A Primer on Computer-Based Education

by Terry L. Wiechmann

Training in the Work Place

It's not hard to figure out why employee training is essential to an organization's growth and success: This is the electronic-information age. One side effect of the escalating information flow is the ensuing apparent time compression. There is less time to get the job done, ever-new market demands, increased competition, and around and around we go!

More organizations are realizing the need to train their employees faster and better. Old methods are falling short of accomplishing the goals within budget and organizational time frames. Ironically, the mechanisms that are partly responsible for the apparent time compression—fast communications and computers—are being used to help solve the problems of training. Computer-based education (CBE), once touted by the National Science Foundation (NSF) and viewed as an educational bright light in the 1960s and 1970s, trailed off, but is reemerging as a concept whose time for practical application has come at last.

Computer-based education . . . once touted by the National Science Foundation and viewed as an educational bright light in the 1960s and 1970s, trailed off, but is reemerging as a concept whose time for practical application has come at last.

CBE broadly encompasses three areas: computer-based instruction (CBI); computer-managed instruction (CMI); and computer-based authoring (CBA). Together they are a viable training alternative to more traditional forms of instruction. The advent of personal-computer hardware and software make it easier than in the past to offer CBE. Powerful processors, sophisticated graphics, multimedia capabilities, along with an underlying object-oriented organization, create an environment for realistic representation of instructional material. Gone are the days of flat instruction on the chalkboard or CRT. Concepts can be brought to life through graphics, animation, sound, and video.

Computer-Based Instruction

CBI delivers instructional materials, hereafter referred to as courseware, by a computer. Courseware can be presented in many forms. It could be simple text describing a concept, an excerpt from a speech displayed via a video window, animated graphics showing flow control in a computer program, or sound identifying a musical note.

There are various aspects to what constitutes good CBI. The field of curriculum research gives us a framework, which is based on Giles, McCutchen, and Zechiel in *Exploring the Curriculum*.[1] It consists of these four components:

- Objectives;
- Subject matter;
- Method and organization; and
- Evaluation.

Beginning with these keys, individual business organizations can develop their training programs to meet their goals. Objectives are well-defined statements of intent based on behavior or learning the student is expected to display upon completing a unit of study. Units should have broad statements, lessons within each unit, and concepts to impart with each lesson. They should specialize the broad objectives into smaller, measurable objectives.

The subject matter constitutes the content of the courseware. What is being taught? This is the most variable part of the framework. The course content determines the strategies, resources, and activities to use to convey the subject matter.

The method and organization cover courseware strategies, resources, and activities. How will the course be implemented and what methods of instruction will be used to accomplish the educational goals? The computer should be looked upon as only one way to instruct. It can be used effectively to organize the material; however, the subject matter and specific educational concept determine the best way to teach the material. For example, if a forestry course has a unit on plants, part of the course should include a field trip to the forest to achieve specific exercises and objectives.

Evaluation measures the extent to which the objectives are met. Approaches to evaluation can vary from simple oral quizzes to written tests to displaying proficiency by writing

a computer program. Any evaluation should be designed carefully to test whether the behavioral objectives were accomplished. If not, either the objectives should be reevaluated or remedial action taken.

Computer-Managed Instruction

CMI involves all functions and activities that assist in controlling and managing the teaching environment. Functions can range from simple statistical management to full management and tracing individual student or group progress. Today, when talking about CMI functions, it is assumed that these rest on a networking system. This accentuates the need for a comprehensive CMI component. Administering courseware can become impersonal when dispersed over large geographical regions. Tools must be in place to administer student progress and provide feedback. Tools such as electronic mail are fundamental and required. Electronic mail facilitates student-instructor communication and two-way management of course study. CMI functions should be available to students as well as instructors with the obvious access privileges enforced.

Computer-Based Authoring

The third part of CBE is CBA, which contains all the tools needed to create the instructional material itself. Numerous authoring packages are currently on the market. They range from modified computer languages to nonlanguage-based tools.

The positive aspect of language-based authoring systems is their flexibility. The negative side is that content authors are very often nonprogrammers and therefore must develop the courseware through a programmer. Problems can arise from that approach.

Nonlanguage-based authoring systems often eliminate the need for a programmer, offering the author complete control over the course-development process. Sometimes, these systems are inflexible and inhibit the development process.

A good CBA package should give the author control and be as flexible as possible. It should include most of the following capabilities to enhance the instructional content:

- Optional sizes and fonts for the text;
- Line drawing as a minimum, but bit map graphics with animation give the author a very powerful tool;
- Sound (used wisely); and
- Video to add an instructor to the courseware or perhaps show historical newsreels, or any other image that brings the real world to the screen.

Into the Future

In the 1960s and 1970s, the NSF funded numerous projects to develop CBE systems. Some impressive systems were developed for that time. They had one large drawback: They were much too specialized and consequently too expensive to be practical.

Today, with the development of the personal computer and the proliferation of high-powered software, the technology is available as an underlying foundation for CBE. CBE is a concept whose time has arrived. Features of a CBA package listed earlier are available on any computer software store shelf. What remains to be done is the integration of these tools into higher-level functionality that accomplishes the goals of CBE.

By itself, CBI can solve a number of commercial organizational training problems.

By itself, CBI can solve a number of commercial organizational training problems. Its self-paced nature lets the student work alone, shifting the burden from a full-time lecturer to the computer. It also structures the course for the student. If designed properly, it includes the evaluation to keep track of the student's progress as well as integrates the practical exercises where applicable.

In the computer industry, the traditional approach to training employees has been to throw the manuals onto the desk and say, "Here's all you need to get started." Unfortunately, CBI courses can be used in the same way. All training should be organized into a well-planned program, with tools integrated, which clearly defines goals to be accomplished and outlines behavioral objectives, content, and evaluation mechanisms. M

Terry Wiechmann has been in the M Technology field for twenty-one years and is president of Educational Systems, Inc., of Natick, Massachusetts. His article on object-oriented programming appeared in *MUMPS Computing* in September 1992.

Endnote

1. H.H. Giles, S.P. McCutchen, and A.N. Zechiel, *Exploring the Curriculum* (New York: Harper, 1942), 2.