## Discussion

The purpose of this study was to assess whether the speed and accuracy checks of the *Reading Mastery* program assessments are comparable with the rate (words per minute) and accuracy data provided by the QRI-II for first-grade students. This investigation is the first to compare the results of the *Reading Mastery* program assessments and informal reading inventories such as the QRI-II. Findings indicate ending reading levels and reading rates are correlated. These findings are significant because they improve the degree of cross-curricular and professional discussion. Evidence of the correlation between the assessments of the *Reading Mastery* program and the QRI-II allows professionals unfamiliar with either instrument to interpret results within a framework that is more meaningful. An understanding of the similarity between instruments also allows such professionals to discuss and generalize findings with greater accuracy.

These findings are also important in that they provide a way to validate and assess the *Reading Mastery* program independent of the assessments the program provides. The compatibility of the two assessments means that the QRI-II can be used to provide another measure of students' progress in the *Reading Mastery* program. Furthermore, such similarity provides a means of making *Reading Mastery* results meaningful to teachers, parents, and other professional who are not familiar with the *Reading Mastery* curriculum.

The findings indicate that the basal levels of *Reading Mastery* are similar to the grade levels provided by the QRI-II, (e.g., a student reading in *Reading Mastery I* is also reading at a first grade level on the QRI-II) greater assessment efficiency is possible. For example, with the knowledge that a student is reading in *Reading Mastery* II, QRI-II assessment can begin at grade 2, eliminating the need to put the student through testing at previous levels.

Results also showed that students read at similar rates on the *Reading Mastery* assessments and on the QRI-II. The correlation between rate in *Reading Mastery* and on narrative QRI-II passages is not surprising since *Reading Mastery* stories are typically narrative, especially in the early levels of the program. However, it is interesting to find a statistically significant correlation between rate in *Reading Mastery* and rate on expository QRI-II passages. This correlation may help teachers predict student performance across different types of reading materials. The findings suggest that despite the narrative nature of *Reading Mastery* passages, teachers can assume that students' will read at a similar rate on expository passages.

The absence of a statistically significant relationship between QRI-II reading accuracy and comprehension accuracy suggests that accurate reading does not mean accurate comprehension. Unfortunately, the relationship between comprehension and accuracy could not be measured for *Reading Mastery* because of the lack of any measure of comprehension.

Although several important findings were demonstrated in this investigation, three limitations and areas for future research are present. The first limi-

tation is that self-corrections were counted as errors in *Reading Mastery* while they were not counted as errors on the QRI-II due to teacher error. If self-corrections had been counted for both instruments, the students' total accuracy may have been more similar for both the QRI-II and *Reading Mastery*.

The second limitation relates to the age range of the participants. Further research needs to examine whether or not the correlations found in this study generalize to students beyond the first grade level. For example, it is important to assess whether the correlation between rate on *Reading Mastery* and QRI-II expository passages will remain stable as the reading passages become longer more complex.

The final limitation is the lack of experimental control during the data collection process. Because data were gathered initially without the intent for research (*Reading Mastery* assessments and the QRI-II were part of the normal classroom assessment process), measures of interrater agreement were not taken. Additionally whether standardized procedures were followed is unknown. Further studies need to be conducted with more experimental control in the data collection process. A reduction in the number of people who administer the QRI-II and *Reading Mastery* assessments may improve the ability to compare the two instruments. Monitored training and administration for each instrument would increase the likelihood that standardization was maintained.

This study as a whole is significant because it furthers the body of research comparing specific curricula and specific assessments. The *Reading Mastery* program has been validated with a number of standardized assessments, but has not been evaluated with an informal reading inventory. The popularity of IRIs attests to their utility in the classroom and the respect they have earned from teachers (McLoughlin & Lewis, 1994). This investigation has demonstrated the similarity between the data provided by the *Reading Mastery* program assessments and the QRI-II at the first-grade level, thus allowing teachers to use them in conjunction with one another in the classroom. This partnership between curricula such as the *Reading Mastery* and independent assessments such as the QRI-II allows more accurate student evaluation. As alignment improves between curricula and assessments, it becomes possible to better measure the effectiveness of curricula and the educational progress of students. ◆

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*Author Note:* The research was directed by the first author in partial fulfillment of a M.S. in School Psychology at Eastern Washington University.

# Direct Instruction and Gf-Gc Model of Cognitive Abilities: Implications for Improved Educational Outcomes

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*Abstract: This paper discusses how Direct Instruction (DI) can address individual differences as determined by psychoeducational assessment based on the Horn-Cattell Gf-Gc model of intelligence. Current educational assessment practices based on the Wechsler intelligence measures do not offer data that can be directly translated into developing intervention and remediation strategies. Further, these data are not particularly suitable for investigating the efficacy of DI for addressing individual differences in learners because empirical evidence supports the use of only the general measure (i.e., Full Scale IQ) rather than the specific abilities (i.e., subtests) in predicting achievement. Horn-Cattell Gf-Gc theory, however, is the most up-to-date, empirically validated theory of multiple intelligences that delineates specific cognitive abilities. Data from children's performance on these specific cognitive abilities, as operationally measured via the WJ-R assessment battery, could specify on which cognitive abilities DI has an effect. Research is needed to assess how DI modifies the status of students' cognitive abilities to promote better educational outcomes.*

Direct Instruction (DI) is a comprehensive model of educational instruction that combines effective teaching practices with specialized curriculum design, classroom organization and management, and careful monitoring of student progress (Stein, Carnine, & Dixon, 1998). Conceived at the University of Illinois in the mid-1960s and further developed at the University of Oregon, Direct Instruction, originally termed DISTAR (Direct Instruction System for Teaching Arithmetic and Reading), was designed to aid at-risk learners (Kozloff, LaNunziata, & Cowardin, 1999). Research on DI demonstrates the effectiveness of the approach in promoting student learning in reading and math, especially for students from lower socioeconomic backgrounds (Joyce & Weil, 1996). The best known and largest research study on the DI Model was Project Follow Through, a longitudinal investigation evaluating the impact of eight different instructional models on socioeconomically disadvantaged students in the primary grades (Mathes & Proctor, 1988; Weisberg, 1983). The results overall indicated that the high-risk students (i.e., scoring significantly below the national norms) taught in the DI model performed at, or above, the national median in language, math, and spelling (Mathes & Proctor, 1988). Research has also examined the effectiveness of the instructional design principles that form the basis of the DI model. These principles provide the basis for the strategies used to teach students a range of reading skills such as: drawing inferences from passages, learning vocabulary words, solving applied math problems, integrating reading and writing skills, beginning reading and decoding strategies, and improving comprehension of text.

The overall goal of the DI model is to teach generalizable strategies but in an explicit manner, scaffolding the instruction to meet the needs of individual students (Stein et al., 1998). In order to achieve this goal, empirically derived curriculum design principles are key. Stein and colleagues identified five main principles. First, "big ideas" are identified to organize content. These big ideas are analogous to concepts in a content area, which when identified and taught, yield the greatest amount of knowledge acquisition in that area to learn in the most efficient manner. Second, explicit, generalizable strategies are taught such as a series of steps students can follow to solve problems. These strategies should be applicable to a broad range of problems to enhance generalizability. Third, support is provided to students as they are learning new strategies. Both teachers and peers can assist in this area by providing coaching and feedback coupled with fading of assistance so that more responsibility for learning rests on the individual student. Fourth, skills and concepts are integrated by teaching students when to apply their knowledge, allowing them to examine

the relationships among various concepts. These relationships should highlight associations within a content area as well as span across different disciplines. Fifth, adequate review is provided in that it is sufficient, distributed, cumulative, and varied. Reviews enhance learning and promote generalization and transfer of knowledge to less structured contexts.

*We must consider how current use of intellectual assessment tools affects interpretation of individual differences, accurate diagnosis of learning differences, and effective design of remediation and instructional programs.*

Criticisms of DI exist and are argued from a variety of perspectives ranging from the philosophical to the practical. In regard to the former, DI is charged as being too structured, reductionistic, and programmed to allow for self-directed learning, insight into learning, and individual differences among learners (Mathes & Proctor, 1988). In terms of the practical, although research has demonstrated DI's impact in improving children's basic skills areas, it has been criticized for not improving the more complex, cognitive concepts and operations (Weisberg, 1983). Research findings, however, do not validate these criticisms. As part of the Follow Through study, nine models of instruction (including DI) were evaluated for their impact on basic skill acquisition and self-concept measures (Weisberg, 1983). DI ranked first on both measured basic skills and measured cognitive-conceptual skills. DI also ranked first for children's self-rated impressions of their own achievement abilities and feelings of self-esteem. In regard to criticisms of failing to take into account learners' individual differences, DI allows for attending to students' individual needs (Baumann, 1988) and often, students will adapt and modify learning of study skills and cognitive strategies to their personal needs (Gersten & Carnine, 1986). Despite these positive findings, there is a paucity of research examining how DI affects individual cognitive ability differences in learners.

## Individual Differences

In an educational setting, individual differences among students create instructional difficulties as these differences are necessarily related to variations in learning progress (Snow, 1986). Historically, educational theorists and practitioners have attempted to develop instructional methodologies to accommodate these individual differences. Unfortunately, educational programming remains fairly unaccommodating to individual student needs. Current debates in educational reform center on the capability and appropriateness of accepted educational practices and programs in meeting the particular needs of students (Flanagan & Genshaft, 1997). This debate also centers on the utility of psychoeducational assessment in diagnosing learning needs and developing effective remedial and instructional practices. This debate, however, rarely addresses the antecedent and potentially more important issue of which assessment methodology will best evaluate the processes by which students learn. If this could be determined, the educational setting could be modified to best serve individual needs and promote academic achievement (Sattler, 1992).

Psychology as a science has extensively studied individual differences in learning and offered its first contribution to education in the form of mental testing, i.e., intellectual assessment, using contemporary nomenclature (Snow, 1986). Since the middle to late nineteenth century, theories and methodologies were developed to assess the well known but much debated construct of intelligence (refer to Sattler, 1992, for a detailed history). As a culmination of these efforts, many standardized assessment batteries have been developed, some of which are commonly used. Yet, much of the prevailing, accepted practice in intellectual assessment is not based on contemporary theory and empirical findings in the study of intelligence (McGrew & Flanagan, 1998). As a result, there exists a serious "theory-practice gap" (p. 6) in the realm of intellectual assessment that undeniably impedes the reliability and validity of diagnostic, classification, and remediation considerations.

## Current Assessment Issues

First, we must consider how current use of intellectual assessment tools affects interpretation of individual differences, accurate diagnosis of learning differences, and effective design of remediation and instructional programs. Specifically, most practitioners and researchers use the Wechsler intelligence scales, which are the most popular psychological measures given to children and adolescents (Glutting, Youngstrom, Ward, Ward, & Hale, 1997). When Wechsler developed his tests, he was not interested in measuring and classifying specific abilities. The goal was to assess in a variety of ways something that he hoped would approximate "general intelligence" (Zachary, 1990). However, Wechsler was noted as promoting the interpretation of subtest

patterns in the introduction of his Wechsler Intelligence Scale for Children – Revised (WISC-R) manual (McDermott, Fantuzzo, & Glutting, 1990). Considerable controversy exists regarding this practice (McDermott et al., 1990; Zachary, 1990; Glutting et al., 1997; & McGrew et al., 1997). In summary, there is little empirical support for interpreting the data from a Wechsler battery via a profile analysis or other subtest analysis approach. Rather, empirical findings support the use of only the general factor (i.e., Full Scale IQ) of intelligence in predicting achievement (Glutting et al., 1997).

*Since 1941, Horn-Cattell Gf-Gc theory has developed into one of the primary conceptualizations of multiple intelligences. The cognitive abilities described in modern Gf-Gc theory are fluid reasoning, comprehension-knowledge, visual processing, auditory processing, short-term acquisition and retrieval, long-term storage and retrieval, and processing speed.*

Despite these findings, many practitioners and researchers in psychology and special education continue to use the Wechsler scale and other traditional intelligence test instruments and unfounded interpretive methods to understand inter- and intra-individual differences in cognitive skills (Flanagan & Genshaft, 1997). This is partially understandable due to the practical and political difficulties of using global IQ measures (McDermott et al., 1990). It also appears that this popular practice demonstrates a belief in the superiority of specific over general ability constructs. Moreover, data exist suggesting that proper use of subtest analysis, when based on appropriate models of intelligence, could enable one to measure the treatment utility of individually-based interventions and thereby perhaps improve educational outcomes (McGrew et al., 1997; Ysseldyke, 1990). A single score of intellectual abilities does not allow this (Woodcock, 1990). These average, more global indices, at best can predict average outcomes in a number of situations that require multiple cognitive abilities. Therefore, the interpretations based on these global scales are incomplete (McGrew et al., 1997). As a result, detection and effective treatment of individual differences is difficult. Consequently, the theory-practice gap of current assessment practices needs narrowing. Assessment of a fuller range of cognitive abilities or of the underlying factors is needed (Reschly, 1990). Improved measurement of the cognitive abilities via empirically derived factors should lead to improvements in diagnostic interpretations and educational programming. For example, findings from intracognitive discrepancies can be applied to developing efforts to train directly or "train around" the deficit(s) in processing. Also, intracognitive discrepancies can be applied to interventions to assess aptitude by treatment interactions (ATI), in that a student's aptitudes could be matched to educational interventions and assessed for improvements in achievement. Unfortunately, the current ATI literature is fraught with disappointing outcomes (Ysseldyke, 1990). This may be due to the inadequacy of current tests and interpretative practices. If this is true, then the treatments implemented based on these tests and interpretations might be ineffective thus accounting for the poor ATI data.

## Advances in Intelligence Theory

The three most prominent theoretical approaches concerning intelligence are the information processing, cognitive modifiability, and psychometric theories (McGrew & Flanagan, 1998). The information processing paradigm uses a computer analogy of humans as information processors. Research in this area is concerned with how humans process information for problem solving and everyday tasks. The cognitive modifiability paradigm posits that intelligence is dynamic, modifiable, and changeable. The psychometric paradigm, which will provide the basis of the ensuing discussion, is based on the use of scores on quantitative scales from psychological tests that can be analyzed by correlative and factor-analytic methods to identify ability dimensions that are assumed to form the framework of individual differences in cognitive ability. The goal of this line of research is to specify a "complete" taxonomy of human cognitive abilities.

In recent years, the psychometric based intelligence theories have intersected on the more comprehensive Gf-Gc multiple intelligences taxonomy. Gf-Gc is an acronym for "fluid (Gf) and crystallized (Gc) intellectual abilities" (Woodcock, 1997). Since 1941, Horn-Cattell Gf-Gc theory has developed into one of the primary conceptualizations of multiple intelligences. The cognitive abilities described in modern Gf-Gc theory are fluid reasoning, comprehension-knowledge, visual processing, auditory processing, short-term acquisition and retrieval, long-term storage and retrieval, and processing speed (McGrew & Flanagan, 1998; Woodcock, 1997). More recently, factors representing quantitative ability or knowledge and proficiency for reading and writing

were added resulting in a nine-factor ability structure (McGrew & Flanagan, 1998). *Fluid reasoning* (Gf) refers to the ability to reason under novel conditions and to engage in deductive and inductive reasoning. *Comprehension-knowledge* (Gc), or crystallized intelligence, represents cultural based knowledge such as communication comprehension, awareness of societal conventions, and social judgement. *Visual processing* (Gv) represents fluency with spatial manipulations and visual stimuli. *Auditory processing* (Ga) involves perceiving, discriminating, processing, and synthesizing speech and nonspeech sounds. *Short-term acquisition and retrieval* (Gsm) is the ability to apprehend, hold, and recall information within an immediate situation. *Long-term storage and retrieval* (Glr) refers to the ability to store information and to retrieve it fluently later. *Processing speed* (Gs) represents the speed and efficiency in performing cognitive tasks automatically. *Quantitative knowledge* (Gq) refers to the ability to comprehend quantitative concepts and relationships, as well as manipulate numerical symbols. *Reading-writing* (Grw) represents ability in areas common to reading and writing, including basic skills and skills required for comprehension and expression (refer to Table 1).

Gf-Gc theory is not based on any battery of tests but has been derived from the statistical and logical analysis of hundreds of data sets from various assortments of published and unpublished tests (Woodcock, 1997). Results from this research demonstrated that the structure of cognitive abilities does not vary across the life span, ages, gender, and cultural and racial groups (McGrew & Flanagan, 1998). In terms of the specific Gf-Gc abilities, developmental evidence exists demonstrating the presence of differential growth curves among the broad Gf-Gc abilities (Shaie, 1994). For example, some cognitive abilities seem to be "maintained" throughout the aging process (e.g., comprehension-knowledge) whereas other abilities that are more "vulnerable" to the aging process (e.g., fluid reasoning) may decline over time.

The Woodcock-Johnson Revised Tests of Cognitive Ability (WJ-R COG) is an operational representation of the Gf-Gc model of cognitive abilities (Woodcock, 1990). WJ-R COG is viewed as one of the most comprehensive measures of cognitive functioning available, as it is based on a clearly articulated theory (i.e., Gf-Gc theory) and as a test was designed to fit this theory (Ysseldyke, 1990). The WJ-R COG is part of a more comprehensive set of individually measured tests named the Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R) (Woodcock, 1990). The other part of the WJ-R is the Woodcock-Johnson Tests of Achievement (WJ-R ACH). As a result, direct comparisons among a person's scores in cognitive ability, scholastic aptitude, and achievement can be made with a higher degree of accuracy than that achieved when scores from separately normed batteries are compared. Documenting and differentiating among kinds of psychoeducational dis-

**Table 1. Gf-Gc Cognitive Ability Descriptions**

| Gf-Gc Ability | Gf-Gc Symbol | Description |
|---|---|---|
| Fluid Reasoning | Gf | Reasoning, problem-solving, & concept formation using novel information |
| Comprehension-knowledge (Crystallized Intelligence) | Gc | General knowledge, verbal communication, & reasoning with learned information |
| Visual Processing | Gv | Analyzing and synthesizing visual information |
| Auditory Processing | Ga | Analyzing and synthesizing auditory information |
| Processing Speed | Gs | Performing automatic cognitive tasks quickly while under pressure and maintaining concentration |
| Short-Term Memory | Gsm | Holding information temporarily in immediate memory and then applying it within a few seconds |
| Long-Term Retrieval | Glr | Storing information and retrieving it later via recall |
| Quantitative Knowledge | Gq | Comprehending quantitative concepts/relationships & manipulating quantitative |

crepancies, such as aptitude / achievement discrepancies, intra-achievement differences, and intra-cognitive variance, are particularly facilitated using information from the test scores on the WJ-R. The WJ-R demonstrates adequate reliability (e.g., WJ-R COG median cluster reliabilities range from .816 to .972 for cognitive ability clusters across ages 5-80; WJ-R ACH median cluster reliabilities range from .920 to .965 for achievement clusters across ages 5-80) and validity indices (refer to WJ-R manual, McGrew, Werder, & Woodcock, 1991, for information regarding content, concurrent, predictive, and construct validity indices). Of interest here is the strong construct validity of the WJ-R compared to other current tests of intelligence (Ysseldyke, 1990). Construct validity is the extent to which scores on a measure relate to a theoretical model and the degree to which the pattern of results confirm specific hypotheses as derived from the theoretical model (McGrew et al., 1991). Results from exploratory and confirmatory factor analyses of the 1977 WJ and WJ-R provide evidence for the construct validity of the WJ-R model of the Horn-Cattell Gf-Gc factors. As a result, ATI research might be improved with the use of the WJ-R (Reschly, 1990). For example, ATI research has frequently focused on matching reading instruction (phonic or whole word) to cognitive processing strengths as measured by neuropsychological approaches and the Kaufman Assessment Battery for Children (K-ABC). Research support, however, is elusive. Reschly hypothesized that the disappointing results in the ATI literature may be due in part to the inadequacy of the measures used. However, it is also likely that a problem with the ATI literature is due to the inadequacies of the instructional strategies or programs used. Reschly suggested that the WJ-R COG might improve the prospects for establishing ATIs by providing more reliable and valid measures of cognitive processes which, in turn, would lead a practitioner to more effective teaching strategies or programs. If this is possible, then a student's profile of cognitive ability strengths and weaknesses on the WJ-R COG can be matched to various educational instructional strategies or programs. Outcomes on ATI research demonstrates whether a test has treatment validity, i.e., the test results will lead to better treatments, educational instruction, and teaching strategies. Finding a battery that has treatment validity is the key to improving factors such as diagnostic interpretations, intervention design, and individual educational outcomes. Therefore, it appears that the model upon which the WJ-R is based, Horn-Cattell Gf-Gc theory, may be a significant step in ensuring that students' individual differences can be accurately assessed and appropriately addressed via effective educational interventions, leading to improved academic outcomes.

## Indices of Gf-Gc Related Treatment Validity

Research on the Gf-Gc abilities attests to their usefulness in matching cognitive abilities with different areas of achievement, such as reading and math (McGrew et al., 1997) and writing (McGrew & Knopik, 1993). Structural equation modeling (SEM) has been used to compare the relative effects of specific Gf-Gc abilities on reading and math achievement, as measured by the WJ-R reading and math tests (McGrew et al., 1997) (see Table 2). SEM produces results that demonstrate whether a particular ability "x" affects a form of reading achievement (e.g., comprehension). Understanding how a specific cognitive ability affects a form of achievement allows one to develop effective interventions. For example, in grades 1-2, Auditory processing (Ga) was found to have significant effects (i.e., statistically significant structural coefficients) on Letter-Word Identification (.33) and Word Attack (.49), whereas Comprehension-knowledge (Gc) had statistically significant effects on Reading Vocabulary (.56) and Passage Comprehension (.47). Therefore, these results suggest that reading subskills could improve by one-third (.33) to more than one-half (.56) of a standard deviation for each standard deviation increase in the respective Ga or Gc cognitive ability. Across grades 1 through 9, Ga abilities significantly contributed to the explanation of Word Attack skills as evidenced by the statistically significant structural coefficients ranging from .20 to .50. Developmentally based results suggest that the association between Gc and reading achievement increases with age (.48 in grades 1-2 to .78 in grades 10-12). In terms of math achievement as measured by the WJ-R Applied Problems test, Gc, Gf, and Gs had statistically significant effects. In terms of developmental differences, the effect of Gc and Gf on math achievement decreased with age (approximately from .58 to .38 across grades 1-12 for Gc; .50 to .21 for Gf ) , whereas the effect of Gs appeared to increase with age (approximately from .20 to .35 across grades 1-12), although not as consistently.

McGrew and Knopik (1993) examined standardized regression coefficients from multiple regression analyses (MR) to determine the relationship between Gf-Gc abilities (i.e., WJ-R cognitive clusters) and writing achievement (WJ-R Basic Writing Skills and Written Expression tests). As described above, SEM provides information regarding whether a cognitive ability affects a kind of achievement. MR

**Table 2. Effects of Specific Cognitive Abilities on Reading and Math Achievement Measures**

| | Reading | | | Math | | |
|---|---|---|---|---|---|---|
| Grades | Ga[a] | Gc[b] | Gs[c] | Gf[d] | Gc[e] | Gs[f] |
| 1-2 | .49 | .47 | — | .50 | — | .20 |
| 3-4 | .20 | .53 | — | .22 | .57 | — |
| 5-6 | .28 | .48 | .20 | — | .57 | .22 |
| 7-9 | .50 | .70 | — | .21 | .33 | — |
| 10-12 | — | .73 | — | — | .38 | .33 |

*Note.* Values presented represent significant structural (standardized) effects from SEM.

[a]Ga effects on Word Attack.

[b,c]Gc and Gs effects on Passage Comprehension.

[d,e,f]Gf, Gc, and Gs effects on Applied Problems. Data in table are adapted from figures in "Beyond g: The Impact of Gf-Gc Specific Cognitive Abilities on the Future Use and Interpretation of Intelligence Tests in the Schools, " by K. S. McGrew, D. P. Flanagan, T. Z. Keith, and M. Vanderwood, 1997, *School Psychology Review, 26 (2)*, pp. 201-203.

results, on the other hand, only reveal whether the specific abilities tested improve the prediction of some criterion, e.g., achievement indices. However, results from MR analyses are useful in determining which cognitive abilities are related to which achievement areas. Results from the McGrew and Knopik study revealed that Gs, Gc, Ga, and Gf were significantly associated with measures of writing mechanics and fluency of written expression. Processing speed (Gs) was significantly related to Basic Writing Skills during the school years (standardized regression coefficients in the mid .20s and .30s) and then decreased in strength with age (coefficients in the mid .10s and .20s). Gs and Written Expression were most consistently associated across all ages (ranging from .30s to .40s). Comprehension-knowledge (Gc) increased with age (from .21 to .61) but was not significantly related to either writing achievement measure before age seven (range of -.06 to .19 from ages 5 to 7). Auditory processing (Ga) was significantly related to Basic Writing Skills and Written Expression primarily before age 11 (from .10 to .29). Fluid reasoning (Gf) was significantly related to Basic Writing Skills during the elementary years (from .12 to .24) and consistently related to Written Expression across all ages (from .06 to .22). These findings suggest that the Gs, Gc, Ga, and Gf specific cognitive abilities should be assessed when evaluating persons with writing achievement problems. In terms of developmental trends, Ga is most strongly associated with writing achievement during the elementary school years which attests to the importance of phonological processing, awareness, and decoding in the development of basic reading, spelling, and non-motoric writing skills. Contemporary Gf-Gc theory and measurement seems to provide practitioners and researchers with a method for addressing the relationship between specific Gf-Gc abilities and diagnosis and educationally effective interventions (Ysseldyke, 1990).

**Educational Implications**

Research evidence is available attesting to the association between the major cognitive abilities as delineated in the Gf-Gc model and educational performance (McGrew et al., 1997; McGrew & Knopik, 1993; see McGrew & Flanagan, 1998 for a more thorough review). Accurate assessment of these associations could facilitate the interpretation of a student's individual differences in learning. This knowledge may then be used to identify effective educational interventions for an individual student. One educational instructional model that attempts to maximize individual learning and achievement is DI. The hallmark feature of the DI model is its precise, systematic approach for developing and preserving basic academic skills. Using the Gf-Gc framework, the curriculum principles can be said to be tapping into a variety of cognitive abilities. More importantly, it may be possible that DI at the early elementary school level (e.g., kindergarten through third grade) may actually facilitate development of a variety of cognitive abilities. For example, identifying "big ideas" to teach concepts involves Gc or Comprehension/Knowledge ability, whereas integrating skills and concepts to know when to apply their knowledge involves Gf or fluid reasoning abilities.

In terms of DI in specific areas such as reading, DI has been demonstrated to improve reading comprehension (Stevens, Slavin, & Farnish, 1991). DI addresses lower level processes related to reading ability as well, such as phonetic decoding (Ga), vocabulary development (Gc), and word identification (naming facility which is subsumed under Glr) (Kozloff et al., 1999). For example, results from an assessment of a child's cognitive abilities based on the Horn-Cattell Gf-Gc model may reveal a problem with auditory processing (Ga). DI could address this child's learning difference by focusing on a combination of phonics and site-word approaches to improve basic reading skills. Specifically, instructors could scaffold the phonics instruction to provide beginning reading and decoding strategies which

may bolster some of the more intact auditory processing (Ga) skills. As a supplement, a site-word approach could be used involving flash cards which would tap and develop cognitive abilities such as Glr which subsumes skills such as word identification (i.e., naming facility) and Gc or comprehension-knowledge to build vocabulary.

*...a great opportunity exists to investigate the extent to which an individual's status on a particular cognitive ability can be modified through training. The implications of this possibility would drastically change current educational instruction practices, the role of psychoeducational assessment, and the pattern of long-term educational and achievement outcomes.*

In the area of mathematics, DI also has been demonstrated to improve mathematical ability. DI addresses processes related to learning math facts (Gc), fluency in math facts (processing speed or Gs), and higher order applications of math knowledge and skills (Gf). For instance, results from an assessment of a child's cognitive abilities based on the Gf-Gc model may reveal a deficit in fluid reasoning ability (Gf) which accounts for the child's difficulty in math reasoning and success on word problems. DI could address this child's difficulty by teaching problem-solving strategies and providing close assistance in learning new strategies, providing feedback, and perhaps providing coaching. Therefore, DI not only can teach skills related to the cognitive skills of the Gf-Gc model, but it may be able to facilitate the development of these skills in young children. More importantly, DI has been demonstrated to improve the academic achievement of "hard to teach" (Mathes & Proctor, 1988, p. 92) or lower-achieving students. It also appears that DI facilitates the development of these skills in these students as well.

Clearly a need exists to examine if and how DI can modify the cognitive abilities associated with the Horn-Cattell model. Interestingly, Ysseldyke (1990) predicted this research need. According to him, a great opportunity exists to investigate the extent to which an individual's status on a particular cognitive ability can be modified through training. The implications of this possibility would drastically change current educational instruction practices, the role of psychoeducational assessment, and the pattern of long-term educational and achievement outcomes.

## Conclusions

Individual differences among student aptitudes and achievement create difficulties for educators in designing instruction and remediation programs to address these needs. With the institution of Public Law 94-142, Individuals with Disabilities Act (IDEA), by Congress (1975), educational institutions are legally responsible for ensuring that all children, even the "hard to teach," learn. Psychology's contribution to education in the form of intellectual assessment has assisted educational institutions in fulfilling their legal responsibility by providing methods and practices for diagnosing, classifying, and remediating problems in learning. However, several of these methods and practices have been based on primarily traditional, perhaps outdated, conceptions of intelligence. More recent advances in intelligence theory offer better alternatives for the assessment of intellectual or cognitive abilities. A prototype of these alternatives is the Horn-Cattell Gf-Gc model of cognitive abilities which provides a more complete taxonomy of human cognitive abilities. This thorough model improves upon traditional psychoeducational assessment in that it attempts to explain the relationship between cognitive abilities and areas of school achievement. Further, interpretation based on this form of assessment may be tailored to specific referral questions to perhaps augment the efficacy of remediation programs. Research in this area is needed. While this model for psychoeducational assessment could potentially be used by researchers to develop state-of-the-art individualized educational instruction programs, this approach may not be time or cost efficient. The next best alternative may be to design a comprehensive program for educational instruction that could address the development and presence of the myriad cognitive abilities demonstrated to affect a student's aptitude for learning. DI may be an appropriate alternative. Based on research principles, DI attempts to maximize learning of cognitive skills and strategies that match well with the Gf-Gc cognitive ability factors. As a result, a student's individual aptitudes could be developed and perhaps maintained via DI leading to possible academic achievement gains. If examined across students, antecedent individual differences in cognitive abilities might be better addressed resulting in overall educational institution achievement gains. Research should be directed first to narrowing the theory-practice gap in intellectual assessment practices by

examining how Horn-Cattell Gf-Gc theory can be applied to DI and the issue of individual differences. Specifically, research should be aimed at how DI addresses individual differences based on the Horn-Cattell model. This research may lead to increased acceptance of DI by addressing the concern of opponents that higher level cognitive skills are not developed when DI is used. ◆

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The first author would like to thank Ronald Drabman for his scholarly input, editorial assistance, and encouragement in the preparation of this manuscript.


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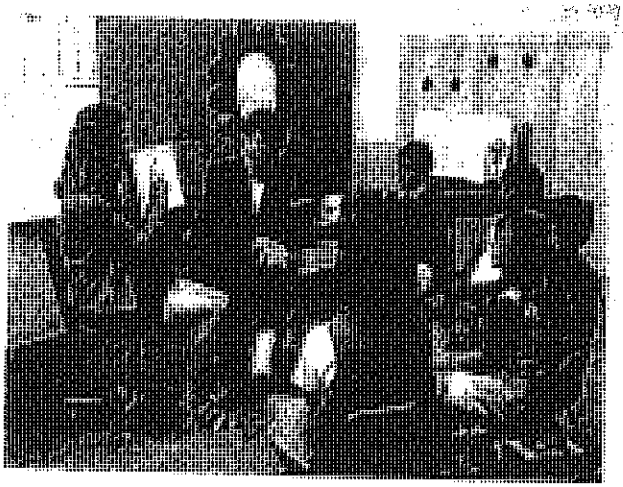

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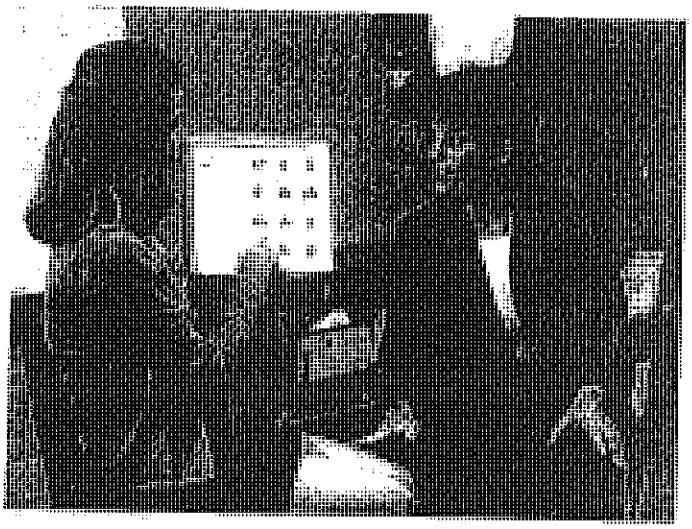

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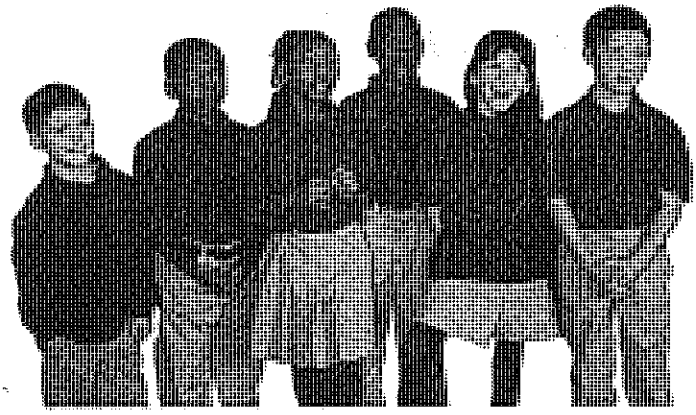

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