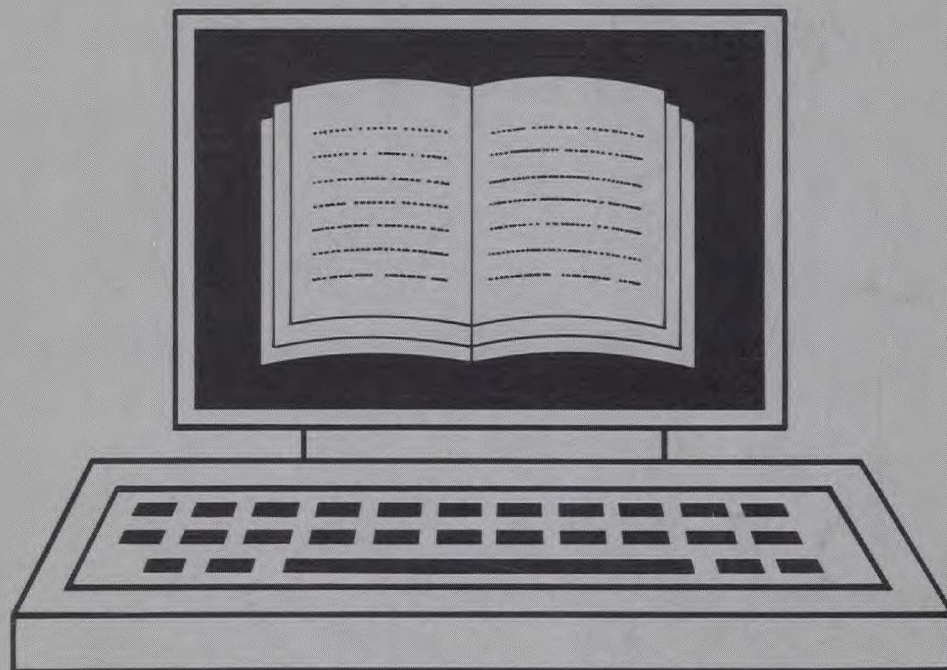


# AN ASSESSMENT OF ELECTRONIC PUBLISHING PRODUCTS & INDUSTRY

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Prepared For  
The Department of Communications  
Government of Canada

Derek Murray Consulting Associates Inc.  
In Association With:  
Evans Research Corporation, and  
Stevenson Kellogg Ernst and Whinney

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**AN ASSESSMENT OF  
ELECTRONIC PUBLISHING PRODUCTS  
AND INDUSTRY IN CANADA**

**— COURSEWARE COMPONENT —**

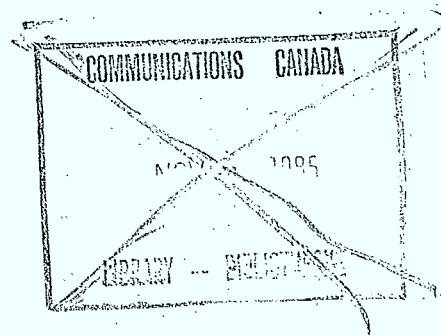
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## 1.0 INTRODUCTION

This report on courseware is part of an overall inquiry into the "electronic publishing" industry. The purpose of the wider study is to provide information about "electronic publishing" in order to formulate appropriate government policies and programs.

Specifically, this component of the study was requested to provide:

- A description of various technologies, systems and techniques used in the preparation, distribution and utilization of educational courseware along with typical cost figures and comparison with other competing methods both in terms of cost and other advantages or disadvantages. What are the technical or non-technical impediments in the preparation, acceptance and utilization of courseware packages? Discussion and forecast of future trends in courseware development techniques and technologies.
- Documentation of existing status of courseware publishing in terms of revenues derived, types of software packages published, number of users and current applications. What is the typical minimum market size required for product viability? Discussion and forecast of future markets and application areas.
- Provision of a profile of Canadian suppliers of courseware and related products in terms of their share of the market, strengths and weaknesses, and competition. Identification of any industry and business opportunities in this area and any impediments in realizing them.
- Analysis of the impact and implications of courseware publishing on Canadian publishers and end users.

In comparison to other study components, we found little published (or unpublished) material related to "courseware" which provided good statistical information on products, markets and projections for use. Given the scope and budget of this small part of the overall study we had to draw, for the most part, on anecdotal material and general literature.

## 2.0 HIGHLIGHTS OF THE STUDY

"Courseware" is a loose product concept, related to an aggregation of instruction and educational activities, in industry, homes, schools and colleges, using computer-assisted techniques in the teaching/instruction process.

Key segmentations of this product area likely include:

- **Computer-Aided Learning**, providing such facilities as:
  - Generation of Learning Materials
  - Management of the Instruction Process
  - Specific Lesson Materials to support a more traditional teaching technique (for example, Classroom Instruction)
  - Providing Instructor Independent Computer-Assisted Instruction
- **Computer-Based Training** in industry, for:
  - Technical or Skill-Based Training
  - Management/Organization Training

Despite the similarities in technology, these two categories of use are very distinct in software product, application, methods of use and channels of distribution. In this report we present our findings separately for the "education" sector and the "industrial" sector.

A good general definition for this whole area would be "any form of training or educational activity, which includes a need for a computer to be involved in some way".

Courseware is developed from one of a variety of authoring languages for use in a specific hardware environment -- normally microcomputer-based. In the private sector, most courseware is developed and implemented on IBM-compatible MS-DOS computers. In the educational sector, there is no predominant hardware standard, with most school and many college/university environments using a variety of vendors' products. The most prevalent vendors are Commodore, Apple, IBM and Radio Shack. There are also "custom" developed systems such as the Ontario-based Icon system.

To date, most courseware uses the basic microcomputer facilities of processor, screen and simple disk drive. But, development of such versatile and cost-effective storage media and CD-ROM is likely to change this significantly in the near future.

There are no good statistics available that describe the size and potential growth of the courseware market in Canada. In the training environment out of the likely \$5 billion spent on all kinds of training in Canada, some 10% is likely spent for discretionary purchases of products and services. Courseware hardware and software is unlikely to exceed 30% of this, or about \$150 million. Additionally, many of the personal computers used for training activities were acquired for other purposes and applications. Despite rosy predictions in the early 1980's, the use of courseware in private sector training does not appear to be growing significantly.

In the educational sector, it has been estimated that the larger provinces are spending annually tens of millions of dollars in hardware acquisition. Software expenditures seem to be significantly lower than those for hardware, perhaps only 10% of hardware expenditures.



Use of courseware in the educational sector seems to be growing at a higher rate than in the private sector. The major impediments to growth in this area appear to relate to the training and capability of teachers to identify, select and integrate courseware into their curriculum activities. This task is made more complex for the teachers by a lack of good sources of evaluation of software products and the variety of hardware standards in use across the country.

Suppliers fall into two basic categories -- developers and distributors. Distributors are easily identifiable, at least in the education sector. Whether supplying industry or education, the majority of distributors do not have courseware distribution as their primary business. In fact, the most significant players are providing courseware as part of a much wider range of services. These distributors mainly fall into three categories:

- **Book Publishers**, particularly in the educational field, who have added courseware to their general product line.
- **Computer Vendors**, who see the provision, directly or indirectly, through distributors, of appropriate courseware as a means of selling additional hardware and general-purpose software.
- **Specialist Training Organizations**, a limited number of specialist training organizations who produce varying levels of courseware to support their activities.

Developers appear to be primarily small businesses (frequently one-person organizations -- particularly in the educational field). Only a few large-scale training specialists (in the private sector) and some of the computer vendors are actually authoring their own courseware. In many ways, the courseware development situation is very similar to that of more traditional writing/publishing activities. The actual authorship is done by one or two individuals, frequently as a part-time activity. Very seldom, except in computer-related materials, does the original developer appear to be heavily involved in the marketing, distribution and support of their products.

The potential for business opportunities and development in the courseware field is, because of some of the factors outlined above, somewhat limited. In both industry and education, effective courseware is seen as a tool, subordinate to the overall training or educational purpose. Thus, the majority of opportunities that emerge in development, relate to the more effective matching of available training/education materials to specific user needs.

The majority of these business opportunities in actual courseware development will be for the smaller organization. On the larger scale, the opportunities are most likely to relate to the distribution of courseware (and the dissemination of information related to the courseware). Again, there would appear to be limited opportunities, at the federal level, for policy intervention. Most people interviewed were cautious about significant involvement in this area. However, three areas of potential interest identified were:

- . Applied research into the effectiveness of computer-based instruction, to assist organizations in determining the usefulness of such tools.
- . Methods for the dissemination of information related to the opportunities for the development of software, possible developers of such courseware and potential distribution methods for information about courseware available.
- . Ensuring that "courseware" developers have access to the same funding and other assistance programs that are, or may be, available to the authors of more traditional media for non-fiction authorship.

Another area of potential government involvement, more likely at the provincial level, is the provision of better training in courseware development and use (probably in community college and university courses, as well as in-place training in schools).

The use of electronic publishing in the educational and training field is still very much evolving with the technology. As the technology is changing, so are the approaches to the design of computer-aided instruction systems (CAI).

Newer CAI systems are moving towards larger integrated systems featuring the use of optical disk and CD ROM technology. The courses themselves are now being designed for more open, less structured learning through interactive software. Even in light of these new approaches, however, the impacts of this form of electronic publishing have been slow to emerge.

### **3.0 METHODOLOGY**

The assessment and analysis of courseware publishing was completed in six steps. These were:

#### **Step 1 -- Background Research**

We worked with staff from our Training Division to develop a comprehensive list of research topics to be considered. Based on this list, we completed a literature search including material from our files and from libraries such as the O.I.S.E. in Toronto. This research provided us with basic information about the present status and likely future trends in courseware development techniques and technologies.

#### **Step 2 -- Obtain Canadian Industry Information**

During this step we contacted a number of potential Canadian suppliers to obtain market-related information.

#### **Step 3 -- Discussions with Major Users**

In this step, we held discussions with a number of users of courseware in Canada. These discussions were intended to elicit:

- Their present uses of courseware.
- Their perceptions on the maturity of the market.
- Their understanding of the suppliers and products available.
- Identification of factors that were likely to encourage or inhibit the increased use of courseware in their organization.

**Step 4 -- Develop the Report on Courseware Publishing**

Based on the information collected in the previous steps, we prepared a draft report on courseware.

**Step 5 -- Client Review of Draft Final Sub-Report**

Consistent with requirement G.2 of the Request for Proposal the draft report was submitted to the client for review and comment. Detailed comments on this draft were provided by the client. These comments were reviewed and, where possible, the report was expanded to include responses to these comments. In some cases, it was not possible to include additional material suggested, because of the non-availability of appropriate background or research material.

**Step 6 -- Consolidate Findings with Remainder of Study**

During this step, we integrated the findings of the courseware report with the sub-reports on specific issues such as standards.

A detailed listing of the individuals contacted during this study is found in Appendix A. Appendix B contains a bibliography of the material consulted in completing this study.



#### **4.0 A DEFINITION OF "COURSEWARE"**

##### **4.1 There is No Single Definition for "Courseware"**

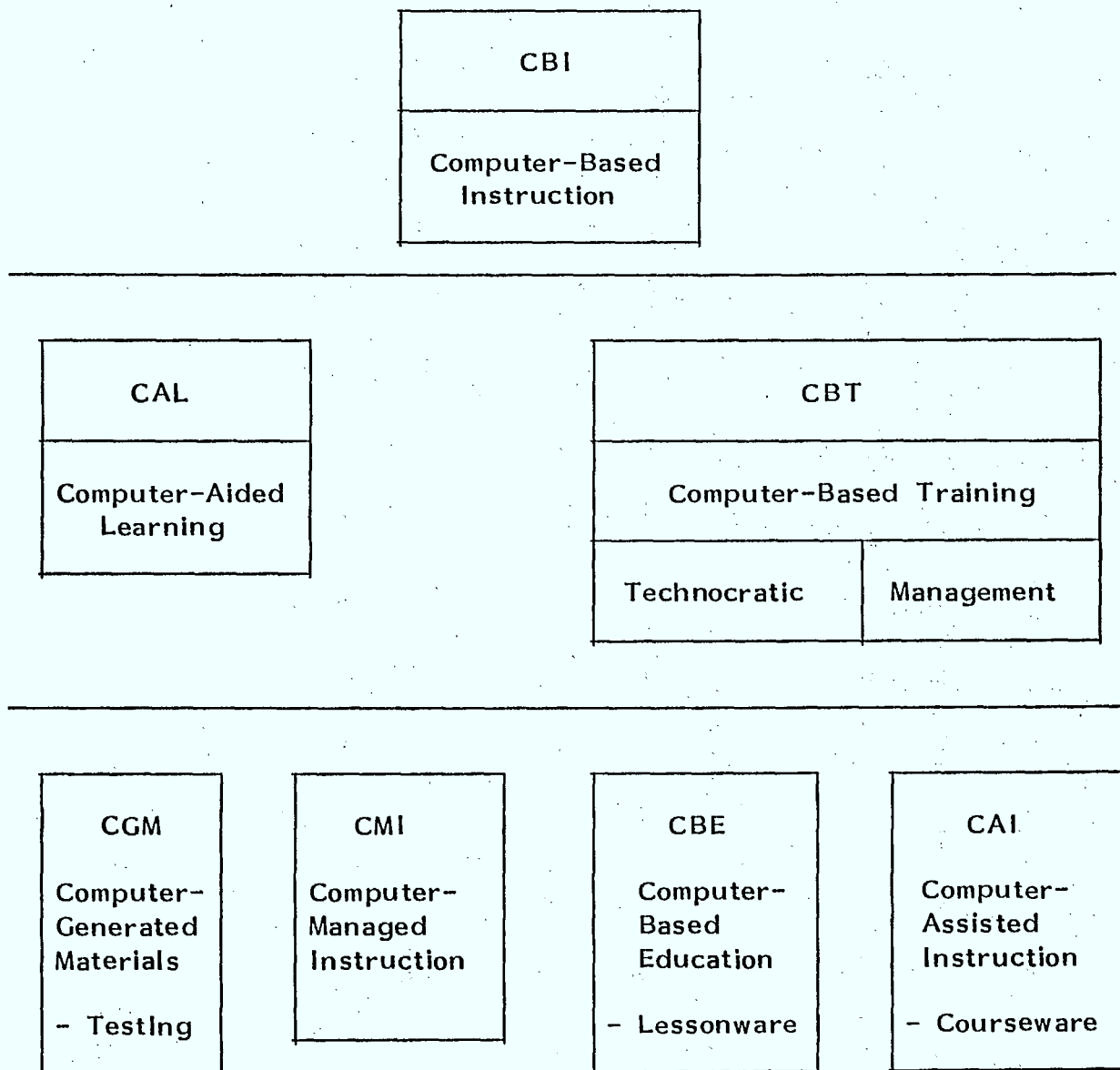
No universally accepted definition of courseware exists. The literature and participants in the industry provide a number of different definitions. The common thread among these is that courseware has to do with computers and instruction. There is one basic element of the definition that all agree on. That is -- courseware is not primarily training about computers. It is easy to see how this misdefinition of courseware has come into being when you consider that the subject matter most courseware has traditionally addressed is computers themselves. Rather, courseware uses computers in some way in the process of instruction.

The diagram presented in Figure 1 depicts one way of describing and segmenting courseware. Because specific definitions of courseware vary so substantially, the diagram below considers that any of the subsegments could be called courseware. Thus the term **courseware** becomes an umbrella under which more specific terms can be developed.

##### **4.2 Computer-Based Instruction**

The most broadly based concept is computer-based instruction. The broad term **computer-based instruction (CBI)** is then subdivided into two basic parts: **computer-aided learning (CAL)** and **computer-based training (CBT)**. This subdivision is roughly equivalent to the two major market segments of education and corporate or industrial training.

FIGURE 1

**A Definition of Courseware**

## 1. Computer-Aided Learning

**Computer-aided learning** is a term that broadly describes a series of ways that computers are used in the process of learning. The specific roles the computer can play are listed separately on the left hand branch of the diagram.

The first role is that of learning materials generator. **Computer generated materials (CGM)** may include such things as tests, evaluation forms, and lists. For example, a large number of multiple choice questions may be stored in a computer for a specific subject area. The computer would generate either specifically generated or random combinations of these questions to generate specific tests. In the case of computer-generated materials, the educator or teacher is the predominant instructor. The computer plays purely a supportive role.

In **computer-managed instruction (CMI)**, the computer manages or leads the instruction but the actual teaching is not done by the computer. For example, the computer might be programmed with a number of different sets of activities to be completed by the student, depending on the level of knowledge of the student at the outset. Based on the results of a knowledge test which the computer would receive, a specific set of activities would be prescribed for the particular student.

**Computer-based education (CBE)**, includes specific lesson materials included on the computer that an instructor would include as part of a course or program. In this

case, the educator or instructor is still the predominant figure. The computers is used as a supplemental tool to provide students with drills, tutorials, problem solving situations, simulations, gaming, or inquiry capability.

Finally, within CAL, **computer-assisted instruction (CAI)** is independent of the instructor. The computer both manages the instruction and provides the educational materials in a self contained, completely self-sufficient unit. It is this last form of courseware that experts in previous years expected would eliminate to a greater or lesser extent the need for educators or instructors. It is also this last form of courseware that is viewed increasingly negatively by many participants in the marketplace for a variety of reasons, including cost and poor quality. Later sections of this report deal in more detail with these issues.

## 2. Computer-Based Training

**Computer-based training (CBT)**, describes in broad terms how corporations or industry at large use computers in the training function. While still valid, industry does not use the categories of computer-generated materials, computer-managed instruction, computer-based instruction and computer-assisted instruction. Instead, it divides computer-based training on the basis of the subject matter. Subjects that are more skill-oriented or deal with technical matters such as mechanics, mathematics and physics are labelled on the diagram as **technocratic**. In these cases the learning material tends to be factual. The second branch is labelled **management**. This area is less skill-oriented. Rather, it deals with conceptual material that is more esoteric.

In summary, we believe the most useful working definition of courseware is a broad definition such as, "any form of training or educational activity, which includes a need for a computer to be involved in some way".



## **5.0 COURSEWARE DEVELOPMENT AND DISTRIBUTION**

Chapter 4.0 provided a basic definition of the range of instruction that had been covered by the "courseware" label. In this chapter, we discuss the tools available for courseware development and presentation, describe the general methods of courseware distribution and identify some of the costs involved in courseware development.

### **5.1 Courseware Development and Presentation Tools**

There are two key components in the development and presentation process. Courseware development is done using a variety of authoring languages. There is a need for some form of computer equipment on which the courseware can be presented to the student. In most cases, the authoring process is done using similar equipment to that used in presentation.

We discuss these two components below and then identify some recent technology developments that are having an impact on the capability and scope of courseware.

#### **1. Authoring Languages**

Many authoring languages have been developed in recent years to produce courseware. A number of the more common languages are grouped according to their derivation or use in Figure 2.

The six levels of authoring languages/packages described in Figure 2 illustrate the range in tools that are available. They move from general-purpose "programming-like"

FIGURE 2

### Some Authoring Languages Used for Courseware

---

1. Languages adopted from compilers for specific use in courseware development:

MENTOR  
CATO

FAIL  
AUTHOR

2. General purpose interpreters used for both computer-assisted instruction and non computer-assisted instruction:

BASIC  
APL

LIDIA

3. Interpreters developed specially for computer-assisted instruction:

COURSEWRITER II  
NEWBASIC/CATALYST  
TUTOR  
PILOT

TENCORE  
CAN-8  
REGENCY/USE

4. Frame-oriented interpretive languages:

IDF  
SCHOLAR/TEACH

PLANIT  
EASSY

5. Non programmed, fill-in-the-screen interpreters:

RPS-1100  
TICCIT/APT  
PHOENIX  
AUTHOR PLUS

PASS  
IIAS  
PDL  
WISE

6. Combination text, graphics and auditory:

TBT/AUTHOR

---

languages, developed for either general-purpose or authoring use, through to high-level "fill-in-the-blanks" tools. Complete CAI packages may include components from several levels. In general, the higher the level the easier the lesson is to author. As is the case with many other personal computer-based applications, the trend is toward easy-to-use tools, given that the authors are unlikely to be computer specialists.

## **2. Computer Systems Used for Courseware Presentation**

### **(a) Training**

For industry, IBM and IBM-compatible microcomputer hardware has become the de facto industry standard. Although IBM has recently introduced the new PS2, the basic IBM PC/PC Clone standard is very strong in the corporate marketplace. This is because the IBM has been widely used for many years for other corporate personal computer uses. The Apple MacIntosh is an increasingly accepted standard for graphics applications.

In some industry applications, the training is presented using a combination of computer and other media. In particular, where the training is for computer-related applications, courses are being developed that use multi-media materials, including written text, audio tapes, video tapes and courseware components -- particularly for drill and practice. Some industry applications are beginning to make use of the capabilities of the compact disk (see further discussion below).

## (b) Education

Hardware used in the education field has been much less standardized than that in industry. Early uses of CAI were primarily operated on minicomputer and mainframe systems using multi-user capabilities. Such systems were used in only a limited manner (primarily in community colleges and universities) and are unlikely to grow any further.

The personal computer has become the delivery mechanism of choice. The variety of delivery systems available reflects the fragmentation and limited standardization in the general microcomputer market. The bulk of courseware available in education has been developed for four families of machines:

- . The Commodore 64/128 (and to some degree, the Amiga).
- . Radio Shack.
- . Apple (predominantly the Apple II, but, increasingly, the Macintosh).
- . The IBM PC.

In addition, in Ontario and Quebec, "custom" computer standards have been set.

American schools have purchased commercial versions of microcomputers. Over 50% are manufactured by Apple Computers, followed by computers from Radio Shack and Commodore. The result has been a broad base of software development in the States. In

Canada, however, the decision by Ontario and Quebec governments to specify new and specific standards for hardware technology for schools has fragmented an already small Canadian software market. Commercial distributors identify the primary markets as being "Commodore-based" in the East, "Apple-based" in the West, with a limited, but growing market for IBM-based products. The direct contracting for software by the Ontario Ministry of Education is seen as an effective "shut-out" of this market for most distributors.<sup>1</sup>

### 3. Recent Technology-Related Developments

A number of developments in the area of technology will increase the attractiveness of courseware:

- Improvements in microcomputer networking capability allow a number of users to access courseware simultaneously.
- The widespread availability of microcomputers in schools, colleges and business will make access to hardware a less significant impediment to use.
- CD ROM and the new McDonnell Douglas Laserfilm storage media create a whole new range of possibilities for training and education materials, particularly in connection with interactive video.
- "Artificial Intelligence", in the forms of expert systems and natural language processing will increase both the power of interactive training software and the power and efficiency of courseware authoring systems.

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<sup>1</sup> The Pepper Wood EL-HI Report on Computers in Canadian Education 1980-1986.



Compact disk technology, in particular, has the potential to change courseware development substantially. Although CD (compact disk) audio and CD ROM (read only memory) are becoming fairly widespread technologies, the use of video disk technology in courseware development is relatively new.

## **5.2 Courseware Distribution**

### **1. Training**

Corporate training courseware is distributed through three separate channels:

- . Retail
- . Direct Sales
- . Distributors

Retail computer and book stores carry training courseware. However, the cost of inventory results in a limited and therefore poor selection for the customer. These stores tend not to carry management courseware because they cannot offer a thorough preview of the courseware before purchase. Titles tend therefore to be generic and skill-oriented. Much of the material is intended for "self-improvement" activities, for both adults and children.

Courseware is also sold directly through telemarketing and personal sales visits to corporations and other users. Direct sales are also carried out through direct advertising and product listings in computer and educational publications. Finally, distributors (including some computer manufacturers) carry courseware.

Some courseware is also provided on a "rental" basis to major corporate users through libraries of training courses provided by such major training vendors as Advanced Systems Inc., Deltak and Boeing Computer Services.

## **2. Education**

In the education segment, at the school level, courseware tends to be distributed in a variety of ways:

- Some Provincial Ministries sponsor course development and then distribute the software to school boards/schools.
- School boards purchase through tendering procedures (sometimes for specific packages, but also for bulk purchasing discounts).
- Individual schools and teachers are purchasing specific packages.

This material is being sold to all three levels by educational publishers (who have added courseware to their printed products) and specialist software distributors. Very little software appears to be sold directly by the original developers.

In colleges and universities courseware is acquired by the teaching staff through any of the distribution methods outlined above.

## **5.3 Costs in Courseware Development**

### **1. Training**

One source in the training market suggested that \$1 million for a major generic courseware package is not an unrealistic cost, considering that programmers cost between \$35 and \$75 per hour. This level of cost prohibits many

companies from developing generic courseware packages for general sale. Those companies that do are usually restricted to a few titles. The majority of courseware packages cost between \$100 and \$500 to purchase, although many cost much more. The cost to develop really excellent interactive programs are much higher. However, the market will not pay such large sums for courseware.

A different source estimates that custom designed software can cost in excess of \$60,000 to develop for a four-hour package. However, four hours of off-the-shelf courseware can be purchased for \$350 to \$450. One good hour of courseware can represent between 150 and 300 hours of skilled labour input.

Authoring in-house courseware accounts for most of the money spent on computer-based instruction because custom designed courseware is so expensive to purchase. Computer-based instruction teaches performance and task-oriented subjects well. Since it is almost one-half the cost of conventional training methods, it is a viable way to teach performance or what we have called technocratic subject matter.

Computer-based instruction appears to be economically effective when:

- It contributes to lower overhead.
- The rate of change in industry is neither too fast nor too slow.
- Capital/labour ratios are high.
- There are economies of scale to be gained from many trainees.

## **2. Education**

For the education market, an average software package can cost anywhere between \$50,000 and \$500,000 to develop. A representative of the Ontario Ministry of Education suggested that the average contract for a package was in the \$110,000 range. The timeframe to develop such a package could be from 12 to 18 months -- 4 to 6 months to design the program, 4 to 6 months to program, edit and debug, 3 to 6 months for tests, 1 to 2 months for production. This compares with about 18 months to produce a textbook.

## **3. Comparisons to Other Methods of Development**

Computer-based instruction can deliver better instruction in a shorter period of time compared to classroom training and individual study. However, the relative hours of effort to develop one instructional hour have been identified by a number of interviewees as follows:

- . Lecture -- 40 hours
- . Print -- 60 hours
- . Slides -- 100 hours
- . Computer -- 150 hours
- . Video -- 100 hours per minute
- . Interactive Video Disk -- 100 hours after the video is produced.

Clearly, there are other issues that can also be considered, particularly related to educational effectiveness. Such comparisons are beyond the scope of this study.

#### 5.4 Some Future Trends

In the field of computer-based instruction it is probable that compact disk-interactive (CDI), will replace video disk and CD ROM in some applications. In addition, the use of artificial intelligence will be increased.

Participants in the industry believe the computer will be increasingly used to provide training and education assessment in addition to being used to deliver information as is primarily the case today. Also, the computer will be viewed in the future as not only a means of delivering information, but also as a facilitator to integrate media, print, telephone transmission, video, networking and to interact with a user.

In the education sector software will be increasingly used as a tool as part of the overall learning environment, instead of attempting to make the computer the total learning environment. Therefore, using microcomputers to manage instruction will become less significant in the future. Integrating and distributing information will gain importance.

Because it is probable that the microcomputer will be integrated in day-to-day curriculums, software producers have trouble producing computer-assisted instruction programs except when contracted directly by the Ministry. Print publishers may be better positioned to satisfy the computer-assisted instruction software requirements that link textbooks, teaching practices and new technology.

In Canada, a fully developed computer-assisted instruction program tied to a textbook program is still a product of the



future. Such a program would have high correlation between content and learning sequences that appear on the screen and in the textbook, a built-in management system and the capability to re-teach skills and concepts.

In the area of corporate training, it is probable that the IBM PC/clone will continue to be the standard in terms of hardware. Standalone instructional programs will become the less prevalent type of commercially available computer-based training. Programs will be increasingly integrated with other forms of classroom and textbook teaching.

It is also probable there will be a move away from computer-based training delivery toward quasi-computer-based training programs that are more like application tools or "intelligent" job aids for trainees. Training will thus be viewed as a process rather than an event.

## 6.0 THE CANADIAN COURSEWARE MARKET

### 6.1 Size

It is difficult to estimate the size of the courseware market in Canada because:

- "Courseware" is not a product segment recognized by any standard research studies.
- Much educational courseware is sold through similar channels as more traditional educational media, such as textbooks and laboratory kits.
- Few, if any, vendors exist whose primary product is courseware.
- Much software is illegally copied and hence actual use is not directly related with courseware sales.
- Courseware is often developed internally within companies and by independent practitioners as a side line. This courseware does not appear in any formal reporting mechanism.

Despite the above, we have been able to obtain some information on the general scale of the marketplace. This information is discussed below.

#### 1. Training

A number of estimates have been made of the size of the courseware market in the area of corporate training. Employment and Immigration Canada's March 13, 1987 issue of Labour Market Bulletin suggests that the total market in 1984 for all types of training, including computer-based instruction, is over \$1 billion. A second confidential source indicates that a total of \$5 billion is

spent on all kinds of training in Canada. Some 10% or \$500 million of this figure is likely spent for all discretionary purchases of outside training products and services, including computer hardware and software. In the United States, we know that, of companies of more than 50 employees, 27% offered at least one computer-based instruction program in 1985. It might be appropriate therefore, to approximate the courseware market in Canada in the order of 30% of the \$500 million for hardware and software. Participants in the industry agree that the market for computer-based training is not booming the way some sources expected it to in the early 1980's. An earlier section in this report on impediments indicates the reasons why.

## 2. Education

In the education sector, the size of the market for courseware is easier to define because of surveys that have been completed. At the end of the 1983/1984 school year, all schools in Canada had spent a total of \$122 million to install 53,000 microcomputers. It is probable that this total reached 20,000 machines in the 1985/1986 school year. English public schools spent \$3.6 million on software in the 1983/1984 school year, and were expected to spend \$5.9 million in 1984/1985, and \$7.7 million in 1985/1986. British Columbia alone has budgeted \$28 million for computer purchases in 1987/1988. Together, the French and English markets were expected to spend \$8.5 million in 1984/1985 for software and \$10.1 million in 1985/1986. These software offerings have been compiled in a catalogue that to-date has listed 1,900 different programs in 15 subject classifications.

## 6.2 Products

### 1. Training

The products available in the training sector have only recently begun to be non-systems-oriented. Even today, some 85% of software packages are technocratic in their orientation. Specifically, a confidential report estimates that various subjects are addressed in the following frequency.

| Type                 | Frequency |
|----------------------|-----------|
| Technical            | 80%       |
| Computer Literacy    | 60%       |
| Clerical             | 40%       |
| Management Training  | 25%       |
| Communication Skills | 25%       |
| Customer Relations   | 25%       |

It is clear that most computer-based training currently does not train managers to help them do their real jobs, i.e. selling, managing and making decisions.

A key advantage of computer-based training is the ability to provide individualized learning experiences. However, off-the-shelf generic programs cannot be customized. And, individualized customized programs are extremely costly to produce. For this reason, it is highly unlikely that individually-oriented management programs will be able to be produced cost-effectively in the future.

## 2. Education

In the education sector, the Council of Ministers has a "Database for Educational Software" that contains 1,900 entries. This software has little commercial value in the retail market because of the limited ability to reuse most educational software. Publishers produce catalogues listing anywhere from a few hundred to several thousand titles.

Canadian educators rely heavily on U.S.-produced software in floppy disk format. This is a problem because the philosophical underpinnings of courseware design in the education market in the United States are fundamentally different from that in Canada. Canadian educators, therefore, find it less than desirable to use American software packages without modification.

In 1984/1985, expenditures on various kinds of software were divided as follows in Canada, as noted in the Pepper Wood EL-HI Report on Computers in Canadian Education 1980-1986:

|                               |       |
|-------------------------------|-------|
| Public Domain                 | 4.6%  |
| Licensing Agreements          | 10.8% |
| Board Purchased               | 45.7% |
| Development of Board Software | 2.0%  |
| School Purchased              | 36.9% |

It is important to note that the ratio of hardware expenditure per dollar of software is declining. In 1982/83, the ratio was 13.64:\$1.00. In 1984, the ratio was \$9.05:\$1.00. In 1984/1985, the ratio was \$8.75:\$1.00 and in 1985/1986, the ratio was \$7.08:\$1.00.

In the educational sector typical unit costs per package range from \$20 to \$75. Training packages are often more expensive, often in the \$100-\$400 range, or higher.

### **6.3 Users**

#### **1. Training**

In the corporate training market, according to our interviewees, users are difficult to define. Although any company with a microcomputer can and may purchase off-the-shelf training programs, there is no way to determine who are the major users. Large companies presumably have a greater need for training, and hence larger resources to spend on training. However, they may not necessarily use computer-based instruction. It is also probable that companies engaged in activities that are technocratic in nature will benefit most from computer-based instruction. However, these companies are not necessarily the ones using computer-based instruction. At present, it seems the vast majority of activities relate to training in the use of computers and computer packages.

#### **2. Education**

In the education sector, Ministries of Education, school boards, schools and individual teachers all act as "users" in one sense or another. It is often the case that although individual students or teachers are the actual users of the programs, it may be the Board of Education or the school that has purchased the software (or in fact the Ministry of the Department of Education may have contracted for the software to be developed either for a fixed purchase price or on a license-basis).

#### 6.4 Comparison to Other Training/Teaching Methods

In the training sector, the following applications and training methods were found to be used in a survey recently conducted in the U.S.A. by Opinion Research Corporation.<sup>1</sup> Computers would be involved in the applications and training methods from the point of simulation through to the bottom of the list.

##### Training Methods and Materials Used

| Application/Training Methods | Training For:    |                   |
|------------------------------|------------------|-------------------|
|                              | Technical Skills | Management Skills |
| Lecturers and Discussions    | 91%              | 92%               |
| Discussion Groups            | 81%              | 93%               |
| Films                        | 76%              | 79%               |
| Slide Presentations          | 74%              | 74%               |
| Audio Cassette               | 70%              | 71%               |
| Case Studies                 | 68%              | 74%               |
| Role Playing                 | 65%              | 77%               |
| Off-the-Shelf Video Tapes    | 64%              | 69%               |
| Simulations                  | 56%              | 60%               |
| Programmed Instruction       | 55%              | 44%               |
| Customized Video Tapes       | 40%              | 36%               |
| Off-the-Shelf CAI            | 37%              | 24%               |
| Customized Video Tapes       | 23%              | 20%               |
| Interactive Video Programs   | 19%              | 22%               |
| Teleconferencing             | 14%              | 14%               |
| Off-the-Shelf Video Disk     | 13%              | 13%               |
| Customized Video Disk        | 7%               | 5%                |

<sup>1</sup> Training and Development Journal, July, 1986, Employee Training in America.



Although we reviewed no survey or research material about the training methods used in the education sector, it is the overwhelming opinion of participants in the sector that "standup" teaching by the teacher is the primary method used. Clearly, the trend is to using more computer programs in the classroom to supplement other forms of teaching aids.

## **6.5 Market Trends**

Participants in the industry agree that there is a change occurring in the use of computers. Until recently, there has been a large investment in hardware and software was copied from another user. Now, there is expected to be a substantial investment in software. This could mean increased opportunities for software developers.

### **1. Training**

From a corporate point of view, computers in the training function are a "last frontier". Computers have been used for a number of years, of course, in most areas of business including finance, accounting, marketing and production applications. But, little work has been done in training.

Computer-based training is not more widespread because marketing and distribution is poor, quality is often questionable, packages are overpriced from the customer's point of view of value for money and too many vendors exist for the size of the market. In addition, computer-based training is increasingly viewed as an enhancement or augmentation rather than a replacement for either

training methods. For this reason, there will be a shift in training away from stand-alone instructional programs. Nonetheless, computer-based training is expected to continue to grow, but not at explosive rates.

Overall, the market potential for computer-based training continues to improve because:

- There is increased demand for all types of training in the corporate field.
- The training profession itself has evolved.
- There is an increased awareness of training hardware and software.
- There are better tools available for evaluating training results.
- There is an increased supply of training hardware and software.

Despite these factors, the largest contributor to the growth of computer-based training is the spread of computers already justified for other reasons. As computing power becomes more inexpensive, the incremental cost of running a computer-based training program drops.

- There is a growing perception of the need for training by management.
- Training is becoming a distinctive business function.
- Computer-based training is instructionally and economically effective.
- There have been advances in evaluation methods.

## 2. Education

In the education sector, it is likely that, unless one predominant hardware standard is adopted, the market will be too fragmented to make commercial software development really valuable to the individual developer. No one is willing to project whether such a standard will ever become reality. Until the 1983/1984 school year, school boards funded computer purchases primarily from existing budgets. In the future, however, it is probable that provincial subsidies will contribute substantially to the purchase of hardware and software based on five year plans submitted by the school boards.

All provinces, to some degree, are providing funding for computer facilities in the classroom.

Over recent years, this has developed from individual projects (at the school level) to major province-wide activities. In most cases, these province-level activities have focused on the provision of hardware and basic software, along with the development of computer literacy and computer science programs. Some key provincial initiatives have included:

- In **British Columbia**, until recently, the primary focus at the Ministry level has been on computer science courses at the Grade 11 and 12 level. However, in 1985 the province launched a major program called "Funds for Excellence" -- about 60% of the funds of this three-year program are allocated to computer activities. Another report, from the Provincial Advisory Committee on Computers, has recommended wide-ranging standards for software and hardware acquisition and methods of implementation in use of computers in school programs. They provide software evaluation services through the Provincial Educational Media Centre, which has responsibility for software as well as more traditional tools. For several years they have published

"Evaluations Microware" -- the general study guide on software which includes evaluations by teachers based on actual use in the classroom. This guide is distributed to all school regions.

- In **Alberta**, the early focus was on computer literacy training. Through major focuses on hardware acquisition from the early 1980's, there are now 27,000 computers in schools, providing a 17 students to 1 computer ratio (one of the highest in North America). They are now focusing on issues related to the integration of the computer tools with the overall curriculum and their "Strategic Plan for Computers in Schools" focuses on this issue. Software is reviewed by a Software Clearinghouse, which has reviewed over 2,000 packages and recommended use of about 200 in the Alberta schools.
- In **Saskatchewan**, where a new "core curriculum" policy mandates 50 hours of computer literacy for all Grade 5 to 9 students, they have provided additional funding for equipment and software through an "education development fund", but no provisions exist for the standardization of microcomputers across schools. The Department of Education has published guides on available software and on techniques to evaluate specific software for use by teachers. Software evaluation is done informally through a teacher network.
- In **Manitoba**, a joint government/private sector program called "Info Tek" is promoting the use of information technology in the classroom and small business. Parts of this program (Education Technology Program) focus on teacher training (6,000 teachers trained over the last 2 years) and implementation of new facilities. They have also provided a \$10 allowance per student for computer-related expenditures (in addition to the normal \$30 per student allowed for other supplies). There are not province standards for hardware and software but they have signed contracts for bulk supplies from several vendors.
- **Ontario** has taken the most major initiative, with the development of the province's own computer standard -- the Icon computer. In addition to funding the development of the hardware and offering software, they have funded the development of a wide range of courseware for specific classroom needs. Recently, they have published a report, "Strategies for Implementing Microcomputers in Schools", describing effective ways of implementing the technology in school and classroom settings.

- . In **Quebec**, they have also taken a specific computer standard approach to ensure the provision of hardware and software to meet specific provincial needs. Recently, their focus has been on the training of teachers (10,000 teachers were trained during 1985 and 1986 in computer-related areas).
- . In **Prince Edward Island**, the main focus has been on improving computer literacy. There have been no standards for either hardware or software in the past, but this is expected to change in the near future. Software identified and provided for specific courses is distributed to schools and a list of recommended courseware is provided as the "starter" kit for schools.
- . In **New Brunswick**, they have established several microcomputer research centres and an electronic bulletin board for exchange of information related to courseware and computer related topics. There are no province-wide standards for hardware or software. Of particular interest is the need for extensive courseware in both English and French.
- . In **Nova Scotia**, standardization of hardware and software is recommended to take place at the district school board level. General guidelines for selection have been published and some province-wide funding is available for new equipment acquisition. The Microcomputer Research Centre coordinates software evaluation including field testing of materials by teachers, and approved software is published and available through the Nova Scotia School Book Bureau.
- . In **Newfoundland/Labrador**, the early focus has also been on computer literacy and programs to support this were partially funded by a 50% startup grant for hardware. While a report has been developed by a Computer Advisory Committee, many of its recommendations have not yet been implemented due to financial constraints.
- . In the **Northwest Territories**, the early focus was on literacy and on drill and practice activities. There are no standards for hardware and software, however Apple computers predominate, with MS-DOS computers being purchased for courses at the high school level. Software is evaluated informally by teachers, with this evaluation being coordinated by the Department of Education.

From the above review, drawn from a recent survey of Ministers of Education completed by "Computers in Education", it can be seen that, throughout Canada, Ministries and Departments of Education are attempting to come to grips with many of the issues discussed elsewhere in this report. It is also clear that there is little likelihood, in the near future, of any general or standardized approach on either hardware or evaluations of software. It should be noted, however, that most provinces, and many individuals interviewed in this study, have referenced the Database of Software Evaluations developed through the Council of Ministers of Education Canada as an important source of courseware-related information.

The consistent themes throughout all responses were:

- . A shift towards curriculum linked courseware.
- . Major problems in identifying, reviewing and selecting courseware.
- . A need for continuing emphasis on teacher training.
- . A continuing mix of hardware standards.

### **3. The Copyright Problem**

Despite licensing agreements, illegal copying continues and will probably continue with the widespread use of floppy disks. The development of the personal computer market has raised expectations that software should not cost "too much". Pricing agreements will become more complex due to networking, multiple copy purchases and print materials. Some vendors are responding by providing "Laboratory Packs", for bulk purchases, providing sufficient discount to make illegal copying less attractive.

## **6.6 Impediments to Growth**

### **1. Impediments to the Use of Training Courseware in the Corporate Environment**

The impediments to widespread use of courseware in the corporate training field are:

- Limited availability of staff skilled in the development of good courseware.
- Portability and widespread distribution are, to some degree, limited by machine-specific software, although the pre-eminence of the MS-DOS environment provides a solid base (note, however, that configuration differences and the emergence of OS/2 both affect this apparent standard).
- It is difficult to implant individualized instruction in any organization. It is possible that such instruction provided by a computer will also be difficult to implement.
- It is unclear how tolerant people are and will be of sitting in front of a computer screen instead of a classroom where social interaction takes place. Since only a small proportion of the population is capable and willing to complete lengthy paper and pencil exercises, it is probable that a similar proportion will stay in front of a computer for any period of time.
- The notion of effectiveness in training is still fairly new. It is difficult to measure existing training methods for effectiveness. It is possible that effectiveness cannot be measured at all for new methods.
- Large sectors of the business population are still unwilling or unable to use computers to help them in their job. Many people simply do not like computers and others are downright computer phobic.
- It is important to counterbalance the demands of technology with the human factor. Companies must integrate the computer with a need for social interaction, personal feedback and group dynamics. This concept presents discouraging prospects for the complete computer-assisted instruction version of courseware.



- Since training plans are still not integrated with overall corporate goals and plans in most organizations, it appears that training as a function is still not terribly important in the overall scheme of organizations. For this reason it is probable that substantial resources will not be spent by most organizations on courseware.
- It is difficult to use courseware widely when customers vary greatly in their training equipment, facilities, locations and budgets.
- The biggest challenge is to develop better methodologies to evaluate training effectiveness. Only in this way can companies make appropriate judgements about the value received for money expended on courseware.

## 2. Impediments to the Use of Courseware in the Educational Environment

The impediments to growth in the education environment are:

- The significant fragmentation, in the Canadian marketplace, for hardware choices by provinces, school boards and schools.
- The difficulty of identifying appropriate solutions for specific educational needs from the vast array of products theoretically available.
- The difficulty of matching courseware to specific teaching objectives.
- The lack of trained teachers (trained in both the use and, to a limited degree, the development of courseware).

### 6.7 Viability

Sources would not speculate about the quantity of purchases or sales that would be necessary to make software development



viable. This is because to date there has not been enough experience with good computer-based training packages. Certainly the market for custom designed software is limited. However, possibilities exist in the area of generic packages. It is with generic packages that insufficient experience exists to estimate sales required for viability of software development.

In the education field, it is estimated that an installed base of between 50,000 and 60,000 machines would justify software development, particularly in instances where the "hit ratio" or sales penetration is expected to be high. The installed base in schools in Canada undoubtedly exceeds this figure (one estimate suggested about 120,000 computers by 1986)<sup>1</sup> -- but represents a variety of vendors and hardware. For example, when schools have purchased a particular type of hardware design, there is a captive market for software designed to run on specific machines. In cases where a high likelihood of sales success does not exist, it is probable that five or ten times as many machines would be necessary to make software development viable.

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<sup>1</sup> The Pepper Wood EL-HI Report on Computers in Canadian Education 1980-1986.

## **7.0 COURSEWARE SUPPLIERS**

### **7.1 Profile of Suppliers**

Some of the key suppliers of courseware in Canada are listed in Figure 3. There appears to be a distinct separation between courseware developers and courseware distributors. Except in the area of training about computers, most courseware developers are not involved in the production and sale of their products. We found it comparatively easy, even in this small study, to identify distributors. We found it almost impossible to identify developers.

#### **1. Training**

Suppliers of courseware in the corporate training field are very diverse. Some portion of this courseware is developed in-house by corporate staff. A further portion is custom designed for a specific corporation and not available commercially. The rest of the market which is made up of generic, commercially available programs, are supplied by a wide range of companies.

#### **2. Education**

A broad range of different kinds of suppliers provide software for the education market. These include U.S. manufacturers of computer hardware, U.S. and other foreign software houses which sell direct or distribute through Canadian distributors, U.S., British and Canadian publishers, specific educational organizations in the U.S. and Canada, the Ontario Ministry of Education as well as individual school boards and educators.

FIGURE 3

## Some Examples of Suppliers

- 
- **McGraw Hill**, a book publisher, develops generic business programs.
  - **Thoughtware** is a small consulting and courseware development company which develops and offers generic management, sales and decision-making packages. This company is Associated Thoughtware in the United States, and transforms U.S. material for the Canadian marketplace.
  - **Milliken and SRA** offer freestanding software programs from U.S. parent companies.
  - **Houghton Mifflin** in Canada produces software with some of the characteristics of computer-aided instruction. In addition to reinforcing basic skills, it provides experience in estimation and concept development and problem-solving strategies. Although there is not a major tutorial element that reteaches weak or unmastered concepts, there is a strong link between specific learning objectives in the textbook and the software program.
  - **Holt Rhinehart and Ginn Publishing** have produced computer-managed instruction programs for placement, testing and general recordkeeping to complement mass programs.
  - **Commodore** has taken 4,000 programs written by educators and culled them to a number of 650 that are of a quality they feel appropriate to make available commercially.
  - Other publishers/distributors include Canadian firms such as **Strider Educational Computer Products (B.C.)**, **Tralco Educational Services (Ontario)** and **Principal Software**.
  - Industry/Trade groups also developed courseware to support their specific objectives -- examples include the development of an economics series -- "Income/Outcome \$", by the Canadian Foundation for Economic Education.
  - **Radio Shack** also has paid for the development of 1,000 programs geared to the education market, which have been culled to a number of 60 that will be available commercially.
-

**FIGURE 3 -- Some Examples of Suppliers (Continued)**

- 
- **MECC** (Minnesota Educational Computing Consortium) supplies the majority of software for Apple users in Canada. In total, 375 school districts have licensing agreements through central provincial agreements.
  - **Control Data** has ten turnkey training centres for clients in Canada.
  - **Honeywell** is primarily interested in military applications. They also become involved in turnkey training centres.
  - **Unisys** offers a wide range of software in non-data processing subject areas, however, their computer-bases are not extensive.
  - **Microtel** (MLS) offers a wide range of training products with strong emphasis on computer-based training.
  - **NCR and Digital** both offer an incremental application strategy to computer-based training.
  - Although **IBM** is a dominant player in the area of computer-based training, they have not made a large commitment to computer-based training as a distinct business area.
  - Major U.S.-based packaged training organizations, such as **A.S.I.** and **Deltak**, have added courseware to their range of educational tools (complementing their existing use of videotapes, audio tapes and cassettes). Most of the application areas covered to date are technology-related.
-

The Ontario Ministry of Education invests in software development so all school boards in the province will have free license to the software. Some 65 to 70 producers are supported by the Ontario Ministry (the 1987/8 budget is in the order of \$6.5 million). Almost all are part-time or very small companies. As a result, it is difficult for commercial firms to survive in this market segment in Ontario, unless they are connected to the Ministry of Education.

The Council of Ministers of Education in Canada evaluates software sent from all provinces and maintains a database of software for access by all members of the Council. Although it does not act as a distributor or a supplier per se, the Council is becoming an important link in the distribution chain for educational software.

The most visible presence in the educational market are the book publishers and distributors. These organizations, already equipped to sell low cost/medium-to-high volume product to this market have seized on the courseware business as a logical extension of their main business. In some cases this can be seen as a major thrust. With others it is probably a defensive strategy.

Educational developers tend to be small (frequently one person) and part-time. Frequently, they are compensated on a royalty basis (as with paperbooks).

## **7.2 Strengths and Weaknesses**

### **1. Training**

Developers in the corporate training sector are largely dominated by U.S. firms or firms with U.S. parent companies. These organizations are far more capable of investing substantial sums of money to produce generic training materials for the large North American market. They have a distinctive advantage over Canadian-owned and managed companies with more limited resources and certainly a more limited domestic marketplace. Since Canadian and American training ideology is relatively similar, U.S. products are directly transferable to Canada. Since the market in Canada is relatively small, and the cost to produce good quality programs is so high, even for generic programs, the number of suppliers willing to commit themselves to computer-based instruction as a business are few.

### **2. Education**

In the education sector, developers are individuals or small companies for the most part. This allows the producer to be flexible and orient their efforts specifically to needs in particular educational niches. However, it also means they lack substantial financial resources to produce a number of programs simultaneously. Also, because the market is so fractured as a result of the different hardware designs, large producers have not and are likely not to develop. Thus virtually all distribution happens through publishers and agents. Some are Canadian, many appear be Canadian subsidiaries of U.S. organizations.

### **7.3 Import/Export**

#### **1. Training**

In the area of training, Canadian and U.S. training ideology are very much the same. In fact, the training ideology, particularly for technocratic subjects, is very similar to the U.S. educational ideology. For this reason, U.S. products are directly transferable to Canadian training uses. Since the U.S. industry is much larger than the industry in Canada, U.S. products dominate the Canadian scene for generic applications.

#### **2. Education**

Canada and the United States differ fundamentally about the instruction ideology most appropriate for education. In some senses, Canada is further advanced because instruction has moved away from rote mechanical exercises to learning concepts and ideas. Apparently there is some indication that the United States' educational community is beginning to evolve in the direction of the Canadian philosophy. At this time, Canadian software producers must modify any products brought up from the United States to suit the instructional ideology of Canadian educators. As the American instructional ideology begins to more closely resemble that of Canadians, it is probable that Canadian software producers will have a significant opportunity to produce software that will be acceptable in the United States marketplace. Particularly as the United States school boards accept Canadian hardware design standards such as the ICON and EDNET, a captive market will be created for Canadian software to run on these particular machines.

Despite the protectionist result of specifying hardware in Ontario and Quebec, the rest of Canada still purchases substantial amounts of software from the United States, simply because sufficient software is not available in Canada. Government funding to create Canadian products would arrest, to some degree, the heavy dominance of American software in the Canadian educational market. Certainly, as indicated earlier in this report, the Governments of Ontario, Alberta and Manitoba have provided seed money for software development in their provinces. Particularly, Ontario is a leader in having invested substantial sums of money over the last three years in the development of software. Models now exist for the educational market that other producers in the provinces can take advantage of, for the production of software.



## 8.0 BUSINESS OPPORTUNITIES

There are no dominant developers in either the education or corporate training market segments with leading positions. So there is, in theory, an opportunity for companies to become leaders in the development of software for either or both sectors. However, the major impediment to achieving a leadership position in either marketplace is investment of capital with a good expectation of adequate return. The educational market will expand in the future as the American marketplace opens. However, software producers would correctly be concerned about the lack of the hardware standard that would unify the courseware marketplace in the area of education.

Some specific opportunities identified by interviewees, or from review of our fact-finding activities, are discussed below:

### 1. Training

The training segment is somewhat less established and more volatile than the educational one. The largest and most hotly competitive segment is that related to training around the use of computers. However, organizations who can effectively move beyond this area are likely to reap significant benefits.

Some of the areas identified have included:

- The continuation and improvement of the use of CBT on the training and application of computer systems (particularly in the area of end-user computing).
- Customized training (often combined with video/CD ROM applications) for end users -- both for internal corporate users and retail-consumer markets (in this case using CBI for both training and marketing purposes).

- . "Full range" training development services for business, particularly for the small organization (which will not have its own specialist training resources).
- . Varieties of "classroom" training (an existing and growing market -- particularly in connection with end-user computer applications) -- offering opportunities to both specialist training organizations and an additional potential business for computer retail stores.
- . Authoring/co-ordination of major training programs for larger corporations (especially in those cases where the finished product will be used by third parties -- such as consumers of distributors/retailers).
- . The development of packages intended to assist basic job training and skills upgrading within organizations.

## 2. Education

This is the longer established marketplace in product, applications and suppliers. However, new and evolving opportunities continue to appear:

- . Elementary and high school programs continue to have a major need for CBI that is closely linked to curriculum (while some curriculum related work is being done, most of the products being offered are more generic in nature).
- . With well over 90% of material on offer being non-Canadian in origin, there is a continuing demand expressed for Canadian-oriented materials (with the qualification that these must be well done and at least comparable in quality to U.S. offerings).
- . Since the key problems here seem to relate to methods of evaluation and distribution, there may also be opportunities for both production use and for evaluation purposes.

## 3. Other Opportunities

The sections above focus on the opportunities for courseware development and support in the training and education field,

unfortunately, for the above, distribution appears to continue to be the more profitable activity when compared to actual courseware development. This means that, particularly in the educational market, some of the more significant opportunities will likely emerge in the distribution area. For example:

- School boards, schools and teachers need access to impartial, well-structured information on courseware being offered and relevance to their specific curriculum needs. Opportunities likely exist, despite the existing review programs in operating in the provinces, to provide this type of information -- whether through journals, guides, electronic databases or specific consulting services.
- "Canadianization" of "foreign" packages, may also be a good potential market. This would require identifying a need in the Canadian market and obtaining the rights to modify a foreign package (probably U.S.-source) to meet the Canadian requirements. The challenge here will be identifying big enough target markets. These might exist in specific curriculum needs of a province or in large industry or industry group (eg. trade association) areas.

## **9.0 IMPACT AND IMPLICATIONS**

### **9.1 Training-Related Issues**

It is probable that the continued use of computer-based training for organizations with easy access to computer terminals will result in a decentralization of training delivery and an integration of training activities into everyday business procedures. Computer-based training will thus become an ongoing process rather than a one-time event.

Some of the continued trends are likely to be:

- Technology will continue to be a driving factor -- with higher performance, lower cost and greater availability of tools.
- This technology development will likely allow more computers to be dedicated for the training function.
- Despite technological advancements, hardware advances will likely outstrip software advances, which in turn will still outstrip application.
- The major inhibitor is likely to be the lack of well trained individuals to develop good CBI programs (only a few institutions, such as Sheridan College in Ontario, are offering effective programs in courseware development).

### **9.2 Education-Related Issues**

In this longer-established field, we are more likely to see continued evolution along the lines already observed. Areas of note are likely to be:

- The continued availability of more powerful computers within the educational environment will increase the potential for effective use of good courseware in many programs.

- Despite the efforts of provincial ministries, much of the courseware development is likely to continue in a fragmented manner.
- Provincial ministries will likely have to continue proactive efforts as funders of curriculum-related development.
- In universities, colleges and schools, the increased availability of networking and networking products will likely impact methods of software distribution and program delivery.

### **9.3 Some Policy Options**

#### **1. Issues at the Federal Level**

Many of the areas in which policy options may be considered are not directly influenceable at the federal level. This is particularly true in the educational area. Most interviewees were also cautious about any roles that might be played by the federal government. Some areas that were raised included:

- Specific research into methods of CBI effectiveness assessment.
- Providing encouragement to the CBI industry through example (i.e. by making increasing use of CBI within the government and having effective procurement methods that will develop the Canadian industry).
- Consideration of standard approaches/criteria for selecting courseware for use within government programs.

#### **2. The Biggest Need is for More and Better Information**

Many interviewees (both private and public sector) identified the biggest single challenge for vendor (and customer) as identifying more effective methods of identifying:

- . Opportunities for the development of courseware.
- . Identifying suitable developers.
- . Providing effective distribution chains for developers.

It is noticeable that, within the educational market, regardless of overall strategy, most provincial education ministries provide services related to information dissemination to school boards and teachers.

### **3. Funding of Courseware Development**

It seems clear that courseware development can be compared to the related activities of authoring textbooks and other materials for industry or classroom. Rather than suggest that government funding should be made available specifically for "courtroom" development, it may be worthwhile to examine other government/industry schemes which provide funding and assistance for the development of training/education/published materials and ensure that courseware development is eligible for this type of funding on the same basis as other, more traditional means.

**Appendix A**  
**INDIVIDUALS CONTACTED**

**Appendix A**  
**INDIVIDUALS CONTACTED**

| <b>Company</b>   | <b>Individual contacted</b>                        |
|--|--|
| Association of Educational Software Producers                          | Robert Arn, President                              |
| Canada Employment & Immigration Commission                             | Matthew Robertson                                  |
| Council of Ministries of Education                                     | Sue Ewing  |
| Digital  | Crystal Hulbert                                    |
| ESTC   | Glen Myers, President                              |
| IBM  | John Bailey<br>Don Brown                           |
| V. Jamieson/Williams Group, Inc.                                       | David R. Williams, Consultant                      |
| Meridian Technologies Inc.   | Robert Arn, President                              |
| Ministry of Education (Ontario)  | Lorne Smith, Executive Director<br>Luella Edgerton |
| Ministry of Industry, Trade and Technology (Ontario)                   | Peter Buchanan                                     |
| Ministry of Skills Development (Ontario) Institute for Skills Training | Anne Martin  |
| National Research Council  | Jack Brahan  |
| O.I.S.E.   | Don Burrill  |
| Ontario Society for Training and Development                           | Cheryl Clay  |
| Sheridan College   | Bob Jones  |
| Software Development Assistance Corp.                                  | Judy Horne   |



**Company****Individual contacted**

Software Ontario Corp.

Joseph Konig

Softwords Learning Systems

Ellen Godfrey

Stevenson Kellogg Ernst &amp; Whinney

Barbara Hungate, Consultant,  
Courseware Development

Thoughtware Inc.

Shane Tracy

Unisys

Ian Montgomery

In addition, some 10-15 informal interviews were conducted with exhibitors at the "Computers in Education 87" conference in Toronto, October 21-23, 1987.

**Appendix B**  
**BIBLIOGRAPHY**

Appendix B  
BIBLIOGRAPHY

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