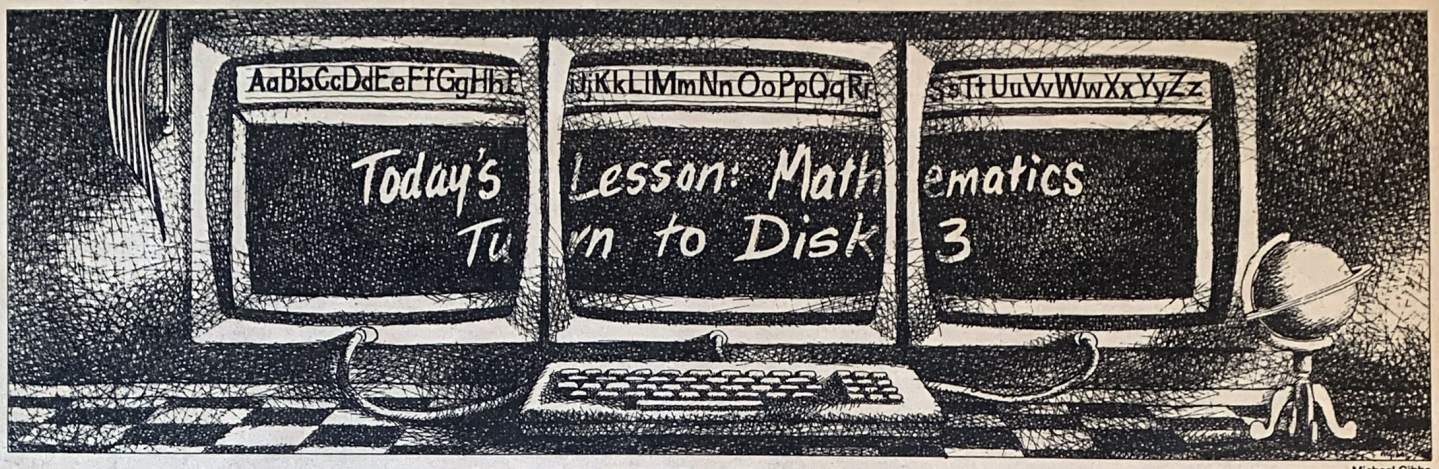

Michael Gibbs

COMMENTARY

Computer-Based Education: A 'Key' to Reform

By William C. Norris

Addressing this decade's unprecedented surge in global competition will require massive restructuring, reallocation of resources, and development of new approaches by virtually all sectors of American society. But while most major U.S. corporations are already striving in these ways to become more competitive, the same cannot be said of elementary, secondary, and undergraduate education. Our educational system is failing to prepare our young people to face the age's economic and technological challenges.

In the simplest terms, a society that is largely technologically illiterate must be transformed into one that produces more scientists and engineers, and more efficiently expands the creation and transfer of knowledge—all at affordable cost.

The steady decline in our workforce's proficiency at routinely applying basic notions of science and technology limits our ability to improve quality and productivity—critical factors in our competitive position. This decline derives from our children's lack of interest in mathematics and science. Compounding this problem are a serious deficiency in the number of qualified math and science teachers and the general weakness of many teachers in these specialized fields.

One key to necessary reforms in education is the adoption of computer-based education (C.B.E.) as the primary mode of instruction in our schools. Under the direction of teachers certified not only in particular content areas but also in the use of advanced educational technologies, a C.B.E. program expanded from its current supplementary role would free teachers of inefficient traditional methods of instruction and record-keeping. In turn, the money saved from improved efficiency could be used to raise teachers' salaries significantly.

To see how effective C.B.E. can be in the teaching process, we need only look at the explosion in the rate of its implementation by industry. Across a wide spectrum of uses, such industries as textiles, transportation, health care, and agriculture are applying this form of instruction.

This rapidly growing utilization of C.B.E. by industry has provided the impetus to make the technology even more cost-effective and to extend the range of applications.

The essence of computer-based education is the direct involvement of the student at the center of the learning process, and the assumption of responsibility by the student for his own learning progress. We know that active involvement of a learner greatly improves the odds that objectives will be achieved.

Our traditional instructor-centered classroom permits too many students to settle into a passive role—in a sense, waiting for learning to "happen to them" rather than actively seeking it. As much as 85 percent of the time a teacher spends lecturing classes in the elementary grades is wasted, having little effect on student learning.

Yet the expansion of C.B.E. does not imply a diminished role for the teacher. On the contrary, relieved of the lecturing and record-keeping functions, the instructor has more time to devote to meeting the needs of the individual student.

> The expansion of C.B.E. would free teachers of inefficient methods of instruction and record-keeping.

C.B.E. involves four elements: computer-assisted instruction, computer-assisted testing, computer-managed instruction, and computer-generated administrative reports.

Computer-assisted-instruction (C.A.I.) materials, unlike traditional lecture-centered classes, engage the student in interaction with an educational lesson and make efficient use of time. Creatively packaged by a teacher-author, the C.A.I. lesson stimulates learning through a variety of exercises, such as drill and practice, tutorial dialogue, inquiry, simulation, games, problem solving, and a wide range of tasks requiring higher-order thinking skills. C.A.I. can be used effectively in conjunction with other media and learning resources, including films, video and audio tapes, books, lectures, and field trips.

Computer-assisted testing (C.A.T.) is an integrated set of software routines that collects results from computer-assisted-instruction activities and constantly assesses a student's achievements against learning objectives.

In its newer versions, C.A.T. provides an assessment of learning strengths and weaknesses peculiar to a student's style of learning.

Tying together all these processes, computer-managed instruction (C.M.I.) connects the student, the teacher, the computer, and other educational resources. It guides each student along a learning path designed by the instructor and focused on each student's needs. At the same time, C.M.I. maintains records of student achievement so that progress can be evaluated by the instructor.

Finally, the computer generates the administrative reports essential for good school management: attendance reports, classroom scheduling, grade reports, and the like. Automating these and other administrative functions now being accomplished tediously by hand will drastically chop administrative costs, which presently consume a disproportionate share of the school budget.

Adoption of computer-based education as the basic medium of instruction from the primary grades through the undergraduate level would substantially increase the quality of instruction, improve learning outcomes, free teachers for more individual interaction with students, and constrain ever-rising costs of current instructional methods.

The widespread use of C.B.E. would also result in the freeing of funds that could be used to raise the pay of teachers, who, as professionals, deserve much higher salaries. Engineers' salaries, for example, in the United States are at least twice those of teachers. In contrast is the pay scale for teachers and engineers in Japan. Those employed in engineering and architectural services earned an average of $14,000 in 1985, whereas upper secondary-school teachers averaged $17,000.

One reason that teachers' salaries have not kept pace with those of other professionals is that the teaching profession itself has failed to keep pace with the needs of an increasingly technological society. Too much of the educational budget that could be used to bring teachers' salaries up to equitable levels is wasted on inefficient instructional methods.

Through the more effective use of technology in applications such as C.B.E. and through the increased productivity of properly trained teachers, higher pay for teachers—as much as double that of the present—can be made affordable.

No longer can costs or lack of courseware be used as an excuse for not putting C.B.E. in every classroom. Recent advances in technology, such as interactive video, compact disks, and read-only memory, will reduce hardware costs and improve performance. Further, an already large volume of high-quality courseware is growing steadily. In the PLATO C.B.E. library alone, there are 15,000 hours of lesson material in over 200 subject areas.

Further improvements in C.B.E. are coming. The cost of hardware will keep declining. Advances in artificial intelligence, as reflected in expert systems simulating human intelligence, will widen the horizon of computer-based education. And, of course, there will be important developments that we cannot foresee today.

At hand is the technology to provide lower-cost, more accessible, and higher-quality education and training. How much longer must it wait in the wings? ■

William C. Norris is the founder and chairman emeritus of Control Data Corporation. This essay is adapted from a speech given by the author at the Ninth Conference on Interactive Videodisc in Education and Training, sponsored by the Society for Applied Learning.

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