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## **Does Instructional Technology Improve School Reading Programs?**

### **Issue Brief**

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## ISSUE BRIEF

# Does Instructional Technology Improve School Reading Programs?

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After four decades of evaluations of computer programs for reading instruction, it is still not clear how much these programs are contributing to American schools. This is one of the major conclusions in the new report *Effects of Using Instructional Technology in Elementary and Secondary Schools: What Controlled Evaluation Studies Say*.<sup>1</sup> The report concludes that efforts to improve reading instruction with integrated learning systems have met with only limited success. It also suggests that other newer models for teaching with technology show more promise for reading instruction.

*Effects of Using Instructional Technology* reviews studies on three major technological approaches to reading instruction: (a) integrated learning systems, which provide comprehensive tutorial instruction at several grade levels and keep extensive records of student progress; (b) writing-based reading programs, which teach children to read by helping them to write; and (c) reading management programs, such as Accelerated Reader, which help students make reading selections and then test the students on their understanding of what they have read. The report bases many of its conclusions on 27 controlled evaluations of these programs carried out during the past decade, but it also takes into account evidence from less formal studies and from earlier reviews of evaluation studies.

Like most recent reviews on technology applications in education, *Effects of Using Instructional Technology* uses effect-size measures to summarize findings. These measures express results from different studies on a single uniform scale of effectiveness. They specify the number of standard deviation units that separates outcome scores of experimental and control groups. Effect sizes may be positive or negative. They are positive when the experimental group in a study outperforms the control group and negative when the control group comes out on top.

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<sup>1</sup> Available at <http://www.sri.com/policy/csted/reports/sandt/it> .

Cohen, a pioneer in the use of effect sizes in the social sciences, classified effect sizes of around 0.2 as small, 0.5 as moderate in size, and 0.8 as large.<sup>2</sup> Slavin, an expert in educational evaluation, judged effect sizes above 0.25 to be large enough to be considered educationally significant.<sup>3</sup>

## Integrated Learning Systems

The term *integrated learning system* (ILS) is little more than a decade old, but it refers to an instructional approach that goes back to the early 1960s when Richard Atkinson and his colleagues at Stanford University developed the first comprehensive computer-based programs for teaching reading. Atkinson's programs presented drill-and-practice and tutorial lessons, required students to respond during the lessons, and kept detailed records of student performance. In the late 1960s, the Computer Curriculum Corporation started to market this type of software to schools, and later other corporations began marketing programs built on the same model. During the late 1980s and early 1990s, educational experts began referring to these comprehensive programs by the term *integrated learning systems*.<sup>4</sup>

Today, the term is used to describe software programs that provide tutorial instruction in basic skill areas at several grade levels while keeping extensive records of student progress on networked computer systems. ILSs manage student registration, assign students to classes or classrooms, prepare reports on student progress for teachers, and manage student progress toward intended outcomes or objectives. The Computer Curriculum Corporation and Compass (formerly Jostens Learning Corporation) are among the best known commercial sources for these systems.

Reviewed in *Effects of Using Instructional Technology* are nine controlled evaluations of ILS programs. Results of these nine studies suggest that ILSs have done little to improve the effectiveness of reading instruction. In each of the controlled evaluations, reading scores of children learning with ILSs were as high as reading scores of those studying in traditional classrooms, but ILS results were significantly better than control results in only three of the nine studies. The median effect of ILS instruction in the nine studies was an increase in reading scores of only 0.06 standard deviations, a trivial increment. This means that in a typical study, reading scores of ILS and control groups were nearly identical at the end of the experiment.

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<sup>2</sup> Cohen, Jacob. 1977. *Statistical Power Analysis for the Behavioral Sciences (Revised Edition)*. New York: Academic Press.

<sup>3</sup> Slavin, Robert E. 1991. "IBM's Writing to Read: Is It Right for Reading?" *Educational Evaluation and Policy Analysis* 13(1):1-11.

<sup>4</sup> Wilson, Judy. 1990. "Integrated Learning Systems: A Primer." *Classroom Computer Learning* 10(5):22-23,27-30,34,36.

These results are consistent with those in Becker's 1992 review on ILS effectiveness.<sup>5</sup> Becker's report reviewed results from 32 early studies of ILS effectiveness in basic skills instruction. The studies included both controlled evaluations and studies without control groups. Ten of the studies presented reading results separately from other results. The median effect size in the ten studies was 0.18. Although this median is slightly higher than the median effect size in recent evaluations, the effect is still too small to be considered educationally meaningful.

Note, however, that students do as well with ILS instruction as they do with traditional instruction. Reading performance of ILS students usually equals the reading performance of control students. Although ILS instruction does not improve reading results, it does not have a negative effect on student progress in reading. Also, it is possible that ILS effects in reading would be stronger if ILS implementations were better. Research suggests that students typically spend only 15% to 30% of the recommended amount of time on ILS instruction and that ILS effects would be greater if schools would allot more time to ILS instruction.<sup>6</sup>

## Writing-based Reading Programs

Writing to Read (WTR) is a reading program that attempts to teach young children to read by stimulating them to write. The program is based on the premise that young children can learn to write in some fashion whatever they can say, and having learned to write, the children can then easily learn to read what they and others have written. The IBM Corporation became a major developer of the program during the 1980s, and in 1984, IBM released the first version of WTR. In 1991, IBM released a revised version of the program called Writing to Read 2000.

Children use WTR for one hour daily during the second semester of the kindergarten year and for one hour daily during both semesters of first grade. Second and third graders who are not yet reading may also use the program. During the WTR hour, children circulate among six workstations, spending 12 to 15 minutes at one station before moving on to the next one. Two of the stations, the computer station and the typing station, involve computer activities. At the computer station, children learn sound/letter relationships, and at the typing station, they type their own stories. At the remaining stations, children practice phonics relationships, using a variety of materials, including work journals, manipulative materials, and books.

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<sup>5</sup> Becker, Henry J. 1994. "Computer-Based Integrated Learning Systems in the Elementary and Middle Grades: A Critical Review and Synthesis of Evaluation Reports." *Journal of Educational Computing Research* 8(1):1-41.

<sup>6</sup> Van Dusen, Lani M, and Worthen, Blaine R. 1995. "Can Integrated Instructional Technology Transform the Classroom?" *Educational Leadership* 53(2):28-33.

Reviewed in *Effects of Using Instructional Technology* are 12 evaluation studies of WTR conducted during the past decade. The studies suggest that WTR effects are large in kindergartens, moderate in size in Grade 1, and small in grades beyond Grade 1 (one study examined both kindergarten and Grade 1 effects):

- Two evaluations found strong positive WTR results at the end of kindergarten. The average effect of WTR in these two studies was to increase scores on reading tests by 0.84 standard deviations, equivalent to a boost from the 50<sup>th</sup> to the 80<sup>th</sup> percentile.
- Grade 1 implementations produced medium-size effects. One of the studies that examined kindergarten effects also examined Grade 1 effects. In addition, five other studies examined Grade 1 effects. The median effect of WTR in the six studies was to increase reading scores in the first grade by 0.40 standard deviations, equivalent to a boost in scores from the 50<sup>th</sup> to the 66<sup>th</sup> percentile.
- Five studies examined WTR effects in grades beyond Grade 1. Two of the studies found strong positive WTR effects, but three studies reported small or trivial effects. The median effect of WTR in the five studies was to increase reading scores by 0.25 standard deviations, equivalent to a boost in scores from the 50<sup>th</sup> to the 60<sup>th</sup> percentile.

A very different picture emerged from a review written by Slavin in 1990 when WTR was in its infancy.<sup>7</sup> Slavin examined 21 studies of kindergarten effects, 13 studies of Grade 1 effects, and 4 follow-up studies of effects beyond Grade 1. The review was notable for its lack of positive conclusions. Overall, Slavin found no credible evidence for WTR effects in kindergartens, in first grades, or in grades beyond first.

It is impossible to say with certainty why early and later evaluation results on WTR differ so strikingly. One possibility is that later implementations of WTR were more adequate than earlier implementations. Another possibility is that later evaluations were better designed and analyzed. Whatever the explanation for the failure to find strong results in early evaluations of WTR, the fact remains that WTR has a record of effectiveness in recent evaluation studies.

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<sup>7</sup> Slavin, Robert E. 1990. "IBM's Writing to Read: Is It Right for Reading?" *Phi Delta Kappan* 72(3):214–16.

## Reading Management Programs

Reading management programs use the computer not as a tutorial device but rather as a tool for guiding and tracking student reading. Accelerated Reader (AR), a program designed for use in K-12 schools, is by far the most widely used of the reading management programs.<sup>8</sup> Introduced in 1986, the program is now used in an estimated 55,000 schools nationwide.

Students begin using the program by selecting a story or book from thousands of titles stored in the program's database. After reading the selected work, the student takes a computer quiz on it, and the program gives the student points based on quiz score and the length and difficulty of the selected work. The program also generates reading reports for school staff, students, and parents.

Three state-wide correlational studies, cited in *Effects of Using Instructional Technology*, found that reading scores were higher at schools that owned AR and lower at schools that did not own the program. The studies that produced this finding were:

- a study of 6,000 schools in the state of Texas, carried out under the direction of one of the developers of AR;
- a study of 740 Tennessee schools, also under the direction of one of the developers of AR; and
- a study carried out by an independent researcher in the state of Illinois that examined reading test scores in 197 AR-owning schools and 303 schools that did not own AR.

These correlational studies do not establish that use of AR caused the higher reading scores at AR-owning schools. It is important to note that mathematics and science scores were also higher at these schools. It seems possible therefore that some other factor might explain the correlation between AR ownership and achievement scores. For example, schools with strong administrative leadership or active parent groups may be more likely to buy AR software and also to have students who do well on achievement tests.

The picture that emerges from experimental and quasi-experimental studies, however, is also favorable to AR. Three controlled comparisons of AR and conventional instruction, also

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<sup>8</sup> Renaissance Learning. 2003. "Renaissance Learning. About Us.." Web page accessed 22 May 2003. Available at <http://www.renlearn.com/aboutus.htm>.

reviewed in *Effects of Using Instructional Technology*, suggest that the program has positive effects on students' reading development. One of the studies found a strong AR effect; one found a moderate-size effect; and one found a trivial effect. Median AR effect in the three studies was an increase in reading test scores of 0.43 standard deviations, equivalent to an increase from the 50<sup>th</sup> to the 67<sup>th</sup> percentile. These are promising results, but more evaluation studies of AR are needed.

## Concluding Comments and Gaps in Information

It is not yet clear how much computer-based programs can contribute to the improvement of reading instruction in American schools. Questions still surround the major technological approaches to reading instruction. Evaluation studies of the past decade consistently found, for example, that ILSs make little or no contribution to the improvement of reading programs. Research also suggests, however, that ILSs are usually incompletely implemented. The job for future evaluators is to determine whether fully implemented ILSs can make a greater contribution to reading programs. WTR compiled a very good record in evaluation studies during the past decade, but WTR had a poor record of effectiveness in earlier evaluation studies. Researchers and analysts still have to account for the difference in the early and later studies. Finally, several studies suggest that the reading management program, Accelerated Reader, may be very helpful to students in both elementary and secondary schools. However, too few experimental studies are available at this point for firm conclusions.