Business and industry in the 70's find computer-aided instruction a practical answer to training problems

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INTRODUCTION

When one reads the technical literature of an industry or business or attends their national meetings, he is faced with subjects such as “Real Time Systems,” “Data Base Systems,” “Management Information Systems” and “Teleprocessing Networks.” Clearly the focus of many industries and business concerns is the application of “on-line” computing technology to their varied operational problems. A recent survey of business and industrial computer users indicates that the majority of medium and large scale computer users have on-line or teleprocessing systems scheduled in their short range plans.

These new on-line systems have brought new problems or have compounded old problems during their implementation. Historically, user training on new computer based systems has been a substantial problem which often resulted in a shaky start-up of these new applications. The reasons for the problems have been well documented and range from user hostility to inept systems design. These problems have often been compounded by inadequate training of the end users by the computer oriented systems and programming staff.

The effects of inadequately trained user personnel were most often compensated by the availability of systems and programming personnel augmenting and hand-holding the user personnel during the start-up phase. The cost of doing this has increased significantly in the last few years.

On-line teleprocessing systems, in addition, suffer even more severe problems.

• The user is often hundreds of miles from the computer.
• Errors made by the user on the terminal system can require enough additional processing to correct, that this can severely degrade both the external system (Customer Service) and the computer system itself.
• Most of these new teleprocessing systems bring the computer face to face with the user's customer. Under batch systems the customer was shielded by the user from poor training and/or system. But under these new on-line systems, the sins of omission and commission in training and systems design will be full public view.
• The new on-line system very often requires direct knowledge by significantly larger numbers of people. For example, the Bank of Montreal in Canada has a requirement to train over 20,000 people in some phase of operating the terminal. This poses a significantly increased burden on training.
• With the above large numbers of people, computer staff became even less desirable as the training staff. In addition, few organizations have adequate training staff to meet these needs.

Due to the above problems industry and business have searched for a viable alternative. This search led several major businesses to an unexpected conclusion. Computer-Aided Instruction (CAI) provided both an operationally feasible and cost effective way of solving this new training dilemma. Thus, CAI which has existed experimentally in education for over 10 years without ever becoming a cost effective widely used educational tool, has found a practical role in the solution of industrial training problems.

HISTORY

The first large scale application of CAI to Industrial training came within the IBM Corporation in the mid-sixties. This was the training and upgrading of their field engineers first on the IBM 1440 system with Coursewriter I and then on a Model 360/65 running DOS. It is interesting to note that IBM did not offer Coursewriter (a CAI language) until several years later as an independent processor on the 360 series. Also internal IBM staff were pushing the dedicated CAI system (IBM 1500) using Coursewriter. This system had little application to training in business and industry and eventually proved to be too costly for public education and has been phased out.

In the latter part of the sixties most experimentation was still going on in the “Education Field” with very little being done by business and industry. A few of the earliest major teleprocessing users, notably airlines and finance companies seeing the need for some teaching devices on their systems added simple programmed instructions to their operating systems. These were not sophisticated, but did show both a need and gave some experience with CAI type approaches.
A major contributing factor to the lack of use of CAI first by "Education" and subsequently by business and industry was the approaches taken by developers of CAI languages and tools. IBM with Coursewriter set the general mode of CAI language development. By the late 1960's CAI languages had proliferated as many universities and federally funded projects had developed their own versions. The major languages in the early seventies are:

TUTOR—(Project Plato University of Illinois)
PLANIT—(System Development Corporation)
COURSEWRITER III—(IBM)

In addition many users felt that time sharing or interactive languages such as FORTRAN, BASIC or APL were all that a person needed to do CAI and so much course material was developed in these languages. Though these approaches were adequate for research and experimentation in "Education" they were too expensive for widespread use. Even though research demonstrated that many applications of CAI (ranging from simple drill and practice to sophisticated simulations) were educationally effective, their widespread use was hindered by the high cost and operational implementation problems. Thus, even though much of CAI had proven educationally sound, interest in it as a tool and hope for its eventual widespread use was waning in the early seventies. In fact, many educators including industrial trainers had felt that CAI was just another passing fad. Most "Education" researchers had moved on to "CMI" (Computer Managed Instruction) which they felt had wider and more immediate requirement. Most industrial trainers returned to other approaches: PI, Video Tape, Cassettes, Seminars, etc.

NEW DEVELOPMENTS

As discussed earlier, the seventies has led to a significant increase in on-line teleprocessing system in almost all areas of business and industries. In order to meet the needs for adequate training, companies have intensified their standard training approaches. This has proved to be very expensive since usually a large number of specialized trainers are required and much traveling is involved. Another commonly proposed approach has been to provide some learning support as part of the computer system. This has usually involved programming training aids directly into the actual application programs (United Airlines, Dial Finance). Two major problems have arisen with this latter approach.

- This increases the time required to get application programs running and often significantly adds to their complexity.
- Computer programmers are not educators and have little aptitude for training requirements. This means that training aids programmed in are often neither adequate nor meaningful.

Research and development people looking at the above problems and the projected increase in on-line systems, set out the following guidelines as a workable solution for a CAI system that would meet the needs of business and industry.

- The normal operational terminal should be able to be used for training with the proviso that such training would not interfere with the normal operation of the on-going production processing on-line environment.
- The computer software for such a system should use a minimum amount of computer resources (10 to 25 thousand characters of memory) and be usable under a wide variety of business and industrial on-line teleprocessing systems (CICS, TSO, IMS, FASTER, APL, etc.) and on a variety of computers.
- The creation of learning material should be able to be done by regular training staff and entered without requirement for computing programmers or computing knowledge.
- The system should provide comprehensive record-keeping and management information capability which provides the training staff with the control critical to ensuring training success.
- The training portion of the system should provide capability to produce training materials from simple drill and practice to sophisticated simulation all with automatic recordkeeping.
- The training system should allow the easy use of other media and training materials (PI Texts, Films, Video Tapes, Cassettes, etc.) and provide for the recordkeeping and management of these materials.

A number of new software and application techniques have allowed this type of system to be developed and to be interfaced with business and industrial on-line systems. To date a few specialized and experimental systems approach the above design requirements. One of these is a commercially available system called TIME (Terminal Instructional Managed Education). This system was developed from an experimental university CAI system and has the following characteristics.

- Programmed in IBM Assembly Language.
- Structure is based on Fourth Generation Data Base and Information Retrieval Concepts. (This contrasts to the compiler language approach taken by most CAI developers.)
- Totally compatible with business and industrial transaction oriented systems.
- Economical of Core. (Only 10-15,000 characters required.)
- Highly modular. Consists of over 200 small (500 characters) re-entrant processing modules.
- Able to run under numbers terminal control systems (CICS, IMS, FASTER, APL, etc.).
- Runs simultaneously with most application programs.
- Uses any current data bases and/or on-line files such as personnel records, branch record, etc.
- Easy to update and maintain.

Equally important to the use of any system such as
TIME is its usability by non-technical training staff to produce, test and maintain specific training materials for the on-line system. The following characteristics illustrate the major training support features required.

- No computing knowledge required to produce training material.
- Editing and error correction aids are available to the coursewriter.
- Provision is made for the trainer to develop course material ranging from simple drill to complex simulation material.
- Complete records are maintained on all student activity and use of course material.
- Provision for a management mode that allows the trainer not only to manage his instructional environment but gives quantitative information on the readiness of a trainee to use the system.
- Provision for a management mode that allows the trainer to manage other types of instructional materials such as PI, Video Tapes, Films, Cassettes, etc.

CURRENT USES

Since the advent of a commercially available CAI package for business and industry, a wide variety of uses have been made with it. The majority of users concentrated on training terminal operators as their major task. But even in this short time other creative uses of it have been made. The following is a list of industries where CAI is being used and the general types of application.

- Banking
  - Terminal Training
  - Data Entry
  - Management Training
  - Supervisory Training
  - Personnel Policies
  - Introduction to Banking Services
- Life Insurance
  - Data Entry
  - Terminal Training
  - Sales Training
  - Product Introduction
- Manufacturing
  - Warehousing and Inventory
  - Terminal Training
  - Management Training
  - Computer Techniques
  - Creativity (Aero Space Company)
- Food Processing
  - Terminal Training
  - Data Entry
  - Warehousing and Inventory
  - Retail
  - Buyer Training
  - Management Training
  - Sales Training
  - Basic Retail Skills Training

<table>
<thead>
<tr>
<th>In Branch</th>
<th>Centralized</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Weeks elapsed</td>
<td>1 Week elapsed</td>
<td>4 Weeks elapsed</td>
</tr>
<tr>
<td>40 Hours per trainee</td>
<td>40 Hours per trainee</td>
<td>20 Hours per trainee</td>
</tr>
<tr>
<td>Overtime required significant</td>
<td>Use of replacement personnel required</td>
<td>No dislocation or overtime</td>
</tr>
<tr>
<td>Impact on branch operation</td>
<td>Maximum branch dislocation</td>
<td>Little impact on branch operation</td>
</tr>
<tr>
<td>Rigid problems with illness, turnover, etc.</td>
<td>Rigid problems with illness, turnover, etc.</td>
<td>Very flexible scheduling allowed</td>
</tr>
<tr>
<td>2nd Most efficient learning</td>
<td>Least efficient learning</td>
<td>Most efficient learning</td>
</tr>
<tr>
<td>Evaluation subjective</td>
<td>Evaluation subjective</td>
<td>Definite evaluation</td>
</tr>
<tr>
<td>Readiness subjective</td>
<td>Readiness subjective</td>
<td>Quantitative information on readiness to convert</td>
</tr>
<tr>
<td>Motivation good</td>
<td>Motivation dependent on trainer</td>
<td>High motivation</td>
</tr>
<tr>
<td>Management information depends on observation</td>
<td>Little management information available</td>
<td>Management information available on all aspects of training</td>
</tr>
</tbody>
</table>

Figure 1—Operational comparisons

As wider use of CAI is made in business and industry, the diversity of materials will expand.

In order to get a better perspective of the use of a CAI system in a business and industrial environment, let's look at a summary of an early leader in this field.

Bank of Montreal—Montreal, Quebec

Bank of Montreal

<table>
<thead>
<tr>
<th>Type of Organization</th>
<th>Nationwide Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Locations</td>
<td>Over 1,000</td>
</tr>
<tr>
<td>Number of Employees to be Trained</td>
<td>20-30,000 initially</td>
</tr>
<tr>
<td>Average Branch</td>
<td>10 staff</td>
</tr>
<tr>
<td>Computer Hardware</td>
<td>IBM 370/168's</td>
</tr>
<tr>
<td>Communication</td>
<td>Leased Line Network</td>
</tr>
<tr>
<td>Computer Software Terminal Control System</td>
<td>Developed Internally</td>
</tr>
<tr>
<td>Applications</td>
<td>DDA, Savings, Installment Credit</td>
</tr>
<tr>
<td>Training System</td>
<td>TIME</td>
</tr>
<tr>
<td>Number of Courses</td>
<td>Over 100</td>
</tr>
</tbody>
</table>

This bank was faced with a large problem. They had over 20,000 employees to train at over 1,000 sites. Since they were putting 5,000 terminals on-line, CAI offered an economically and operationally feasible approach. Robert McDougal, Vice-President, responsible for the mechanization project decided that the cost savings (up to $1,000 in some branches) and the operational benefits (Figure 1) more than offset the newness of the concept. His foresight
has proven valid in retrospect as the Bank of Montreal is now heavily into conversion.

Being first posed some problems, but the bank drew in its own training staff and hired Gordon Davies with a heavy background in training systems in the military to head the development of the system. Courses were developed and tested by this staff and then were piloted with the first few branches. Since CAI allows changes easily, the bank is still changing materials when they are found not to be doing the job.

After their entry application of CAI the bank pointed out the following benefits beyond the obvious ones of cost and operational use.

- Availability of CAI for other types of training (Management Procedures, Sales, etc.).
- Uniformity of materials and methodology in the presentation of learning material.
- Validation of training materials with easy modification when required.

When the Bank of Montreal completes their training they will be one of the largest users of CAI in any environment—business, military or educational.

CONCLUSIONS

CAI has indeed found a permanent place in business and industry. It is predicted that most companies going to major on-line systems will make use of this tool. As users become more experienced they will branch out into wider areas of training. Perhaps this wider application of CAI will spur educational institutions to reevaluate their positions on its use. In addition, having CAI tools available in many major companies opens new vistas for educators to serve the business and industrial areas.