

TRAINING FOR END USERS

The debate is still in progress—are end users who want hands-on use of a computer better served by terminals tied to mainframes (or to departmental minis) or by having their own personal business computers? Regardless of which approach a company chooses (and all three might be used), the need exists to improve the ‘computer literacy’ of the new end users. And it is unreasonable to expect executives and managers to spend many hours in classes to gain this computer literacy. Fortunately, the computer itself can help provide the needed training—via ‘computer aided learning.’ Here’s some important progress.

It is no surprise to anyone in the computer field that a very fundamental change is taking place in the field. That change is the dramatic shift in interest toward hands-on use by new users of computers, brought on largely by the relatively inexpensive micro-computers.

These small computers have brought with them something just as important—good quality, relatively low priced application software. Packages of the type that cost thousands and tens of thousands of dollars for mainframes and minis are available on micros for a few hundred dollars. These packages may not have all the features that the more expensive ones do, but the functions they perform are appropriate for the small computers on which they work.

The result has been that more and more people have been saying to themselves, “I finally can afford to have my own computer. The computer and the programs are within my reach. I can learn about computers and can learn at my own pace, and I’ll be the only one to know about the mistakes I make.” A good number of such people are executives, managers, and professionals, we gather from our contacts with companies.

Whether these people end up getting their computer services via personal business computers or by using terminals tied to mainframes or minis is almost a secondary question. What is important is how they can be trained to make effective use of a computer (or, more likely, of several computers).

Following are a few illustrative examples of what is now available on the market to help train new users of computers. Note that these are only some of the many possible examples that could be cited. We divide the discussion into computer assisted learning (CAL) on (a) micro-computers and on (b) mainframes, as representative of what is becoming available.

CAL on micro-computers

SELECT word processing. The SELECT™ word processing package, from Select Information Systems, Inc. of Kentfield, California, is designed to run on single-user micro-computers under the popular CP/M® operating system (from Digital Research).

One of the unusual features of SELECT is its 'Teach' mode, which is listed on the main menu right along with the program's other functions. The first-time user is told in two printed paragraphs how to load the program into the computer and get the main menu. The user then enters T (for Teach), and the Teach program takes over.

Everything that Teach does is done on the screen; there is no need to refer to a manual. Each word processing function is described, one at a time, and the steps needed to use it are listed. Then the user is given a simple example and asked to perform the function (such as insert text, delete text, move text, etc.). If the user does it right, a congratulatory message is displayed and the user can move on to the next function. If a mistake has been made, the user is so informed and is encouraged to go back and do that function again. The explanations are quite easily understandable. But even if the user has some difficulty understanding what is said about a function, repeated trials generally will make it clear very quickly.

Teach takes an experienced word processing user less than 30 minutes to go through the explanations and examples. The people at Select Information Systems say that it may take a novice user up to 90 minutes to go through all of the exercises.

Teach does not cover everything about the package, but it does give the user enough to begin making practical use of it. Additional fea-

tures of SELECT, including a spelling checker and a merge function to print documents with names and addresses from a mailing list, are covered in a manual.

In addition, Teach can be used as a refresher by occasional users of SELECT, to go over one or a few functions quickly before starting use. Also, SELECT provides a Help function which can be called up at any time from the main menu; it lists the steps to be followed for using a desired function.

Select Information Systems also offers another package, TEACH/M™, by which a computer novice can learn the use of the CP/M operating system. It operates much like the Teach function.

For more information on SELECT and TEACH/M, see Reference 1.

SuperCalc electronic worksheet. The SuperCalc™ electronic worksheet package, from Sorcim Corporation of Santa Clara, California, runs on single-user computers under CP/M.

Training on using the SuperCalc program is obtained from a clearly written manual that comes with the package. It was designed to be used by someone with no prior experience with computers. At the same time, it is also suitable for someone who is familiar with computers.

The heart of the manual is nine lessons that take the user from the first steps in using the electronic worksheet through all of the functions that the SuperCalc program provides. Each lesson is from two to five pages in length and requires anywhere from a few minutes to (say) one-half hour to complete. Each lesson generally asks the user to create a simple worksheet and then perform the functions that are discussed. The different options are explained in the manual, and the user is encouraged to try them out. The user, of course, can skip some of the features that are not of immediate interest and come back to them at a later time.

Then the user is encouraged to use three examples of SuperCalc worksheets that are provided on the floppy disk that holds the SuperCalc program. One is a financial planning worksheet, giving monthly projected balance sheet figures for a calendar year; another is a breakeven analysis that shows profit or loss under different income and cost assumptions; and

the third is an engineering example showing how the formula capabilities of the program can be used. These are non-obvious uses, as compared with (say) laying out an income and expense budget.

In about two hours of hands-on use, it is quite possible for a new user to learn enough about the program to begin doing some non-trivial financial planning with it.

For more information on the SuperCalc program, see Reference 2.

American Training International Inc., of Manhattan Beach, California offers computer-based training packages for several of the popular micro-computer programs. These include SuperCalc, CP/M, MS/DOS, Word Star, VisiCalc, dBASE II, and others. Their training packages are simplified and interactive, and it takes about 40 minutes or so for the user to get to a productive level. Their diskette programs emulate the packages being taught. For more information, see Reference 3.

IBM Displaywriter and Datamaster. IBM's Displaywriter is a word processing system that can also be used for data processing, while the reverse is true for the Datamaster. These two IBM products are normally (but not always) single-user systems that use floppy disk storage.

Displaywriter. IBM has emphasized, in a frequently-used television commercial, the ease with which novices learn to use Displaywriter's word processing functions. This ease of learning comes partly from the fact that the functions of Displaywriter have been divided into five levels. (An extra charge is made for adding to the system the software and hardware for each new level.)

For each level, there is a pre-installation seminar, a manual, and a training diskette that provides textual information to be used; this textual information is also shown in the manual. IBM urges that new users send at least one representative to the pre-installation seminar, to learn how to put the system to use immediately upon arrival. That person would then oversee the training of other users. For hands-on training, a new user reads the manual, calls up the desired text file from diskette storage (if appropriate), and then activates the Displaywriter function

that is being explained, such as how to change or delete text.

Displaywriter functions are listed on a master menu and a function is activated by entering the appropriate symbol for the function as shown on the menu. The first level system, as would be expected, has the most limited main menu and covers only the basic word processing functions. These include creating, modifying, saving, and printing out documents. A new user can learn to perform these basic word processing functions in about two hours time, we were told.

At the other extreme, level 5 provides the bulk of the data processing functions. Intermediate levels provide additional word processing capabilities.

If a customer orders a system with (say) the first three levels, IBM recommends that each level be learned in turn. After each level, IBM also recommends that at least one user representative attend a seminar that covers experiences with the level just completed and paves the way for the next level.

One version of the popular CP/M operating system can be obtained from outside sources, thus opening up the large selection of CP/M compatible software to Displaywriter users.

Datamaster. IBM's Series 23 Datamaster does not have training diskettes but does have a profusely illustrated training manual on how to use the hardware and the operating system. Other manuals are available for the Datamaster's word processing package and a data storage and retrieval package called BRADS.

Prior to installation, the user company is encouraged to send at least one representative to a pre-installation seminar. After the system has been installed, this person should go through the appropriate manuals and perform the exercises that are described therein.

While no training manuals *per se* are provided for IBM's *application packages* for Datamaster, a Help feature is provided. Each displayed 'screen' in an IBM package is assigned a serial number that appears in the upper right corner of the screen. If the user encounters difficulty, he/she can call a toll-free telephone number, identify the installation and the screen number, and describe the trouble. The person at the other

end usually can solve the problem then and there, we were told.

For more information on Displaywriter or Datamaster training, see your local IBM sales office.

CAL on mainframes

PLATO. PLATO® is a computer assisted learning network service offered by Control Data Corporation. It was developed in the late 1960s at the University of Illinois, and was acquired by CDC in 1974. While it was originally designed to run on mainframes (and most PLATO services still are on mainframes), CDC has recently begun to sell courses that can be conducted on micro-computers.

The PLATO network service is most impressive, in our opinion. Communication is at 1200 bps, with full duplex operation. It is surprising how well computer graphics are displayed in this mode of operation. PLATO makes extensive use of graphics and achieves good performance by transferring the graphics code to the intelligent terminal while the student is working on the prior frame. The terminal then produces the graphics and the mainframe delivers the relevant text.

The system is among the most user-friendly that we have come across. User training for PLATO takes only a few minutes, and is concerned mainly with how to use the keyboard. From that point on, each frame tells the user which options are available and what key to press for each option. Practically nothing has to be remembered about how to operate PLATO.

But if the user *does* have trouble with PLATO, help is available. Both a conversational message service and a stored message service are available on the system, for asking for help. The incoming and outgoing messages appear on the last two lines of the screen and do not disturb the lesson material that is displayed on the rest of the screen. The remote person can 'monitor' the user and see exactly what the user sees—and can then communicate by the message system.

There are over 1,200 courses in CDC's PLATO library. A good portion of them have been written by third parties and put into the library on a royalty basis. Many are of a general education

nature; for instance, there are numerous courses on management principles. Others are job-related, such as real estate sales agent training. Still others are related to specific skills. But whatever the course, it must meet PLATO's standards of user friendliness in order to get into the library.

As CDC says, PLATO is 'mastery based.' The student must demonstrate a mastery of the material presented—determined on the basis of the number of test questions answered correctly—before he/she can progress to the next unit of instruction.

Homework. HOMEWORK™ is a particular use of PLATO that CDC has developed in order to help home-bound disabled people return to the work force. It was started within CDC but its use is now sold as a service to many other firms and government agencies. The goal of Homework is to make these disabled people self-supporting and thus take them off the disability lists.

What Homework does is to train disabled people (those who are interested and who qualify) to become entry level business application programmers. Motivation and mental abilities are the main qualification criteria; most physical disabilities can be accommodated. These people have a PLATO terminal at their homes, plus workbooks and other supporting material (audio tapes, possibly video tapes, etc.), and they have access to on-line counseling and consulting to help them. They work at their own pace and at the times of their choosing. During the 9-month (nominal) course time, they learn to use seven programming languages.

After graduation, CDC attempts to place them in regular jobs, which they perform using terminals in their homes. If placement cannot be accomplished, a portion of the fee is returned. But, we gather, a majority of the graduates do get placed in regular jobs.

Micro-computer delivery. CDC is beginning to issue PLATO material for use on micro-computer systems such as the CDC 110. The 110 has either one or two 8-inch floppy disk drives (dual side, double density), and a printer can be attached. It can act as a stand-alone PLATO computer, or as a

stand-alone CP/M computer, or as the terminal for using the PLATO network.

One feature of CDC's PLATO terminals, such as the 110, is the 'touch screen.' The screen is divided into 16 rows and 16 columns, giving 256 small areas. The operator can communicate with the system by touching one of those areas, as indicated by text or graphics on the screen.

One PLATO package currently available is for pilot or navigator training in the use of an inertial navigation system (INS) control unit. In this training, a navigation problem is first presented showing (say) air distances and headings from point A to point B, and from point B to point C, by means of computer graphics.

Then the student is asked to set the INS unit for going from point A directly to point C. A drawing of the control unit appears on the screen. The student makes the settings by touching the screen, to turn switches on or off, to turn a knob to a desired setting, etc. When the entries have been made, the system checks for correctness and notifies the student. And the package has the user-friendliness that is characteristic of PLATO.

For more information on PLATO, Homework, and PLATO courses on floppy disks, see Reference 4.

On-line training. The way that the John Hancock Mutual Life Insurance Company, Boston, Massachusetts, used on-line training for a new application system is described in Reference 5. The problem was to teach some 2,500 people at more than 400 agency offices how to enter insurance policy and marketing information via on-line computer terminals—without having to send instructors to all of those offices. Agency offices were located as far away from Boston as Hawaii and London.

Hancock installed a computer-aided instruction system on an IBM 3033 located in Boston. The training programs were developed by five Hancock people using IBM's Interactive Instructional Presentation and Authoring system. In addition to providing the training material, the programs also keep the administrative records for the students, so that supervisors can plan and track progress. Employees are allowed to enter 'live' transaction data only after successfully

completing the training for that particular type of transaction.

After the training 'courseware' had been developed, 26 four-day meetings were held, to introduce key people to the new system. As terminals were installed in an agency, training began. Four to six weeks were allowed to finish the training and clear up any operating problems for that agency.

Hancock reports several advantages to this method of training. For one thing, the people became quite familiar with the terminals during their training sessions; by the time they were ready to enter live data, they were comfortable with the system. Another obvious advantage was the costs that were saved by not having to send instructors to all of the offices. Still another was the speed of training; installation of the new application system in agency offices was twice the speed of what it would have been using conventional training methods. And the training system remains in place, for training new personnel and as an aid in introducing new services.

The training requirements

As mentioned earlier, the theme of the day is "more computing power in the hands of end users." On-line application systems (such as the John Hancock case just discussed), word processing, computer message systems, financial planning packages—all these and more are involving hands-on use of computers by people not previously familiar with these machines.

Just who are these new users who are interested in hands-on operation? They include executives, managers, professional staff members (accountants, planners, etc.), secretaries, typists, and office workers. True, not all people in these positions yet have a need (or, in some cases, a desire) to make hands-on use of a computer. But the number of new users is growing rapidly—partially spurred, as we said earlier, by the low cost of micro-computers and the wide range of software now available.

One question that needs to be addressed is: what is the best way to train these new users so that they can use computers comfortably?

The message of this report is: the computer itself can play an important role in the training—

via computer assisted learning (CAL) and computer managed instruction (CMI)—almost regardless of the size of the organization or the size and type of computer (or computers) used.

Training in the use of computers is not as self-evident as might first appear. There are a number of factors that must be considered.

Training content. How much 'computer literacy' is needed for each type of new user? Certainly, users must be trained in some basics—how to turn the equipment on and off, how to sign on and off, how to load paper in the printer, how to handle floppy disks, how to handle common operating problems, and so on.

Then training is needed on each application system that the user will be using.

If the user gets a personal business computer, training is also needed in how to access and communicate with the company's mainframe computer, and possibly with one or more outside network services.

So an important aspect in defining training requirements is identifying what has to be taught.

Training levels. Most of today's training seems to use the 'teach everything' approach. If training in the use of a new system or package is being conducted, *all* of the options are taught—because it is not convenient to hold many short training classes.

A much better approach is to teach, at the outset, just enough so that the user can begin to make practical use of the system or package. Then, as experience is built up and the user is ready to move into a more extensive use of the system or package, give training for that next level. At some point in this approach, a user might well choose to skip some material completely and be selective in what is to be learned. (We will discuss this approach for learning end user query systems next month.)

So another part of the training requirements is to identify desirable levels of training.

Complexity. Tied closely to training content and levels is the question of the complexity of what is being taught, in order for the new user to begin doing something useful with the system or package. A *simple* situation is one that can be taught in a relatively few minutes—how to turn

equipment on and off, how to sign on and off, how to access a network service, etc. At the *intermediate* level, a few hours of time might be involved. Examples here include learning to use a query system, or learning to use an electronic spreadsheet package. At the *difficult* level, days or weeks of training time are required. Examples here are learning enough about (say) the BASIC programming language to begin doing some useful programming in it, or learning to make non-trivial use of a data management system.

In addition, general education may need to be provided. For example, as managers and executives start using statistical routines to analyze data, or use forecasting packages, they may find that they need to know more about the principles and basic assumptions upon which such routines have been based. Or, if they are using bibliographic search services, they may want to learn more about formulating search strategies.

Quite different approaches might well be used for the three levels of training, as well as for presenting general education material.

Time. Then there is the question of time—when will the people take the training, and how much of their time will it require?

For training executives and managers in the use of computers, it is likely that the training will have to be provided at *their* convenience—whenever they want to take it and for only as long as they can devote the time. In addition, since executives may make rather infrequent use of computers, they probably will want quick access to very short refresher training. Conventional courses and seminars do not fit these needs well.

At the professional staff, secretarial, and clerical levels, conventional courses and seminars are more likely to be acceptable than at the managerial levels. But even so, if more efficient and effective training methods can be found, these people will be pleased.

Location. Where will the training be provided? At a school? At an in-house training facility? At the employee's desk? (And the employee's desk might be in a headquarters' office or in a branch office hundreds or thousands of miles away.) Or at the employee's home, during eve-

ning or weekend hours? Or even when the employee is on a trip?

Why all of these possible alternatives? Because it is hard to predict when and where users—particularly executives and managers—will want training in the hands-on use of a computer.

Continuing training needs. Training needs are continuous. Current employees leave and their replacements need to be trained. People's jobs change and they find they need some new training. Or they want to move to the next higher level of use, of a system or a package.

Speed and reliability. How quickly is the training material to be presented? This can mean from the time the user decides he/she needs some training until the first training material is being presented. And it can also mean the response time of an interactive CAL system. Ideally, both of these times should be very short—minutes in the former case and a second or so in the latter.

And how reliable is the training system? Will it be available when the user wants it? And will it continue to operate until the training is finished? An unavailable or unreliable system will quickly lose the support of its users.

User-friendliness. To what extent is the training system self sufficient, so that a novice user can use it with little or no human help? At each step, is the user clearly told what his/her options are and how to exercise them: for proceeding, for going back, and for stopping? What can the user do if 'stuck' on a certain part of the training—such as when the system says the user's answer is not right and the user cannot understand why?

At the same time, the human instructors cannot be eliminated from the training system, as the following requirement indicates.

Human instructors. What will be the role of human instructors when CAL is used? We talked with Norman Carter, President of Development Systems International in Studio City, California (Reference 6). His firm has developed career and middle management training programs for a number of the *Fortune 500* companies. Carter's main point to us was, even with all of the au-

tomated training media available, the need for human instructors still exists.

CAL courseware usually is imperfect, he says, and the student can get hung up at some point and need a human instructor to help get past the difficulty. Also, some people are afraid of the computer and what it might do to their jobs; they will need interaction with human instructors until the computer becomes non-threatening to them. And a computer cannot emulate a live instructor in certain coaching-type situations, where spur-of-the-moment stress and variations must be introduced.

Using a network service, or the telephone, for providing answers to users' questions, has difficulties, he says. Ideally, the counselor should be one of the supplier's most competent persons. In practice, it is hard to staff this job with competent people, so trainees may be used (who know even less about the system than the user with the question).

Further, said Carter, the higher in management levels the new user is, the more impatient that user is likely to be with the computer or application package. If an executive is using a package for the first time (say, a forecasting package) and is clearly getting wrong answers, the tendency for him/her will be to just give up then and there, and turn the whole thing over to a subordinate. A human instructor can steer such a person through initial difficulties of this type, and the person may then become an enthusiastic user.

So, says Carter, there is a continuing role for the teacher/counselor in the training of end users on the use of computers.

Yes, there are a number of things to consider when planning a training system to teach end users how to use computers. When new users begin using computers, they generally want short bursts of training at unpredictable times, to get them to the next level of use or to get them past an impasse. Conventional methods do not meet all of the needs of this training environment.

Computer aided learning and computer managed instruction, while they do not promise Utopia, do have some important advantages for meeting these training requirements.

What's happening with CAL and CMI?

First, some definitions. Computer assisted learning (CAL)—sometimes called computer assisted instruction, CAI—is the process whereby the computer is the delivery vehicle for the material to be learned. The original CAI work was based upon the concepts of programmed instruction developed by B. F. Skinner at Harvard University in the 1960s. In addition to presenting the material, the CAI programs also tested the student with questions and branched depending upon the correctness or incorrectness of the answers.

But the early CAI concepts did not work out too well, and new approaches have been developed, as will be discussed. The term 'CAL' has been coined, possibly to differentiate today's ideas from those in original CAI.

And, as will be seen, even CAL has been subdivided into two schools of thought—'tutor mode CAL' and 'tutee mode CAL.' In the tutor mode, the computer presents the material to be learned to the student, somewhat like CAI. In the tutee mode, the student 'teaches' the computer, in an interesting and powerful way.

In computer managed instruction (CMI), the computer is *not* necessarily delivering the material to be learned; generally, conventional methods are used—classes, books, workbooks, films, video tapes, audio tapes, and so on. The role of the CMI programs is to test the student on what has been learned, evaluate whether the learning has been satisfactory or not, prescribe corrective action in case the material has not been learned adequately, and control the student moving ahead to new material until the current material has been mastered.

Most of our discussion will be about CAL, since it seems appropriate for training people in the hands-on use of computers. CAL, however, has a much broader application than this—such as for general education and for training people in a wide variety of job related skills. But our concern here is for fast, effective ways to make new users comfortable using a computer.

Conventional training methods tend to be batch in nature, where the student is trained in a

group or class. Further, the class members are all taught a wide range of material. The student must remember this material and select from it in order to perform a particular task.

CAL makes it possible to provide quite a different training environment. The training can be on-demand, interactive, specific to the immediate interests of the student, performed where and when the student desires, and (to a great extent) not requiring a human instructor to be active in the process.

Following are some of the concepts upon which CAL is based.

CAL in the training mode

Programmed instruction. One of the basic concepts underlying CAI, and tutor mode CAL, is the use of programmed instruction. In book form, programmed instruction presents some material and then immediately tests the student on the main idea within that material. Based on his/her answer, the student may be branched to another page that (a) congratulates the student for the right answer and then gives more new material, or (b) indicates that the answer was in error, gives more explanatory material, and tests again.

Electronic page turning. With a printed book, this testing and branching must be quite constrained, or the number of branched-to pages gets out of hand. With a computer, there can be a wider variety of acceptable answers to the test question. Also, the branching can be more extensive than is practical with a printed book, if desired. So one of the features of CAL—and one that researchers tend to look down on as relatively unimportant—is electronic page turning for the programmed instruction material.

Coleman Furr, whose work we will discuss below, pointed out to us that one of the major problems with the original CAI concepts was writing the material for handling incorrect answers. Students invariably come up with 'essentially right' answers, and complain when those answers are graded as incorrect. In this regard, multiple choice questions are particularly hard to develop; the incorrect answers must be plausible but also clearly incorrect, and this is difficult to do. So course authors have spent *many* hours developing and refining course material.

Furr told us that he has had the most success in the use of CAI when it was rote material that was being learned—learning to type, learning to spell, performing arithmetic drill, and such. The method was quite difficult and expensive to use for material with more intellectual content, he said, such as learning a new programming language. For such material, he much prefers the CMI approach.

Tutor mode CAL avoids some of CAI's complications by (say) not branching differently for each particular incorrect answer, in a multiple choice question. Instead, the program tells the student that his/her answer was wrong and what the right answer should be, and then may give the student the option of going back to the material, or going on, or exiting from the system.

Timed performance. One method that the PLATO system uses for teaching arithmetic is called 'Speedway.' The idea could be used in other contexts. Speedway presents a graphic racetrack, on which the student's 'car' will race another 'car.' The student's car is moved ahead when the student correctly answers an arithmetic problem (in addition, subtraction, etc.). A trial run is made first, to get the student acclimated to the idea—but, behind the scenes, PLATO remembers the time it took the student to answer all of the problems needed to complete the race. In the first actual race, the 'other' car progresses at the speed of the student's trial run—so the student is racing against him/herself. The same concept is used on subsequent races.

So concepts quite different from electronic page turning—such as timed performance—are possible with CAL.

Authoring systems. To reduce the time required for authors to write CAL courses, authoring systems have been developed. Reference was made earlier to the use of the IBM authoring system at the John Hancock Insurance Company. In addition, PLATO material has been developed with authoring systems.

Because of the growing introduction of small computers into school classrooms—computers such as Apple, Pet, TRS-80, and Atari—there has been a good amount of effort spent on developing authoring systems to run on these comput-

ers. Hence, much of the progress in CAL course material that is being made today is at the micro-computer level.

There are two general types of authoring systems. One is essentially menu-driven. The author need not learn a 'programming' language, but simply deals with the packaged functions (listed on the menus) and enters the desired text. The other type uses a high level authoring language, similar to a computer programming language.

For a menu system, the different functions listed on a menu include creating, adding, changing, and deleting the instructional material, specifying test questions, specifying the correct answers and their responses, specifying the incorrect answers and the responses to be made to them, and responses to be made to unexpected answers.

With higher level authoring languages, the author enters, line by line, what the computer is to do. In one language, for instance, the entry 'T: HELLO' means "Display HELLO on the screen."

The menu driven systems are easy to learn and easy to use, we were told. It is not unusual for a person to learn to use one of these systems in from one to three days, and to create material for up to one hour of instruction in about two days time (16 hours). A high level authoring language may take the same person two to six weeks to learn—and, again, about 16 hours to create the same amount of instructional material. If the BASIC programming language were used, it would take *much* longer to both learn the language and to develop the instructional material.

All in all, new authoring languages have made the economics of CAL more attractive.

Tutee mode CAL. Moursand (Reference 7) discusses pre-college computer literacy, and the role that personal computing might play in it. He describes the roles of the two modes of CAL—tutor and tutee—and, while he says that the tutor mode probably will become the standard mode of instruction/learning, his interest clearly is in the tutee mode.

Much of the research on the tutee mode has been done on systems designed to teach very young children to use the computer, and even to program. The LOGO project at M.I.T. is an in-

stance of this work, and Moursand shows some examples of how children can tell the computer to draw squares, rectangles, and so on.

Moursand then makes a point that is relevant to this discussion. A modern word processing system provides an example of the tutee mode, he says. The student must make an initial effort to learn to use the basic word processing functions—but can then immediately begin to put the system to productive use. Writing is easier, and correcting errors is substantially easier, than with hand writing or using a typewriter.

The SELECT 'Teach' function, discussed earlier, is an example of *tutor* mode CAL (and might well have been developed using an authoring system). After a short time with Teach, the student is ready to begin using SELECT itself, for entering actual text—and the tutee mode begins.

We see this concept playing a very important role for training end users in the use of computers. Get them through the minimal set of basics very quickly, so they can actually start telling the computer what they want to do. Then, as they themselves see the need for additional training, provide it, at least partially through the use of CAL.

Before discussing computer managed instruction, some mention should be made of the use of CAL in the job (rather than training) environment.

CAL in the job mode

As mentioned earlier, most conventional training gives students a 'once through' coverage of material and expects them to remember it. If the material is immediately put to use, reinforcement occurs and the material does get remembered. If not used immediately, forgetting occurs.

It is probably unrealistic to expect executives and managers to make immediate and frequent use of a computer, after their first training for hands-on use. Or, while they may come to make frequent use of their computers or terminals, they may make very infrequent use of some packages or network services.

Toward these ends, there are two 'job mode' uses of CAL to consider: refresher training and job aids.

Refresher training. If a person uses a computer and/or a package infrequently, means are needed for quickly refreshing that user's memory on how to do things. Ideally, most of this material will be on the computer itself, with perhaps only one or two printed paragraphs needed to get the user started (such as how to turn the computer on and load the main menu).

Again, the SELECT 'Teach' function provides a model of what is desired, in our opinion. To get started, the user may have to refresh his/her memory on how to load the SELECT program into the computer, by means of two paragraphs of printed matter. SELECT then displays its main menu, one item of which is Teach. By entering T (for Teach), the user gets the Teach main menu, which lists all of the word processing functions. The user can call up one or more of these functions, quickly go through the sample cases, and is then ready to begin using the system. In addition, the Help function, together with the name of the word processing function on which help is needed, causes the step-by-step procedure for performing that word processing function to be displayed.

So, in this instance, refresher training is just one more use of the Teach function.

Job aids. Harmon (Reference 8) says that when a training package designer tackles a new problem, the first decision to be made is whether the training strategy will rely mainly on memorization or on job aids. What responses will the trainee be expected to give when performing the job—memorized responses or responses guided by job aids? Harmon argues for job aids.

What are job aids? As the name implies, they are 'prompts,' messages, keyboard keys, etc. that help the user make the correct response, or help the user to correct an error.

A menu on a CRT screen is a job aid; the user can select from among the functions that are listed on the menu.

The opposite of a menu system is a command system, where the user is expected to remember the commands, what they do, and (probably) how to enter them correctly. (Package designers sometimes display humor in connection with these commands. One of us recently entered an incorrect command in a popular package and

got the message "Congratulations! You have just found an unimplemented function.")

A Help function, perhaps initiated by a Help key on the keyboard, is a job aid. It can tell the user what options are available to him/her at that point.

A restore function, that restores things to the previous situation, is a job aid; it is sometimes called the 'Oops' function. Ideally, it can be used repetitively to get back to a suitable restart point, for correcting an error.

Lists, such as file directories (preferably with some descriptions and dates, not just file names) and indexes, are job aids. Checklists of things that need to be done in performing given tasks are job aids.

Understandable error messages, that tell what the error is and what to do to correct it, are job aids. Error messages given by most operating systems that we have used are generally horrible; one has to look up in a manual what "Error code 83" means. Even when this information is found (and sometimes it isn't in the manual), one might not be told what to do to correct the error. Executives and managers, for instance, will likely be quite intolerant of using operating systems and application packages with cryptic error messages.

Manuals, pocket guides, or other documentation that show the step-by-step dialog that the user will see are job aids. Manuals for the Peachtree application packages, for use on micro-computers, are particularly good in this regard. The computer prompts are shown on the left side of the page; opposite them, on the right side, is an explanation of the meaning and what the user is expected to do.

This, then, is how we see the role of computer aided learning for teaching end users how to use computers and application packages.

But what about computer managed instruction? Where does it fit?

Computer managed instruction, CMI

What does a CMI system consist of? Here are some of the main functions that these systems perform.

Student records management. With CMI, the computer keeps track of each student's individ-

ual progress. It may keep track not only of which lesson the student is working on but also at what point of the lesson the student is working. When the student desires to terminate a session, the computer can keep track of just where that point is, and can start the next session either at the point or at the nearest previous restart point.

Proficiency based. Grades may or may not mean much in this type of training but proficiency and mastery certainly do. The computer can control the student's moving ahead by not providing new material until the current material has been mastered.

In general education courses, where grades are important, the computer can keep track of the student grades on quizzes, etc.

Automated testing and grading. For training, the CMI programs test the student on the material that has been assigned. Each test question or problem can draw not only on the material just studied but also upon previous material.

For general education use, and even for some training use, the CMI can randomly select test questions from a body of questions, as well as the sequence of multiple choice answers. With this approach, no two students' tests would be the same. Also, if the tests are conducted on the computer, the CMI programs can do the grading of the tests.

We talked with Coleman Furr, president of Coleman College in San Diego, California, about his college's use of CMI. Coleman College is a private institution specializing in computer field education, and grants associate, bachelor, and masters degrees. We have discussed their data processing education in previous issues, most recently in our August 1980 report, because of their award-winning curricula.

As mentioned earlier, Furr tested out the CAI approach in its early days, and spent literally hundreds of hours developing a relatively few hours of instructional material. He found that this approach was useful for teaching rote learning, such as how to type. But it was far too slow and expensive for developing the colleges main courses in data processing education.

In 1978, they began using CMI, where the computer does not deliver the instructional material but rather performs testing, evaluation, and prescription of corrective action. The instructional material is presented by conventional means—classroom presentations, text books, books in the library on the reserve list, video tapes, etc. They make extensive use of video tapes, and create four new half-hour tapes a week—some for new material, but mainly for updating existing material.

A student attends class, hears the instructor's comments, perhaps sees a video tape on the material, and is assigned study material in the text book. Then the student takes a non-threatening, non-graded test on the material, using a computer. The computer draws a random selection of questions from the question pool, presents them one at a time, and checks the student's answers. At the end of the session, the student gets a printout of the questions missed, as an indication of a need for further study. The CMI program may suggest that an additional video tape be viewed, or that a book in the reserve section of the library be studied (with the specific pages indicated), or other such remedial action that the course planners have previously identified.

Two such non-graded tests are given in this manner on each body of material; the third test is graded and is official.

Each teacher is also given a list of the questions missed by students, as an indication of where bolstering of instruction is needed.

Furr is still experimenting with new uses of CMI. He wants to be able to identify by which method each individual student learns best. Some learn best by hearing a teacher, others by reading, others by seeing a video tape, etc. Using CMI, he hopes to determine which method works best for each student, by way of their test scores,

and then let the student use that method most of the time from then on.

In summary, whether one favors CAL or CMI, we see the computer itself playing a key role in the training of new end users. Computer assisted learning techniques can be used for training executives, managers, and others in hands-on use of the computer and application packages. Computer managed instruction techniques can be used for training on material that has more complexity and intellectual content. Both, in fact, may be needed for meeting the challenge of "more computing power in the hands of end users."

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COMMENTARY

APPROACHES FOR DESIGNING TRAINING PACKAGES

Interest is growing in computer assisted learning, for training end users in their use of computers. The need is becoming particularly acute with the arrival of the new automated office systems. Some measure of this interest can be found in four recent papers.

Allen J. Henderson of IBM discusses his ideas on training packages for office systems (in *OAC '82 Digest*, AFIPS Press, 1815 North Lynn Street, Arlington, Virginia 22209; pages 729-737). He draws on his experience with the distributed office support facility for the IBM 8100.

He gives 14 very practical points to consider for such training packages. Some of these are: (a) Start the training by giving the user small but tangible successes, to develop a positive attitude about the new tool; (b) Use a hands-on training package, so the user can learn while doing; (c) Teach the package's functions by having the user do familiar office tasks; (d) Avoid the use of a training package designed for secretaries as the training vehicle for occasional users; (e) Consider layering the lessons (basic and advanced) and making the advanced lessons modular (pick and choose). And, he says, don't forget about the need to train experienced users in the new features of a new release of the package.

Howard Mozeico of Tektronix Inc. describes his company's development of a multiple level user interface for an interactive graphics system (in *Communications of the ACM*, ACM, 11 West 42nd Street, New York, N.Y. 10036; February 1982; pages 100-104). While the graphics system itself is command driven, a multi-level interface was built to help new users learn the system without having to learn the commands.

The first level was designed for "the needs of casual, harried, or one-time" users. It consists of questions from the package, answers by the user, and confirmation by the package. An example of this dialog is: (Package) "If you want a title beneath the horizontal axis, enter it now." (User) "TIME, seconds." (Package) "The EASY GRAPHING command corresponding to your previous response is: XTITLE ' TIME, seconds.'" By confirming the user's input with the command that is used, the system attempts to make the user familiar with the commands.

The next level is a tutorial on the command language. The third level is the use of the command language itself. Mozeico says they would have preferred to sub-divide this third level into levels three, four, and five, so as to divide up the command language itself into levels, but could not justify the cost of this step. However, their approach seems to be work, he says, since novice users can produce results easily and then gradually move into the use of the command language.

Calvin K. Clauer of IBM describes how the self-training package for IBM's Displaywriter was developed (in *OAC '82 Digest*, address above; pages 867-

873). In the body of this issue, we described how the Displaywriter functions are divided into five levels. Clauer's main point is that the self-training package for these levels went through a four cycle 'build, evaluate, and improve' development process.

After the first package was built, seven operators were obtained from a temporary employment agency, varying in age and prior exposure to computers. They were asked to use the package to learn to use Displaywriter. The Displaywriter was tied to a System/7 for recording all keystrokes, for later analysis. Based on the results of this analysis, the design was changed and the process was repeated—this time with 12 operators.

By the fourth such iteration, a total of 41 operators had used the self-training package. A significant improvement was detected in the number of assists needed by the students (from human instructors) for completing the training. So Clauer recommends an iterative build, evaluate, and improve development process.

Lawrence A. Welsch of Rutgers University discusses how he has used a campus electronic mail system as a teaching tool (in *Communications of the ACM*, address above; February 1982; pages 105-108). He was teaching an undergraduate course with 26 students, but was concurrently employed full-time in industry. To complicate matters a bit, the students were affiliated with five different colleges, some were night students, and some were non-resident. Further, they were divided into seven teams, each working on a different class project.

The problem was: how could this class communicate quickly and easily, not only with him but also with their other team members? The solution was to use the university's electronic mail system. It was used by Welsch for sending assignment instructions, answers to questions, and grades to the students. It was used by the students for sending questions and assignment results to him, and to communicate with their other team members.

In the typical campus environment, students with questions that they want to ask the professor must try to see him/her during office hours, generally right after the class. Typically, too, they must stand in line for this. The electronic mail system allowed the students to enter their questions at almost any time, and Welsch could answer them when it was convenient for him to do so. The method might not be quite as satisfactory as face-to-face discussions, but it did result in a more efficient use of time (both his and theirs) and an increased student/teacher interaction.

All of these cases bear on the subject of end user training in the use of computers, it seems to us. Further, it seems likely that training methods will be undergoing a big change because of these new needs. The computer will have a big role to play in the training of end users.

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