9

NEW TECHNOLOGIES

This chapter describes a sample of efficient computer, Internet, and social technologies that yield results equal to or better than conventional methods, often at a fraction of the usual monetary and time costs. They were selected on the basis of variety, research available, my personal experience seeing several in action, and being illustrative of how psychological principles can be automated and efficient. Other technologies that might have been chosen may be equal or superior to those mentioned here in advancing achievement.

Computer and Internet Technology

Together with the Internet, computers have greatly increased the efficiency of manufacturing, services, and our personal lives. E-mail, for example, is cheaper, faster, and more convenient than first-class and express mail. Automatic paycheck deposits and mortgage deductions, cash dispensers, and personal banking at home make most trips to the bank unnecessary. Amazon supplies nearly 200,000 different books for Internet downloading to Kindle, its new wireless reading device. Though a large bookstore might provide

100,000 titles, Amazon can provide next-day delivery for more than one million books. An estimated 1.3 million people make a living buying and selling objects of their interest on eBay. These and other technologies are also becoming cheaper and easier to use.

By comparison, the schools have been slow to take advantage of new technologies. But some exciting precedents can be described that have the potential to vastly and efficiently advance achievement.

Value-Added Accountability and Research

High achievement status of a school at a single point in time is likely to be misleading about the school's effectiveness. Schools with high achievement status do not necessarily make good achievement gains. As emphasized in previous chapters, family background is a powerful determinant of test scores. Students in affluent communities are likely to be ahead of others even before they start school and to achieve well even if their schools are ineffective. Some schools in poverty areas, moreover, make excellent gains, but at a given time their achievement status may be below average. For this reason, policy makers are turning to the year-to-year gains or value-added scores rather than achievement status at a single point in time as a better indicator of school success. Data systems (or ''warehouses'') of test scores and computerized statistical calculations enable states to more fully and fairly evaluate schools.

Tennessee has been the pioneer in this effort, and may be a decade ahead of other states. Though data for schools are often publicly available, the Education Consumers Foundation displays the school comparisons on the Internet and distributes comprehensible reports that compare schools to others in the same areas and to the averages of the state as a whole. These reports received much press attention and public interest, and members of several school boards previously thought successful as indicated by their status are being replaced.

Such data and analyses also allow practical research on the features of highly successful schools that may deserve imitation. Stone, Bruce, and Hursh's recent report[1] describes a dozen practices used in common by six of Tennessee's top-performing elementary and middle schools (see Table 4) out of over 700 statewide. Derived from such atypical cases, these findings corroborate other evidence described in this book including a strong focus on clear goals, sustained and engaged effort, close monitoring of results, constructive learning environments, and close contact with families.

Distance Education

Instructional technology is likely to prove more effective, cost efficient, and time saving than regular classroom teaching. In the most extensive synthesis of past research covering 232 control-group studies, Bernard and his colleagues found that student achievement, attitude, and retention were roughly the same for traditional classrooms and distance education. Distance education, however, can be delivered cheaply to hundreds of thousands of students by television and increasingly over the Internet.[2] Like computer programs, great care can be taken to design and evaluate distance programs. Teams of top subject matter experts, instructional designers, and teachers can bring their best to course design, much more so than any given single educator working alone.

Moreover, improvements in distance education can be expected. Computers and the Internet are increasingly faster and accessible. Unlike whole-class teaching, distance programs can be designed to adapt to students' individual abilities, interests, and

1. John E. Stone, Guy S. Bruce, and Dan Hursh, *Effective Schools, Common Practices* (Education Consumers Foundation, 2007), www.education-consumers.org/tnproject/practices.htm.

2. Robert M. Bernard, Philip C. Abrami, and Yiping Lou, "How Does Distance Education Compare with Classroom Instruction? A Meta-Analysis of the Empirical Literature," *Review of Educational Research* 74, no. 3 (Fall 2004): 379–439.

TABLE 4
Effective Schools, Common Practices

1. Use progress tests that assess the same skills that are tested on the state's Comprehensive Assessment Program (CAP) examinations.
2. Require students to meet higher-than-minimum mastery criteria on student progress tests.
3. Employ practice-intensive learning activities that target the types of skills required by the examination.
4. Provide principals with frequent reports of individual student progress with respect to the attainment of Tennessee's curriculum standards.
5. Provide teachers with frequent reports on the progress of each of their students.
6. Adjust teaching practices when a student makes insufficient progress toward a curricular objective. (Students simply are not permitted to quietly fail.)
7. Use student progress data to assess each teacher's classroom effectiveness. (Teaching performance is tracked continuously by the principal or by colleagues who are assigned to monitor teacher and student progress.)
8. Routinely work with struggling staff to improve their teaching skills.
9. Obtain for principals supplemental budgetary support for the training and materials required to improve teacher performance.
10. Regularly inform parents about their child's performance and seek to work with parents whenever children are progressing insufficiently.
11. Survey parents at least annually to assess satisfaction with the school's services.
12. Provide school-wide programs that reward positive social and academic student behavior. (Principals monitor the success of these programs, collecting data on the number and type of student referrals for problem behavior.)

Adapted from John E. Stone, Guy S. Bruce, and Dan Hursh (2007), *Effective Schools, Common Practices.* Education Consumers Foundation, www.education-consumers.org/tnproject/practices.htm.

circumstances. Although programs may be costly to design and build, once improved and field-tested to ensure high quality, they can be used with thousands of schools and homes at increasingly lower costs per student. ''Winner-take-all'' teachers or one-in-a-thousand top performers can record their presentations. Customized coaching and small-group discussions can proceed with e-mail, ''texting,'' and other interactive systems.

Distance programs arose from non-distance, computer-based technologies for which control-group studies showed clear superiority over regular classroom instruction in eight (meta-analytic) reviews. Students in computer-based groups not only learned more on average but found their classes more enjoyable. Computer-based tutoring and acceleration classes for gifted students were especially effective.[3] As distance technology improves, greater effectiveness and efficiency can be expected, to say nothing of the convenience of access any time, any place.

Distance Testing

The federal No Child Left Behind legislation requires testing to measure how well schools are meeting state standards. In a perfect world, Adequate Yearly Progress (AYP) would be continuously measured, but that is currently impossible. With computer-administered tests, however, students can be periodically assessed throughout the school year. The not-for-profit Northwest Evaluation Association (NWEA), a consortium of school districts, has developed a reliable computer-administered assessment now used several times during the school year in approximately 6,000 schools around the country.[4] The NWEA tests are adaptive and give more

3. James A. Kulik, *Effectiveness of Instructional Technology in Elementary and Secondary Schools: What does the Research Say?* (Ann Arbor, MI: University of Michigan, 2001).

4. This subsection on distance testing is adapted from several paragraphs in Herbert J. Walberg, ''Assessing Learning'' in *Reforming Education in Arkansas* (Stanford, CA: Hoover Institution Press, 2005).

difficult questions to students who answer correctly and easier items to students who give incorrect answers so as to converge quickly and reliably on their achievement level and cut testing time by as much as 50 percent.

Computer-based tests can be calibrated to state achievement standards and can predict the likelihood of making AYP. As soon as they finish the test, students' scores are available. Detailed reports of each grade's performance can be produced within 24 hours, and reported in NCLB categories. Students can take the NWEA tests up to four times a year, often at a lower cost than paper-and-pencil tests, which are usually given only annually. NWEA tests produce scores comparable across grades, and therefore can be used to measure value-added progress. They can measure student progress across classes and schools, regardless of starting points.

Principals, teachers, and parents can use detailed NWEA reports the way firms use more frequent progress reports to guide ongoing decision-making. Reports can be presented to parents, school boards, and lawmakers in September, December, February, and May, for example. Rather than going to the expense, difficulties, and scandals of creating their own tests, some states are considering adopting the NWEA tests.

Headsprout Reading

It may be hard for adults to remember the difficulties of learning to read. How many need to be reminded that children need to know left from right to be able to distinguish the letters *b* and *d?* Can they remember all the time, patience, and tedium of those who instructed, encouraged, and corrected them in such minutia? If well defined, however, such teaching can be automated. With color, sound, and animation, it can be made enjoyable.

Headsprout Reading Basics, available to parents and schools, does just this. It establishes over the Internet the skills essential for reading success among nonreaders and beginning readers.[5] At a cost of $100, students learn letters, their sounds, and how the sounds are blended. As they advance through the lessons presented in accordance with their individual needs and progress, they learn to read words and sentences in simple short stories—in no more than 15 hours of typically 20-minute lessons. School districts are investing in the program to teach first through third graders who have not yet learned to read.

The program includes simple comprehension exercises to ensure reading with understanding. Students are required, for example, to identify correctly one of three pictures based on a sentence just read. If they respond incorrectly, the program recycles them through that part of the lesson or to another lesson until they acquire mastery of each skill.

Headsprout Independence builds on this foundation to provide mastery of additional sounds and word-deciphering strategies to extend the reading vocabulary to over 5,000 words. Children respond to longer and more complex passages until they reach the point of correctly completing exercises typical of standardized reading tests.

Developed by reading experts and behavioral psychologists, Headsprout employed a trial-and-error engineering approach informed by learning scientists and experienced educators. Like the Wright brothers, who made small changes in wing design until they got things right for the maiden flight at Kitty Hawk, the Headsprout

5. Joseph Layng, Janet S. Twyman, and Gregory Stikeleather, ''Headsprout Early Reading™: Reliably Teaching Children to Read,'' *Behavioral Technology Today* 3, (2003): 7–20; and Janet S. Twyman, Joseph Layng, Gregg Stikeleather, and K. A. Hobbins (in press), ''A Non-linear Approach to Curriculum Design: The Role of Behavior Analysis in Building an Effective Reading Program'' in *Focus on Behavior Analysis in Education,* Vol. 3, W. L. Heward et al, editors (Upper Saddle River, NJ: Merrill/Prentice Hall). See also www.headsprout.com.

developers utilized the capacity to quickly change program features and measure their effects. Billions of children's electronically tabulated responses helped efficiently tweak the program.

On the surface the program appears to the child as an interactive cartoon. Underneath is a patented technology that systematically teaches the phonics skills to sound out words and begin reading with understanding. The program was so rigorously developed and tested that Headsprout offers schools a full product refund for each kindergarten or first-grade student who is not at or above grade level in the first grade.

The keys to the Headsprout success are:

- A complete and detailed specification of the pre-reading skills, such as individual letter recognition, that children need to become effective beginning readers;
- The precise recording of each child's responses so that reinforcements and correctives can be individually administered over the Internet with the patience, speed, and appropriateness that could not be achieved by a skilled tutor; and
- Continuous revision of the program based on children's responses.

Skilled reading is perhaps the most foundational of all academic skills. It is a difficult skill unattained by many high-school students and adults. Yet, the teaching of reading can be automated and provided at minimum cost. Though many third graders have yet to learn to read, the cost of their schooling is roughly $30,000 at a current cost of $10,000 a year. Headsprout guarantees success with 15 hours at 0.3 percent of the cost. Since beginning reading is difficult to teach, even greater success may be expected in mathematics and other subjects. Still new competitors seem bound to arise, which may challenge Headsprout and spur new and improved instructional offerings.

Social Technology

New forms of charitable organization enable people, both donors and recipients, to contribute to projects that would have little hope of achieving well on their own. Though computers and the Internet can facilitate such projects, the creative part is how they organize institutions and volunteers to efficiently provide opportunities.

Room to Read

On a Nepal trekking vacation from Microsoft in 1998, John Wood accepted an offer to visit a school.[6] He learned the library holdings consisted of *Finnegan's Wake*, a romance novel, and a travel guide to Mongolia—all kept under lock and key for fear the children would damage them. Wood collected over 3,000 books from friends, acquaintances, and donors and brought them back on six donkeys. In 2000, he devoted himself to the (nonprofit) Room to Read, which helped build more than 8,000 libraries in Nepal, India, Vietnam, Cambodia, Laos, and Sri Lanka and provided 2 million books, including books written by children in their native language. This number of libraries eclipses the numbers sponsored by one of America's greatest philanthropists, Andrew Carnegie, whose foundation built approximately 3,500 libraries, mostly in the United States.

Room to Read financially collaborates with local communities to give scholarships for girls and to build schools and computer laboratories, although it concentrates on building libraries. Grant recipients must put up a fraction of the cost of the library and form a board for its governance. Donors can specify what part of the program and what country their contribution funds.

Expanding faster than highly successful for-profits (including

6. See the Room to Read website http://www.roomtoread.org/about/index.html and Wood's book *Leaving Microsoft to Change the World: An Entrepreneur's Odyssey to Educate the World's Children* (New York: Collins, 2006).

Starbucks during its growth period), Room to Read is now in South Africa and Zambia and plans to be operating 10,000 libraries in 15 countries in Africa and Asia by 2010. My evaluation of Room to Read with Susan Paik showed that teachers and parents in the four beginning countries viewed their Room to Read libraries very favorably.[7]

Wikipedia

Both old and young academic fuddy-duddies may be quick to dismiss recently born *Wikipedia* because its content is nearly all consumer supplied and edited. Anyone at any time can submit or edit parts or all of an article (although many are screened by voluntary ''super editors'' who monitor articles within their specialty to guard against error, bias, and vandalism).

Wikipedia is free, nearly instantaneous in answering queries and is usually first- or near first-cited in objective Google searches. It contains more than 2.8 million articles in English alone, over 25 times more than the 240-year-old *Encyclopedia Britannica*. In response to current events and research, *Wikipedia* is updated daily. Perhaps along with *Science,* the most prestigious of all ''hard'' science journals, *Nature* reported that in 42 randomly selected general science articles, there were 162 expert-identified mistakes in *Wikipedia* versus 123 in *Britannica*.[8]

As its editors declare, *Wikipedia* requires expansion and improvement. With 25 times the number of articles and 76 percent of the accuracy of *Britannica* however, *Wikipedia* is only a few years old in contrast to the much older *Britannica*. At its current growth rate, *Wikipedia* seems likely to excel in quality as well as its astonishing size.

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7. Susan Paik and Herbert J. Walberg, *Overview of the Room to Read Evaluation 2005*, http://www.roomtoread.org/programs/downloads/Monitoring_and_Evaluation_Summary.pdf.

8. ''Internet Encyclopedias Go Head To Head,'' *Nature* (2006): 438, 8. 900–901.

SearchLit

The nonprofit website SearchLit[9] provides for free viewing, downloading, and reproduction or republication of more than 15,000 outstanding, out-of-copyright, children's stories, poems, and books such as Louisa May Alcott's *Little Women*, Mark Twain's *Huckleberry Finn*, and Stephen Crane's *Red Badge of Courage*. The books are computer analyzed to supply precision grade-level difficulty estimates. They have been categorized in various ways including virtues such as honesty, courage, and perseverance to facilitate reading choices by educators, parents, mentors, tutors, and children themselves. Also available are user-contributed lesson plans and many plays, poems, and stories as well as links to dictionaries, histories, world cultures, historical time lines, and children's book of the year awards from Australia, Britain, Canada, New Zealand, and the United States.

Why haven't schools made better use of psychologically valid practices described in previous chapters and the more efficient innovations in distance and social technologies described in this chapter? Despite substantially rising costs, why have schools made so little progress? These are questions to which the last chapter now turns.

9. See the site at www.searchlit.org.