Direct Instruction and Reading in Africa:

A Comparison of DIBELS Scores of a DI School in Liberia, a Comparison Liberian School, and US Schools

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Educating young children is one of the most pressing problems facing less developed countries around the world. A well educated populace is crucial in helping nations escape from grinding poverty. But developing a well functioning education system in the face of very limited financial and human resources can be extremely difficult. This report describes how Direct Instruction can help meet these educational challenges. Our data come from Liberia, a country in West Africa, and replicate results that were obtained in an earlier study in an impoverished and highly segregated area of South Africa.

The first section of this report briefly summarizes research on Direct Instruction and its use in the African context two decades ago. It then describes the use of DI in a Liberian school and reports data on reading skills, comparing the achievement of the Liberian DI students to that of Liberian students in a comparison school and to students in the rural Midwestern United States. A final section briefly discusses implications of these results.

Background

A large body of literature has examined curricular and school reform models that can enhance student achievement and has documented the importance of systematic and explicit instruction (e.g., Institute of Child Health and Human Development, 2000; Juel & Minden-Cupp, 2000; Murphy, 2004; National Reading Panel, 2000). Meta-analyses examining specific curricula support this conclusion, showing that programs that embody these elements consistently result in larger achievement gains (Adams & Engelmann, 1996; American Federation of Teachers, 1998; Beck & McCaslin, 1978; Borman, Hewes, Overman, & Brown, 2003; Herman, et al., 1999).

One of the most prominent explicit instructional approaches is Direct Instruction (distinguished from other "direct instruction" approaches by the use of capital letters), which was developed by Siegfried Engelmann, Wesley Becker, and their colleagues (Engelmann, 2007; Engelmann & Carnine, 1982). DI curricula are specifically designed to accelerate students' learning by teaching more than traditional programs in the same amount of time. Unlike many curricula, the DI programs are extensively field-tested before dissemination to ensure that they produce the greatest learning in the most efficient manner. The programs, which are

commercially available through SRA/McGraw Hill and Sopris West, involve scripted lessons designed to provide teachers with the most effective wording to allow them to present tasks to students at a relatively high rate of speed. The amount of new material introduced in each lesson is carefully controlled, with applications becoming increasingly complex and designed so that, at the end of each lesson, all children will have mastered all of the content in the current lesson. The content of the lessons is also carefully designed to provide the basis for continued academic growth and understanding. Analyses of the DI curriculum suggest that, unlike traditional teaching methods, including those often termed "direct," the DI approach teaches an underlying order of knowledge and provides the basis for accelerated cognitive growth (Carnine, Grossen, & Silbert, 1992).

Numerous studies have documented the effectiveness of Direct Instruction in promoting achievement, and several meta-analyses have summarized these results. For instance, Borman and associates examined studies of 29 comprehensive school reform models. They found that the most evidence was available for the Direct Instruction model with "49 studies with 182 outcomes" compared to a median of four studies and 23 outcomes (Borman, et al., 2003, p. 141). DI was found to produce the strongest effects of all models examined. It was one of three models that met the authors' criteria of "strongest evidence of effectiveness," which involved replication of the outcomes "in a number of contexts, …statistically significant and positive achievement effects in studies using comparison groups or third-party comparison designs and…accumulated evidence from at least 5 third-party comparison studies" (p. 161). More recently, Hattie (2009) summarized the results of four meta-analyses that included DI, incorporating 304 studies, 597 effects and over 42,000 students. He found that the average effect size associated with DI was .59 and noted that the positive results were "similar for regular (d=.99) and special education and lower ability students (d=0.86), … [and] similar for the more low-level word-attack (d=.64) and also for high-level comprehension (d=.54)" skills (pp. 206-207). (See Adams & Engelmann,1996; AFT, 1998; Beck & McCaslin, 1978; and Herman et al., 1999 for other meta-analyses incorporating Direct Instruction.)

While much of the research on DI has occurred within the United States, Grossen and Kelley (1992a,b) examined the extent to which Direct Instruction could enhance achievement of children in a third-world setting. Their study occurred in Gazankulu in the late 1980s and early 1990s, when the area was a homeland in the apartheid-era South Africa. (With the end of apartheid Gazankulu became part of the South African province of Limpopo.) Students spoke Tsonga as their first language and were generally introduced to English in school, with formal reading instruction in English beginning in first grade. Direct Instruction mathematics and reading curricula were gradually implemented in one school in the area. The teachers had

experienced the highly segregated educational system of South Africa, but were trained in DI by skilled instructors from the United States as implementation of the program commenced.

Kelly and Grossen (1992b) reported the results of three studies comparing achievement of students who received DI with that of students who did not. The studies looked at the achievement of the DI students in reading, English language, and mathematics at the end of first grade and the end of second grade. Comparison groups included students in higher grade classrooms at the same and similar schools in the same locale, as well as students from more privileged environments in the country, including a mixed-race classroom and native English speakers in an urban environment with a well educated teacher. The DI students had significantly higher mathematics achievement than the other groups of children in all comparisons. They also had significantly higher reading and English language scores than all of the Tsonga speaking comparison groups. The only area in which the DI students had significantly lower scores than the more privileged comparison groups was receptive English language scores.

In discussing these results Grossen and Kelly stressed that the increases in the Gazankulu students' achievement, and their favorable performance relative to other students, occurred in the face of dire economic conditions, very poor school environments, and large class sizes. Such conditions are, unfortunately, still found throughout Africa. The following section describes the implementation of Direct Instruction in another African country, Liberia. In addition to examining a different national context than Grossen and Kelly's work, this analysis looks at a larger grade range and students with more cumulative exposure to the curriculum and compares their achievement to that of students in the Midwestern U.S. as well as other Liberian schools.

Methodology

Liberia, a country in West Africa, is one of the poorest nations in the developing world. The average income per capita is only $300 (U.S.) and 95 percent of the population survives on less than two dollars a day. Of its population of 3.4 million, 44 percent are less than 15 years of age, more than twice the percentage as in the United States. Few children persist in school to the higher levels. Because this pattern has existed for decades, only slightly more than half of all adults are literate (PRB, 2009; UNICEF, 2009). There are few Liberians who have completed teacher training programs. Thus, the small potential pool of teachers, for very large numbers of children, has relatively low levels of education, especially in comparison to more developed countries.

Our analysis focuses on Liberty School, an elementary school in Monrovia, the capital city of the country. Like other schools in Liberia, this school serves children from very impoverished backgrounds and has very limited supplies and infrastructural support, including reliable electrical power. Textbooks, other materials, and furniture for the school were donated by American philanthropists and school districts that had discarded materials.

In the summer of 2004, Oregon-based educational consultants trained instructors at the school on techniques associated with several DI programs: *Reading Mastery*, *Language for Learning*, *Reasoning and Writing*, and *Connecting Math Concepts*. The school's principal also received extensive instruction in managing the programs. In addition to implementing Direct Instruction curricula, the US consultants provided training in Positive Behavior Support (PBS). Other schools in Liberia routinely use switches to punish and "motivate" students, swatting them throughout the day for answering a question incorrectly or for other minor "infractions." The US consultants convinced the school to prohibit the use of switches at Liberty and report there are very few behavior problems in the school. They attribute this to the placement at the correct instructional level and strong reinforcement schedules associated with DI as well as teachers' training in PBS management strategies.

To examine students' reading achievement, in fall, 2009, a random sample of 43 Liberty second to sixth graders were administered DIBELS Oral Reading Fluency (ORF) probes using the standard administration protocols, which employ three different passages. The ORF score of number of words read correctly per minute is a standard measure of children's ability to read connected grade-level text passages. Studies indicate that it is a highly reliable measure and is correlated with tests of reading comprehension. It is also a good predictor of students' future academic achievement (DIBELS, 2008).

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As a comparison group, 19 students in two nearby schools with similar populations, but which have not used Direct Instruction, were also tested. These data were compared to DIBELS scores obtained from students in three Midwestern elementary schools. The Midwestern schools have gradually introduced Direct Instruction as a core curriculum for lower grades. The data represent averages over a four to five year time span in these communities, and thus combine the scores of students with varying degrees of exposure to DI. Average values are given for the mid-year administration for each grade in the Midwestern schools; and it should be noted that this provides a somewhat conservative estimate of the difference (in favor of the U.S. schools), for the Liberty students were not yet at the point in their school year that paralleled this testing period.

Table 1

Average Scores, DIBELS Oral Reading Fluency, Non-DI Liberian School, Liberian DI School (Liberty School), and three Midwestern Schools

Grade	Liberty School (DI)	Liberian non-DI Schools	Midwestern Schools
2	64.2	23.6	80.6
3	73.5	22.4	92.0
4	79.3	32.0	107.6
5	120.3	22.7	120.2
6	123.1	68.1	127.0

Effect Sizes for Comparisons of Liberty School with Other Schools

Grade	Liberian non-DI Schools	Midwestern Schools
2	1.10	-0.44
3	1.38	-0.50
4	1.18	-0.71
5	2.38	0.00
6	1.34	-0.10

Scores represent the average obtained with three reading passages, as directed by DIBELS protocol. Some students in second and third grade in the non-DI Liberian school were not able to read any words correctly, and their scores were recorded as zero. Mid-year (winter) scores were used for the students from the U.S. Effect sizes are Cohen's d.

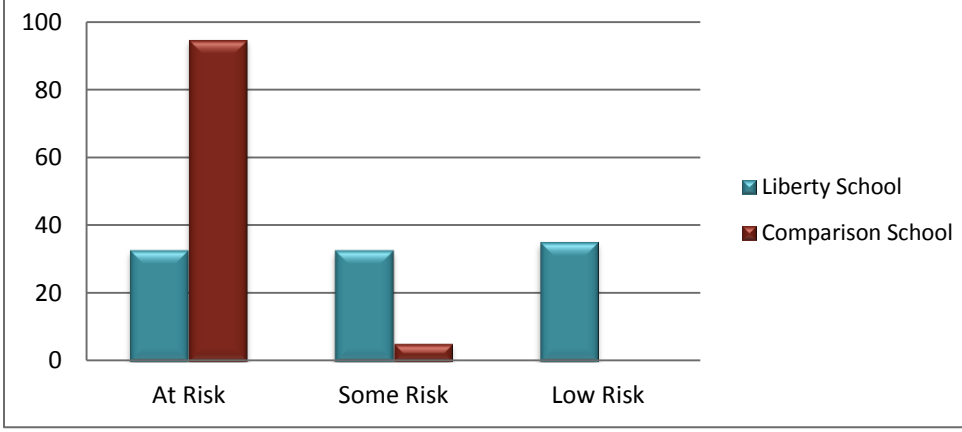
The top panel of Table 1 reports average ORF scores for these groups of schools from grades 2 through 6, and the bottom panel gives Cohen's d, a standard measure of effect size calculated as the difference between the means of two groups divided by the common standard deviation. It can be seen that Liberty School students had, on average, markedly higher ORF scores than the students in the other Liberian schools. These differences were always more than a

standard deviation in magnitude. In comparison to students in the United States, the Liberty School students had lower ORF scores in second through fourth grade, with differences ranging from about one half to almost three-quarters of a standard deviation in magnitude. However, comparisons at the upper grades alter markedly, with the Liberian DI students having ORF scores within one-tenth of a standard deviation of their American counterparts.

Because the data in Table 1 combined scores from three United States communities, comparisons were also made with data disaggregated across the school districts. These comparisons indicated that the average Liberty school fifth grader had higher ORF scores than the average 5th grader in two of the comparison Midwest communities. The average Liberty school sixth grader had a higher score than 6th graders in one of the communities and came close to the average score in another community.

Researchers working with the DIBELS system have developed "cut-off" scores and "benchmarks" to guide instructional practice. If students score at or below the cut-off score in a given grade they are considered to be at risk for future academic failure. If students score between the cut-off score and the benchmark, they are considered to be at some risk of future academic difficulties. Students who score at or above the benchmark are considered to be at low risk of future academic problems. Based on the scores in Table 1, and using mid-year U.S. norms for their grade, about one-third of the Liberty students would be termed "at risk" of having future academic difficulties, while all but one of the students in the comparison school fell in that category. None of the comparison Liberian students were deemed "low risk," while a third of the Liberty students were in this group. These differences were highly significant (chi-square = 24.95, df = 3, $p < .001$). (See Figure 1.)

Figure 1:
Percentage Students "At Risk" of Future Academic Difficulties, Liberty Elem. and Comparison School



Among the Liberty School students, at risk status was much more common for those in the lower grades. In grades two through four, the average Liberty student's score indicated that he or she was at "some risk" of future academic failure. However, by the 5th and 6th grade, when students had been exposed to the DI curriculum for three to five years, the average scores were substantially higher and well above the benchmark. Inspection of the raw data indicated that only one of the 5th or 6th graders would be considered "at risk" of future academic difficulties and over half would be considered at "low risk." In contrast, over one-fourth of the Midwestern U.S. students were categorized as being at risk.

Average scores, such as those in Table 1, cannot describe the variability of achievement within a school and the extent to which all students are meeting high standards of achievement. Table 2 reports the minimum and maximum ORF scores at each grade for each group. An effective school would be one in which all students experience success – that is, a school with high average levels of achievement and lower variability. Data in Table 2 (again based on the average across the three ORF passages) indicate that the minimum values at Liberty are higher than the minimum values in both of the other groups. In other words, the lowest student tested at Liberty scored substantially higher than the lowest student at either the non-DI Liberian schools or the Midwest schools. In addition, for third through sixth graders, the minimum value at Liberty is higher than the maximum value attained by students in the non-DI Liberian school. That is, at the upper elementary levels the range of ORF scores in the DI and non-DI Liberian schools do not overlap.

While the minimum ORF scores attained at Liberty school surpass the minimum values in the Midwest schools, the maximum scores are far less at Liberty than in the Midwest sites. This suggests that there may be substantially less variability at Liberty and may well reflect the very similar socio-demographic characteristics of the students at the school, where all of whom come from backgrounds that would be considered very economically deprived, especially when using U.S. standards. Of course, only future research can assess this hypothesis.

Table 2

Minimum and Maximum ORF Scores by Grade and School

	Liberty School (DI)		Liberian non-DI		Midwest Schools	
Grade	Min.	Max	Min	Max	Min	Max
2	36	87	3	48	0	215
3	48	106	0	58	0	211

4	53	102	13	50	0	242
5	93	144	23	23	4	272
6	99	161	59	76	15	258

Future Research and Policy Implications

Our results replicate those reported by Grossen and Kelly (1992 a,b), extending the findings into higher grades and including comparisons with U.S. populations. On-going research is, of course, needed to examine the extent to which the variation in achievement reported here is sustained in the future. Research should also examine the extent to which the students exposed to DI are able to translate their reading skills into other areas of academic achievement.

At the same time, however, these data indicate the potential for advancing education in areas of the world with very limited resources. Like Grossen and Kelly, the U.S. consultants who worked with Liberty School report that the teachers had relatively little formal educational training, with schooling estimated equivalent to a high school education in the industrialized world. Yet, the students at Liberty School developed reading skills by the upper elementary grades that were virtually indistinguishable from those of students in U.S. Midwestern communities. The Liberty School consultants echo the conclusions of Grossen and Kelly by suggesting that these achievements reflect the dedication of the teaching staff, the hard work of the students, and strict fidelity to the DI curriculum.

Grossen and Kelly also describe how elements of the Direct Instruction curriculum contribute to its effectiveness in this setting. As described above, the design of the curriculum is exceptionally efficient, promoting the fastest possible achievement gains in the shortest periods of time. In addition, the well-designed, scripted teaching manuals may be especially useful to teachers from impoverished educational backgrounds and with minimal access to training. Finally, the teacher-directed nature of the Direct Instruction approach has been cited as especially empowering to members of disadvantaged groups and welcomed by both parents and students. Studies, based in the United States, have found that members of such groups distrust child-centered, "discovery," approaches, believing that when they are used "secrets are being kept, time is being wasted, and teachers are abdicating their duty to teach" Delpit, 1988, p. 287).

The educational consultants also suggest that the work in Liberty Elementary School could serve as a model for schools throughout the developing world. Twenty-two sub-Saharan African countries have English as an official language of commerce and instruction. Over 200

million children under the age of 15 currently live in these nations (PRB, 2009), and their educational achievement will be a very important factor in determining the economic, political, and social development of their homelands. The results provided in this technical report suggest that using Direct Instruction curricula in their schools could significantly enhance student achievement and skills.

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