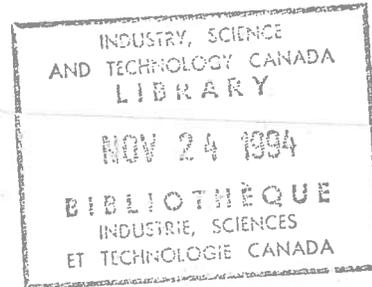


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# TECHNOLOGIES AND LIFELONG LEARNING

## VOLUME I

Report for the  
Prosperity Secretariat

By

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Steering Group on Prosperity



PROSPERITY INITIATIVE



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### SOURCES USED



# EXECUTIVE SUMMARY

Efforts to realize the objectives of lifelong learning have not yet taken advantage of state-of-the-art technology. Advances in technologies and in software development now enable education and training programs to offer the type of services necessary for lifelong learning: programs individualized for the learner; customized to meet client needs; results-driven and flexible in location, timing and method of delivery and credential-based. These advances make access to learning more equitable and they open up a large range of choices for learners. Lifelong learning is not likely to become a reality without extensive use of learning technologies.

Education, training and learning in Canada are at risk, according to many. The quality of output from our institutions is widely viewed as inadequate. Once people leave the formal system, they have few opportunities to continue to learn and, for many, the concept of learning ends with formal schooling. However, basic skills and the tools to pursue lifelong learning are now seen to be necessary for Canadians to participate actively in the economic and cultural life of the country.

This report summarizes key successes and barriers to technologies in lifelong learning, and identifies characteristics of four priority groups for lifelong learning. As well, it proposes initiatives to create an infrastructure for the realization of lifelong learning in Canada. Volume II of the report contains cases, examples and data to support the analysis.

## Successes and Barriers

Attachment A presents examples of new modes of learning, created by the symbiotic relationship between technological innovation and lifelong learning. The experiences are often impressive, whether from distance-learning projects, in-house training activities, open learning systems, access to educational information and administrative networks or from primary and secondary schools. They demonstrate at times dramatic learning gains and elicit consistently positive attitudes on the part of learners of all age groups. Taken together, the examples show that technologies can successfully support every step in a person's lifelong learning map.

Attachment B is a synthesis of issues which will shape the public policy debate on the role of technology-based learning. Among the key issues are the following:

- Governments and education institutions will lose their traditional control. Commercial interests are emerging as active participants in the provision and development of technology-based learning, leading to a larger degree of competition, novel in the learning environment.
- The learners themselves will force governments and companies to change their policies and programs as they opt for the flexibility and choices these modes of learning provide. Learners can enrol in courses from a distant college, from other provinces and other countries, can compare quality and choose delivery modes that are convenient for them.
- Institutions will need to drastically change operating procedures to effectively use learning technologies. Open entry/open exit and self-paced learning appear

to be most suitable for such an environment, but are difficult to mould out of an existing institution.

- "Education professionals", such as teachers, trainers and administrators, are beginning to see the value of technologies in the learning process. The barriers they see are lack of sufficient hardware which will create bottlenecks in the learning process, and limited opportunities for professional development which will lead to ineffective use of the technologies.
- Under the surface, however, loom some difficult contract issues such as instructor-learner ratio, "opening hours", and the availability of facilities and staff during the summer months.<sup>1</sup> Other issues relate to funding structures, public sector partnerships, the provision of hardware, and the availability of appropriate material.
- Jurisdictional and structural issues will dominate the debate over technologies for lifelong learning, impeding progress.

## Priorities in Lifelong Learning

To translate the debate over technologies and lifelong learning into a more concrete action plan, a focus on four main groups of learners is proposed:

- Learners who are now in primary and secondary schools.  
  
Technology-based learning can help them "learn how to learn" and motivate them to remain in school until they master basic skills. One of the most important investments we can make in our learning future is to ensure that hardware, materials and human resource development are put in place to bring technology-based learning to the schools. Some of the examples in Attachment A demonstrate radical initiatives to financing such investments. These range from budget reallocations, to changes in class sizes, to commercial-public partnerships.
- Learners in need of basic education.  
  
Assisting all Canadians to obtain the basic skills necessary to function in today's society is possible today with the use of technologies. With learning technologies at hand as an ally, action should not be delayed.
- Today's eight-year-old, who will be seeking access to post-secondary education at the turn of the century.  
  
A great proportion of the younger age groups will be participating in higher education. To serve them by expanding existing models of education, with its high costs of infrastructures and services, does not appear to be a viable option.

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<sup>1</sup> Studies show that costs of learning hardware can be very high and need to be reduced on a per learner basis. Extended opening hours and year-round operation will be an attractive way of spreading costs and bringing more advanced technologies into the system. Technology-based learning is ideally suited for such operations.

Open, self-paced and distance-learning models which use new information technologies promise to be efficient, productive and effective. Such models need to be initiated now to be in place in time. Given the existing infrastructure and expertise, we propose an evolutionary path toward this future. It would see internal and external structural changes to existing institutions, such as open entry/open exit enrolment, and mandated co-operation in course development and delivery, using learning technologies.

- The two million or more Canadians who will be looking for access to learning, retraining and upgrading annually.

The needs, learning experiences and personal situation of these new learners will be diverse. They will need to upgrade basic skills, refresh trade skills or technical concepts, or study advanced technological innovations. Some will need access to existing materials, others will need to connect to recent innovations (e.g. in automotive design or in biomedical research). They will need this at a place and time that is suitable, in convenient modules. Serving this group is the combined task of business and educators.

Businesses, firms and associations, as purchasers and developers of training, have an important role to play in forging a lifelong learning system for this "fourth group" of learners. Many of the companies already use technology-based training where it is cost effective and suitable. Through their purchases, they can increase the pool of technology-based materials available. Releasing these materials for sale to other companies, individuals or associations will have a direct impact on the availability of lifelong learning opportunities of Canadians.

## Infrastructure

The infrastructure essential to providing learning opportunities for these priority groups has four components, i.e., learning hardware, learning materials, an electronic backbone, and human resources. The initiatives related to hardware and to materials development are absolutely critical to the success of lifelong learning and need focused and immediate attention. The other two will fall into place with time.

- Learning Hardware

Access to learning hardware is critical. Insufficient or incompatible equipment will frustrate development. Access to hardware can be possible through a vigorous program of establishing learning centres - or "learning hubs". We believe that a large percentage of the activities under lifelong learning will take place at learning centres and classrooms, not at home. The cost for such an undertaking will be high. Under the right conditions, however, private money can be attracted for the establishment and operation of learning hubs. Public institutions can also co-operate by keeping schools open for extended hours during the summer, and allowing individual learners or college/university-level students access to the equipment.

- Learning Materials

Learners will need choices of appropriate, relevant and fun materials, courses or delivery modes. The best "learning hub" and the most advanced electronic

backbone will not be used unless they offer what the learner wants and needs. A large amount of the necessary content knowledge exists in educational institutions, in industry and in business. The purchasing policies of large private companies and government may be the key to creating a pool of materials of value to a large group of learners and to creating a healthy production industry.

- **Electronic Backbone**

The electronic backbone that links learners, learning hubs, materials, information sources, learning support, tutors and peers is an important component of the learning infrastructure. The public network will make major strides, in the next decade, toward offering an all-digital service, which should come close to meeting many of the needs of learners. Telephone carriers and cable operators can make important contributions, as they are doing in the U.S., by underwriting the physical expansion of their networks into individual classrooms. The learning community itself must play a much more active role in shaping services and tariffs. It must pool its expertise and resources to be heard in the appropriate forums. An educational user telecommunication alliance could intervene at CRTC hearings, help formulate software standards and guide software and technology research.

- **Human Resources**

Lastly, human resource development must be accelerated and diversified, both in formal training and in professional development. To function in the new learning models, new and different skills will be required. For example, many teachers and trainers will act as facilitators and will no longer deliver learning; tutorials may be carried out via electronic mail, not in person. People such as supervisors will have to take on support functions, such as tutoring, and will find that they need training to cope effectively. To date, few opportunities are available to gain these skills formally.

## **Conclusion and Recommendations**

Technology-based learning will no longer be an option which governments, institutions and other learning providers can ignore. Learner demand and market pressure will make this learning mode a reality. In order to forge a lifelong learning system that makes the best use of our resources, a number of interventions are recommended.

Critical among them is the need to establish partnerships between public educators and private interests, which make the establishment of learning centres mutually beneficial.

In order to develop the pool of learning materials and the required expertise, new courses and learning modules in the public and private sector should be reviewed to see if they are suitable for technology based delivery. Curriculum changes should be accompanied by technology-based delivery methods. A User Alliance should be created among educators to ensure that their interests are represented in regulatory and policy debates and in the development of research agendas. Lastly, training and negotiation should be increased to ensure that the people operating the new learning models are trained and available.

# CHAPTER 1

## INTRODUCTION

This paper was commissioned by Consulting and Audit Canada, for the Prosperity Secretariat (Learning), as input into the deliberations of the Steering Group on Prosperity. It has its foundation in the publication *Learning Well . . . Living Well*, the discussion paper released at the time the Prosperity Initiative was launched, and in the National Roundtable on Learning (Aylmer, February 1992).

It focuses on the strategies and initiatives designed to fuse the partnership between lifelong learning and learning technologies. It is based on a review of existing materials; interviews with key people in leading-edge projects; and discussions with analysts from education, training, and telecommunications and with regulators.

Volume I first identifies benefits that have accrued when technologies were used in the past. It then discusses priorities for lifelong learning and steps that need to be taken to bring learning opportunities to the target groups for lifelong learning. On this basis, the report paints a picture of an infrastructure that will support these opportunities. As well, it addresses issues that will influence the direction of a technology-based lifelong learning system and the speed with which it might develop. Lastly, it presents recommendations for action.

The analysis in Volume I is based on data and examples reported in Volume II, which consists of five Attachments. Attachment A highlights uses of technologies for learning; B identifies barriers; C identifies relevant research; D outlines some relevant organizations; and E defines and lists learning technologies.

### 1.1 Context

"Technological innovation is the pull factor which, heretofore, has been missing in efforts to realize the objectives of lifelong learning."<sup>1</sup> Advances in technologies and in software development now enable education and training programs to offer the type of services necessary for lifelong learning: individualized for the learner; customized to meet clients' needs; results-driven and credentials-based in design; and flexible in how, when and where they are delivered. They also make access to learning equitable and open up a large range of choices for learners. Lifelong learning is not likely to become a reality without extensive use of learning technologies.

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<sup>1</sup> Morrison, T.R., Lifelong Learning and Technological Innovation, in National Institute of Multimedia Education. *The Second International Symposium on University Distance Education*, Tokyo, Japan, juillet 1990, p. 7.

## 1.2 Dramatic Success with Learning Technologies

Attachment A documents the success of technologies in supporting the learning process. Evidence shows that:

- Primary and secondary students are better equipped for lifelong learning when they use technologies in "learning how to learn" and in acquiring foundation skills in reading, writing, mathematics, technology and group work. As a result, future generations will be better prepared to pursue lifelong learning.
- Learners who are not interested in pursuing an academic career can make a more effective link between learning and the skills they need for work or for everyday life. For example, self-testing can be done to determine if language skills meet the language level required for a technical education. In addition, technology-based courses can use simulators to help familiarize students with the kinds of technology they are likely to use in the workplace. Also, computer-based learning can help familiarize students with rapidly changing technology.
- Technology-based learning can help learners who initially chose a non-academic career make up the components they need for an academic program.
- College and university education becomes learner-oriented, more closely linked to the world outside the learning institutions and more efficient through judicious use of technologies. This applies to on-campus as well as off-campus education. It is an important factor at a time when the majority of entrants will be older and will not have come directly from secondary schools.
- More people can enter post-secondary education since restrictions resulting from lack of physical space, class schedules or the local availability of relevant courses do not apply to technology-based off-campus studies.
- At risk students, dropouts, and others who have left the formal education system without having acquired basic skills appear to be motivated by the use of learning technologies. They often achieve impressive learning gains in reading, writing and mathematics.
- Students enrolled in continuing education and training courses (degree or non-degree) are major beneficiaries of technologies. There are many examples of innovations and initiatives by organizations and individuals involved in continuing education.

- Workplace training can become more cost effective by using technologies because of reduced learning times and consistent or improved mastery of the subject, combined with flexible scheduling that allows training to be integrated into a normal work day.
- The examples also illustrate the use of technologies and software to manage and administer off-site education or self-paced learning. Such an infrastructure is essential for the growth of lifelong learning.

In summary, the benefits of technology-based learning include:

- demonstrated and at times dramatic improvement in learning;
- consistently positive attitudes of learners, such as:
  - young adults (including native Canadians) who have left the formal system or are at risk and who appear to be motivated by technology-based learning tools,
  - older learners who generally seem to like learning with the help of technologies,
- the increase in subjects choices for learners, as well as the provision of higher quality content;
- flexible access to learning;
- more efficient administration of learning:
  - testing (and self-testing), registration, mentoring and monitoring the progress of independent learners are facilitated by technologies,
  - technology makes it possible to capture and update the individual's "learning history" through a "learning credit card".

A review of the cases and examples suggests that technologies are essential to learning and even more essential to implementing the concept of lifelong learning. However, it also raises a key question:

If technology-based learning has all the attributes highlighted in this report, why is it not used more extensively?

### 1.3 Barriers and Solutions Related to the Use of Technologies

Evidence shows that technology-based learning is quickly gaining acceptance in schools, colleges and, in particular, in-house workplace training. The last five years have seen impressive gains. This growth is bringing to the fore barriers to the use of technologies in the learning process (identified in Attachment B). The situation can be summarized as follows:

- Barriers are largely related to issues of jurisdiction, of financing methods and procedures and of raising sufficient capital funds to purchase the requisite hardware. These can be bottlenecks in any change process.
- They are more pronounced in the public education sector than in corporate or private sector training.
- Learners are generally positive about the use of well-executed educational technology programs and are not likely to be deterred by barriers.
- Teachers, trainers and others educators increasingly support the use of technologies in the learning process. Their concerns and suggestions are specific. These include better preparation of professionals to use the technologies and access to sufficient hardware and materials to warrant the transition to new learning and teaching methods.

Documented initiatives to overcome these barriers include:

- partnerships linking the private sector's access to capital and its management approaches with the educational know-how of public institutions;
- partnerships combining the private sector's expertise in the development of learning materials and their marketing outlook with the content expertise and accreditation function of public institutions;
- purely commercial ventures offering short, modular and output-oriented learning packages, particularly successful for in-house training;
- government legislation effectively giving school boards a mandate to use technologies; e.g., by directing all schools to offer an advanced and specialized curriculum;
- incentive and training programs directly involving teachers and learners in the formulation of learning programs; and
- donations of equipment and infrastructure from the private sector, e.g., cable TV companies, equipment manufacturers.

## CHAPTER 2

# LEARNING AND TECHNOLOGIES: FOUR AREAS FOR PARTNERSHIPS

According to many accounts, there is a crisis in education, training and learning in Canada. The quality of output from our institutions appears to be below expectations. Once people leave the formal system, they have few opportunities to continue their education. For many, the concept of learning ends with formal schooling. However, basic skills and the tools to pursue lifelong learning are necessary if Canadians are to be active participants in the economic and cultural life of the country.

Lifelong learning implies a culture that values learning from cradle to grave. This means that more adult learners will seek access to learning, with more say over what they learn. Traditional methods of providing this learning will not satisfy the needs of the new learning culture, even with significant expansion of existing facilities and services, as many adult learners will be constrained by teaching hours, transportation, semestering and so forth. Technology-based learning can overcome most of these obstacles.

Further, the traditional learning system may not be appropriate for many new learners. People are looking for learning that is short, modular and more job or sector specific than is typically offered. The appropriate sources may be in-house, suppliers, equipment vendors or trade associations. These groups increasingly use technologies to support training and can be expected to do so even more in the future.

Lifelong learning must be very much a part of primary and secondary education. Here, the primary benefits of learning technologies are not related to satisfying increased demand and flexibility of access, but to providing better choices and quality of learning and to developing the tools for lifelong learning.

Lifelong learning is a vast "continuum", with many areas where technology-based learning can help satisfy a learning need. In our model for lifelong learning, we focus on groups of learners who need immediate learning opportunities; i.e. for upgrading basic skills and for retraining and further training. The needs of the other groups also have to be tackled before a crisis is reached around the end of the decade. For example, today's school children will need access to appropriate tertiary education by the turn of the century.

Four groups of learners deserve priority attention:

- people of school age who need a solid foundation, including the tools for lifelong learning;

- those who have left school without adequate basic skills, or are on the verge of doing so, who need remedial education;
- school leavers who will need access to post secondary education;
- people who have left the formal education system who will need learning opportunities and choices.

## 2.1 Giving Young People the Tools

To be part of the learning culture, young people need two sets of tools.

- **They need to "learn how to learn" inside and outside of formal education, i.e. where to find resources, how to use them and how to choose alternatives.**
- **They need to get a basic education in skills ranging from reading and writing, mathematics and technology to group work.**

Technologies can help young people develop these tools effectively while they are in primary and secondary education.<sup>2</sup>

Telecommunications links and data storage facilities, such as CD-ROM, can give the learner access to a universe of information far beyond textbooks and school libraries. Further, this access is available to learners wherever they live. With these facilities available, students will be encouraged to use their own judgement and initiative while sorting, analyzing and choosing from this wealth of information. These skills are integral to learning, both for work and for personal enjoyment.

Technology-based learning also is a major asset for learners who need to acquire more than basic education. Advanced geometry or electronics courses in rural or remote areas can be as exciting and as advanced as they are in schools with a large contingent of subject-matter teachers. Video courses brought in by satellite TV, or available on a multimedia platform, can make this happen. Further, the use of technologies in itself can benefit the learner's understanding of technical processes.

Examples and analytical studies stress that nothing short of a dramatic change in the teaching-learning paradigm will bring about the necessary results.<sup>3</sup> Such changes will only happen over time, given the scope of the task, the present barriers, and the amount

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<sup>2</sup> See Attachment A for details, specifically case studies under the rubric of primary and secondary education.

<sup>3</sup> See Attachment B: Barriers for details.

of funds required. Less dramatic approaches are being implemented, sometimes on a large scale,<sup>4,5</sup> with apparent success.

The first steps toward providing today's school population with a foundation for lifelong learning are:

- **Implementation of immediate and large scale professional development programs for teachers and staff to help them integrate technologies more closely with school activities.**
- **Reallocation of a significant percentage of overhead and payroll budgets to the purchase of technology and software.**
- **Adjustments to procedures and regulations, such as restrictions on telephone connections in schools, internal wiring, cable TV, etc.**
- **Establishment of policies and guidelines that define the technology and software base that a school should offer its students, e.g. mandated access to appropriate databases or access to advanced subjects that are not taught in all schools.**
- **Creation of a climate for partnerships with the private sector to draw on additional capital and to benefit from possible economies of scale to access materials, courses and information.**

## **2.2 Empowering Adults with Basic Education**

A large percentage of the Canadian population (between 20% and 30%) reportedly does not have the reading, mathematical or communication skills that will be needed to function effectively in the work or cultural environment of the future. This presents a high cost to the economy (some estimate a loss of \$4 billion annually). Not only do many adult learners achieve more with technology-based learning, they also accept the method, which motivates them to learn and increases their self-esteem. Evidence shows significant success in improving basic education for students at risk, drop outs and older learners. The case studies show that technology-based programs may be efficient, as staff can usually handle larger numbers of learners. Sufficient courseware also exists to start the job.

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<sup>4</sup> For example, the Kentucky legislature has mandated all school boards to have the capacity to link into an educational satellite network for supplementary teaching in advanced subjects and for teacher in-service training. Further, all classrooms must be connected to the telephone system. Non-compliant schools will be integrated into schools with these resources.

<sup>5</sup> Supplementary teaching via satellite or audioconferencing is also expanding in Canada.

Given these findings, it is difficult to understand why we are not using technology-based learning for more significant initiatives. The consistent and often dramatic gains achieved by this group of learners should provide sufficient evidence for action.

The next steps in the strategic direction should focus on implementation and cost:

- How can technology-based learning be made available to the large number of learners needing basic education who are located in all parts of the country and who span the age groups from high school to retirement?

The following strategies appear appropriate:

- **Review results from projects, technologies and courseware to develop a plan for immediate implementation of the cost-effective delivery of basic education to adults.**
- **Implement a major in-service education initiative to foster the understanding and use of technology-based learning by those who plan and deliver basic education to adults.**
- **Encourage funders of basic education for adults to adopt a technology-based approach in their service contracts with providers. The contracts would stipulate mastery and cost per learner, as opposed to the present approach which ties payment to length of time in training. (Applies equally to public and private sector purchases.)**
- **Open up purchase rules and policies to encourage private companies to become partners in the process of providing this training.**

## 2.3 Ensuring Opportunities for Qualified School Leavers

A lifelong learning culture will further support the trend for increased participation of 18- to 24-years-olds in post-secondary education by the turn of the century.<sup>6</sup> The expectation that employment opportunities will be better for people with a post-secondary education is a major factor in this trend. The capacity of institutions to serve this demand through traditional means, by adding buildings and staff, is questionable, given funding constraints.

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<sup>6</sup> Conversation with AUCC staff.

Experiences with technology-based learning can guide the development of a cost-effective approach to opening post-secondary education to larger numbers of learners.<sup>7</sup> Two principal approaches are being used. One is technology-based distance education, the other is on-campus education operated as an open-entry/open-exit system, coupled with self-paced learning.

The economic benefits of a technology-based approach to post-secondary education largely depend on courseware costs, hardware utilization and costs associated with tutorial staff, administration, etc. On campus, sufficient numbers of learners will make courseware costs very reasonable over time. To achieve a reasonable cost per learner, the more costly and sophisticated hardware and facilities need to be used extensively. This can be achieved on campus in open-entry/open-exit arrangements, where drop-outs as well as accelerated learners can quickly be replaced by new entrants. At the same time, it must be worthwhile for an institution to revamp its classroom-based delivery system and to invest significant funds in hardware and materials in order to graduate more people in a shorter period of time. Again, a move from time-based to mastery-based funding will be critical here.

In distance education, the economics of hardware are different. The use of costly and more advanced technologies will likely need to take place in a multi-user "learning centre" and materials destined for home study will need to use the technologies available in most households, such as the telephone, TV, video or, increasingly, computers.

The implementation of a post-secondary system that will offer access and choices to school leavers anywhere in the country by the turn of the century must start now. Some opportunities are available now on a regional basis, through Athabasca University, the Open Learning Agency, Télé-université, and some TV or correspondence credit courses that count toward a degree.<sup>8</sup> Significantly more options can be available in the future. Technologies are a major asset in preparing these options.

The following strategies will help develop a more open system by the turn of the century. The strategies' aims are to develop, in institutions, capabilities for the support of such a system, including administrative procedures and the know-how to develop and use appropriate materials. This will involve:

- **Developing financing arrangements which ensure that the economic benefits of technology-based learning accrue.**
- **Offering incentives for staff and faculty to use, adapt or develop courseware for a technology-based delivery system.**

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<sup>7</sup> The examples in Appendix A of Athabasca University, Télé-université and the Northern Alberta Institute of Technology are particularly relevant here.

<sup>8</sup> See Attachment D for some more details.

- **Developing a substantial pool of learning materials by mandating that courses under development by a public institution must be designed to work with different delivery methods.**
- **Eliminating duplicate course development through targeted purchases. This applies to purchases by the private sector as well as the public sector. Duplications can be reduced by measures such as: linking the purchase of training seats and "contract training" to flexible access in terms of location and time and to subject mastery.**
- **Developing procurement procedures which encourage co-operation among public institutions as well as with private companies. Measures might include, for example, shared royalties from sales to third parties.**
- **Establishing advanced technology learning centres for use by learners from schools, colleges and universities. Private interests might be added to such partnerships to bring in capital and operating flexibility to the learning centres.**
- **Reviewing jurisdictional and credit issues in order to turn the opportunities provided by technologies into a reality. Possibilities include a flexible credit pooling system or challenge examinations to establish "prior learning".**

## **2.4 Serving the New Group of Learners**

Over two million adults annually may seek access to opportunities for lifelong learning, should the learning culture take hold.<sup>9</sup> They will live in all parts of the country, will be employed or unemployed, and often will have family responsibilities. Their prior learning experiences will be varied, as will their learning needs, interests and styles. As a group, they will need the flexibility to learn at times and places that are convenient for them, choices in terms of what they learn, and learning materials that are suitable given their backgrounds. Further, they will tend to favour learning that is packaged in short modules which build upon each other rather than full-length courses.

Examples of the uses of educational technologies in Attachment A attest to the range of opportunities that technology-based learning opens for adult learners. These range from graduate level technology courses delivered to work sites via satellite, to workplace safety training for employees delivered on PCs, to Interactive Videodiscs to enrich a museum visit.

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<sup>9</sup> According to Bates, the figure for British Columbia is 150,000, which is roughly 10-15% of the population of the country. The number of 2 million may therefore be reasonable.

At present, learning opportunities for this group are limited and fragmented. Those that exist are offered through continuing education or part-time studies at colleges and universities. In-house training programs, private sector trainers, and suppliers of equipment or services represent another source of learning for this group. It is likely that much of the knowledge and skills that make up the content needs of this group are being taught or delivered somewhere in the country. Learners, however, cannot readily access these opportunities, as delivery is at specific locations, face to face. The learning opportunities also are not "curriculum-" or "progression-oriented", meaning that it is difficult for a learner, or an employer, to develop a learning path, to avoid overlaps in content and to be confident that a new course is at the right level for the learner. Another handicap is the absence of an administrative structure that supports lifelong learning.

Technologies can make a significant contribution to serving the emerging client group. Multimedia technologies can facilitate access to suitable materials. Telephone and computer links connect learners and tutors anywhere in the country. Computer-based testing and measuring tools can help position learners in relation to learning materials. A computer-based personal learning profile can help the learner identify and track a personal learning "map". Administrative software protocols, combined with telecommunications links, can effectively manage enrolments, withdrawals, completion and progress of large numbers of learners, located anywhere in the country.

Most of these technologies' applications are being tested or are already commercially available. The key issue for a strategy is to stimulate a learning and economic climate that will make it worthwhile for providers, learners and employers to use them.

The following strategies will help stimulate market demand for technology-based learning:

- **Convert planned and existing courses into technology-based products,<sup>10</sup> while encouraging a commercial orientation and an appreciation of market value of learning materials through partnerships between public and private interests.**
- **Develop a learning delivery system that targets the newly emerging client groups. Encourage initiatives where commercial interests finance and operate the technological infrastructure, and leave content matters to educators.<sup>11</sup>**
- **Rationalize the accreditation system to help learners build a personal learning path, which includes technology-based courses, experiential learning and in-**

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<sup>10</sup> See, in Attachment A, an example of an innovative approach by Seneca College to develop courses that are portable.

<sup>11</sup> See the points under "Private Commercial Ventures" in Attachment A, and "Financing" in Attachment B, which reflect experiences and debates on the topic. The description of the Open Learning Agency in Attachment D is relevant as well.

house courses. Computer-based testing and performance measurement tools are needed to support the process.

- **Create a nation-wide service dedicated to the support of part-time learners who will enter and re-enter the learning system over time, and irrespective of where they are located. Functions should range from registration to monitoring assignments to testing and the exploration of the "Learning Credit Card".<sup>12</sup>**

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<sup>12</sup> See Attachment A1.

## CHAPTER 3

# AN INFRASTRUCTURE TO SUPPORT LIFELONG LEARNING

The previous discussions define the technological and content components of a lifelong learning system. Basically, such a system must reach learners at "learning hubs" anywhere in the country with quality materials. It must provide learners with tutorial and similar support and must provide the basis of an efficient administrative structure.

It is neither possible nor appropriate to single out one particular technology as most suitable to serve all priority areas. Computer-based technologies, including computer communications, are gaining acceptance by learners, teachers, trainers and administrators alike. Technologies such as videos or audioconferences continue to be popular. Appropriate learning systems are likely to include most of these technologies.<sup>13</sup> Canadian institutions, organizations and entrepreneurs have impressive capabilities in these technologies and software applications. They present a good foundation of experience upon which to build the future.

When it comes to serving the four groups of learners identified as priority groups for a lifelong learning culture, priority in terms of initiatives and funding should be given to the first two, namely: establishing learning centres and encouraging the development of learning materials.

### 3.1 The Setting for Learning

Getting suitable hardware and support services to learners is a key priority. A number of factors suggest that learning centres or "learning hubs", rather than homes, will be the predominant setting for learning in the near and medium term. In-house programs have shown that learners generally do not pick up on the option to study at home. The situation is somewhat different in general courses (i.e. not directly linked to work), as some of the case studies show. The fact that the capital cost of hardware for advanced systems is relatively high and requires a fair number of users to justify the investment is a further, practical reason for the use of learning hubs.

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<sup>13</sup> See Attachment E for a list of educational technologies.

Attachment A shows that hubs include some or most of the following features:

- PCs and networked PCs (local area). The ratio between computer and number of learners appears to be in the range of one computer for four learners. Obviously, the ratio depends on the learning activity.
- External telephone connections and computer communication modems.
- Advanced technology platforms to operate Interactive Videodiscs, CDIs, etc.
- Television or cable service, with TV monitors, as appropriate.
- A satellite TV receiver, wired to viewing facilities.
- Library services which house courseware and books.
- Separate areas for activities such as individual work (with or without technology), for group work, for lectures, and for counselling.
- Tutors, trainers, or supervisors at varying ratios in proportion to learners, depending on the learning design. Examples range from a ratio of 1:80 to 1:20. Other cases show that tutorials by phone or by E-mail are effective.
- Learners equipped with a personal identification number or a "learning credit card" which helps the individual pursue a personal "learning map".
- Staff to maintain and operate the technical equipment.
- Operating, staffing and scheduling procedures that allow for long opening hours, effective scheduling, etc.

Attachment A illustrates that learning hubs are being set up in schools, colleges and universities. Large as well as small companies are looking for suitable models. Public facilities, such as libraries, are toying with the idea. Even mobile vans are being used for the purpose. An apparent trend exists (mostly in the U.S.) toward commercially-operated learning hubs, often established in partnerships between education institutions and commercial interests. One reason is that the front-end investment required for a hub can be more easily recovered when it operates commercially.

### **3.2 Courseware and Learning Materials**

For successful learning to take place, materials must be available that are valid, relevant, of high calibre and attractive. Our definition of materials includes courseware products,

educational and specialized databases, learning management software, test and guidance software and computer "chat-lines". Incentives and encouragement for the development of high-quality materials are essential. A serious commitment to a learning culture by all levels of government and the private sector will encourage the demand for learning and create the necessary market.

The examples in Attachment A show a range of approaches to the development and use of learning materials, including co-operative ventures among educational institutions and with private companies.<sup>14</sup> They indicate the following trend for the development of learning materials:

- Materials consist of audioconferences, programs distributed via cable, computer-based courses with significant video components, print, access to a specialized information base, CD-ROM or a combination of these.
- Many of the materials are likely produced by teams with different expertise for content, instructional design or technology. Much of this process can be handled electronically.
- Increasing sophistication of software authoring tools allows teachers and tutors to adjust materials to fit their particular teaching-learning approach.
- More and more materials and information sources use a common technical basis, and learners can put together their own learning packages. For example, an employee who is having problems with a new protocol for statistical process control can search the company's learning resource centre to identify relevant learning modules.

### 3.3 The Electronic Highway

The connection between individual learners and information, courseware, tutors and administrative support is obviously important in a technology-based learning environment. In principle, free access to and exchange of any kind of materials anywhere in the country appears attractive, whether from home, a learning centre, a company, a school or a college. In fact, the degree to which this connection needs to be high-capacity (i.e. carry large volumes of data), real time (i.e. provide direct access to another computer) or distributed by disc and other forms of electronic media, is a cost and engineering trade-off. It is not evident that the exchange of large amounts of data or immediate access to a tutor is a priority need of the learner at home or a crucial factor in the operation of learning centres, be they in companies or at schools. The need for real-time, high-capacity transmission is more evident between large centres, with many learners and

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<sup>14</sup> In the previous section (2.0) we identify specific initiatives in materials development for the four priority groups.

staff, which also engage in joint research and joint course development.<sup>15</sup> These applications are not identified as priorities in our analysis of lifelong learning needs.

The requisite infrastructure for a high-capacity network is evolving. The public network will have implemented an ISDN network between major centres by 1996. Broadband ISDN services, which will easily carry multimedia materials, are under discussion. The speed of expansion of such service outside major centres will depend on market demands. A dedicated education and research network will likely be able to negotiate bulk purchases from the public network, add software capabilities and manage a value-added service.

While a high-capacity network is not a priority for a lifelong learning system, it is important that the education community form a communications user alliance. The alliance must follow technical network developments, intervene in relevant tariff and service hearings, promote services which are essential to the learning culture, and set directions for public investments in related research.

The examples show the following range of electronic links being used for learning centres, schools and, in some cases, home-based learners:

- Telecommunication links and modems to retrieve information from databases.
- Telecommunication links and modems to connect learners with the administrative computer service at a company, college, university, professional association or any other entity that manages the learning process.
- Telecommunications links and modems to connect schools, learning centres, etc. for their own administrative and management communications.
- Telecommunication links to reach tutors or fellow learners, by voice, E-mail, etc.
- Satellite television antennas, often combined with audioconference equipment.
- Connection to cable television, possibly featuring new interactive technology.<sup>16</sup>

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<sup>15</sup> The CANARY and NREN networks in Canada and the U.S. would serve this set of needs. The Nova Scotia Technology Network, which was set up under the umbrella of CANARY developments, serves academic institutions, albeit at moderate speed.

<sup>16</sup> See description of Videoway services in Montreal.

- Audioconference facilities.

### 3.4 Human Resources

Tutors, teachers, supervisors, other students or mentors need to be part of the learning infrastructure. They need new and different skills to operate in a technology-based learning system, as highlighted in Attachment B.

The new learning model changes the paradigm of the teacher's role. The development of a course and its support materials, which has been done by instructors, can now be separated from course delivery and done by teams of people with specific skills such as content, computing or instructional design.

Another important factor in the development of appropriate human resources is the fact that learners often will be linked to tutors and advisors as well as to administrative departments by telephone, E-mail or other services. Therefore staff will need to be trained in the appropriate use of such infrastructure. For example, they will need to be familiar with the resources available so that, during remote counselling sessions, they will be able to call up students' files and records on previous assignments, or past contacts with tutors, electronically. There appear to be few opportunities to gain these skills through formal study.

Lastly, the role of the learner changes. Older learners will not always find it easy to operate in a self-directed learning environment, which is so different from previous learning experiences. Tutorials and advisors will be essential to help people learn.



# CHAPTER 4

## IMPLEMENTATION ISSUES

The preceding discussion of priorities and infrastructure needs brings to the surface a number of issues, which must be dealt with. Some of these are discussed in the following sections.

### 4.1 Institutional Change

It is reasonable to expect that public institutions will continue to be the determining element in our learning culture. Technologies will be essential in every aspect of their operations. Adjusting operations to make the most efficient use of technologies is a long-term, difficult and costly process.

Purchasing practices must be put in place which will force a rationalization of the system and will avoid duplication of programs and services. As learners will be taking courses from a range of sources, an administrative body will be needed to look after enrolment and completion of assignments. For example, it might make economic sense for a college, university, industry and sector association to collectively contract a supplier to manage all the administrative aspects of part-time self-paced learners.<sup>17</sup> As well they might jointly commission a private firm to develop multimedia electronics courses, deliver them on or off campus, and award credits to the learners. They might also operate learning facilities jointly and not only share access to hardware but also use the same tutors or monitors to work with their students.

### 4.2 Jurisdiction

The proliferation of technologies and learning materials takes a significant amount of control away from governments and educational institutions and gives it to the learners themselves. With technologies, learners can easily enrol in credit courses from other provinces or from other countries, use study programs to which the province may have restricted access, or use videodiscs and CDI to learn on their own. They will have choices among programs in terms of accessibility, perceived quality, etc.

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<sup>17</sup> BCTel operates the CLAMS system which might be suitable.

According to Morrison,<sup>18</sup> "the shape, structure, and degree of openness of our learning system will be the policy issue of the future." Learners will be vocal in defending their right to learning choices, especially when they can compare quality and convenience.

### **4.3 Funding Structures and Materials**

Because of the high front-end development costs, a large number of learners is required for learning providers to cost-justify investment in technology-based learning. The principal advantage of technologies is that they reduce learning time, typically by between 20 and 60 percent. Training purchasers, however, still use time-based funding criteria to a large extent. Thus, the reduced learning time can bias purchasers against technology-based learning and may result in lower revenues for the suppliers despite the advantages, e.g. less trainee time away from work.

### **4.4 Funds for Hardware**

A major investment is required to equip schools, colleges, universities and learning centres with sufficient hardware to make technologies part of the learning culture. Mechanisms to ensure that the requisite funds will be available should receive primary attention. Suitable mechanisms for funding include the reallocation of existing budgets, e.g. by changing the size of classes, and the generation of more funds through year-round utilization of facilities, possibly as commercial operations. Partnerships with commercial interests could bring in capital funds for the technology, which could be repaid through operating and service contracts.

Hardware costs are also an important consideration in corporate training programs. For the most part, technologies used for work operations are not used for training. Investments in technologies for training are made on a cost-benefit basis and may include lease and access arrangements with commercially operated facilities.

### **4.5 The Telecommunication Infrastructure**

The costs and the innovative aspects of an advanced telecommunication infrastructure for lifelong learning tend to overshadow other more immediate issues in building a learning culture, such as materials and human resource development. In fact, it is not evident that an advanced technology infrastructure will make a significant difference to lifelong learning. It is important, however, to continue to research and to monitor developments in this area in order to be prepared for its use once fully commercial services are available.

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<sup>18</sup> . *op cit*, page 9.

## **4.6 Teachers, Trainers, Managers and other Decision Makers**

The fact that technology-based learning will be an important contributor to the learning culture appears to be generally accepted. Intensive professional development (in-service and for those entering the field) and rewards for innovation are among the most evident vehicles to bring about a good understanding of technologies and their place in learning. Staff contracts and working conditions will become important in the future as technology-based learning is implemented.

## **4.7 Copyright**

Copyright will be difficult to uphold as materials move from the creator to the learner and are repackaged and reorganized along the way, even by learners themselves. Several people interviewed for this report reported this as a potentially troublesome area.

## **4.8 Research<sup>19</sup>**

One of the main objectives of software and technology research is the development of network interfaces, platforms and operating systems that are compatible and user-friendly. The learning community will benefit from these efforts.

Research on learning and how it can benefit from technologies is scarce. In the United States, for example, only one tenth of one percent of the total education budget goes into research and development on education. In order to monitor progress towards a lifelong learning culture and the value of investments made, and to forecast the directions for future investments, governments and companies should insist on making evaluations part of their initiatives.

## **4.9 The Learner**

In order to make it worth a learner's while to be part of the learning culture, the benefits must outweigh investment in time and effort. A number of technology tools help learners achieve the balance. One is access to self-testing and individual measurements to help judge progress and areas that need more work. Another is a personal learning profile (such as the "learning credit card") that records over time a learner's learning history, learning style and mastery achieved. This background helps avoid the chances of selecting similar learning materials and helps learners choose options suitable to their style, i.e. between differently structured materials.

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<sup>19</sup> Attachment C identifies a number of research projects in Canada and elsewhere to provide a point of reference.

These tools are on the market, but not readily available to learners. A joint initiative of school guidance staff, career counsellors and corporate trainers will help learners obtain a learning map to navigate through the learning culture.

#### **4.10 Credit**

Through technology, many adult learners will be able to access a wide range of learning materials from different sources, using different media, and judge their relevance and quality. These learners will not understand why high quality courses offered independently of their local institutions do not result in credits toward their diploma. It will also be difficult to make business and firms see the reason why some of the excellent courses they offer their staff do not count toward credits. For a lifelong learning culture to flourish, problems such as these have to be resolved, e.g. by establishing prior learning through challenge examinations.

## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

The use of technologies in learning will not remain an option for institutions or governments to select or reject. Market pressures will make it a reality. In order to forge a consistent infrastructure for lifelong learning, a series of actions need to be taken. These actions should focus on bringing sufficient hardware into the reach of the learners and on ensuring that quality and appropriate materials are available. The issues of telecommunications links and of human resource development, while important, will evolve with less direct intervention.

Further, in a technology-based learning environment, action cannot be directed by the traditional players; i.e. governments, educational institutions and, to a degree, corporate training departments. New players are essential. Courseware developers, private investors, private training businesses, telephone companies and cable operators are among the new players that will bring capital, courseware development know-how and the electronic highways to the system. Their entry into education means that new operating rules will apply. The public policy task will be to ensure that all learners benefit.

#### 5.1 Learning Centres

The establishment of learning centres is essential to a lifelong learning structure. These learning centres can be schools, public facilities, commercial ventures, or company-intern facilities. However, it is necessary to attract sufficient funding to establish them and also to operate them efficiently. The following steps can be taken:

- **Make it attractive for private interests to invest in learning centres. For example, partnerships are possible in which the public sector defines and credits the learning, and the private operator invests in and operates the centre for a fee, making a profit on the initial investment.**
- **The federal government can contribute directly to the successful establishment of learning centres by buying a percentage of its own internal training from them. The federal government buys significant amounts of training and its actions will have a significant impact on the overall system.**

- **Private companies can direct their training purchases to such centres. A number of companies are doing this already and are the main clients of the few commercially operating centres.**
- **The cost-effective operation of learning centres in small communities may lead to shared-use arrangements between different levels of the education system as well as with businesses. School boards and local business interests would have to cooperate to shape the most appropriate arrangements. Co-investments of private and public sector funds may be necessary.**
- **Provincial directives could also be used to encourage schools to achieve a good ratio of technology units (e.g., computers) and learners.**

## **5.2 Learning Materials**

Appropriate learning materials are also essential to the structure. The development of such materials can be encouraged through a number of venues:

- **Assessment of non-traditional delivery modes could be required for every new course that is developed in the public education sector. Where feasible, courses should be developed to serve learners who will not attend the classroom-based sessions.**
- **Curriculum changes which emphasize technology and sciences in the schools could include the mandatory use of technologies as part of the learning model.**
- **Larger firms could require that each new training unit be reviewed to determine its suitability for technology-based delivery. Small and medium-size companies would benefit from such developments, if the materials were made available through learning centres.**
- **Commercial courseware producers have the know-how to help educational institutions and corporate training departments develop their materials, or to develop them on their behalf. Such partnership need to be encouraged.**
- **Technology-based learning materials require a fair amount of front-end investment, which is difficult to access at present. Changes in purchasing rules for learning and training will encourage private sector investments in this area. Specifically, expenditures should reflect the mastery achieved by a learner and not, as is now the case, the time spent "in learning".**

### 5.3 Electronic Backbone

Telecommunication links to support education and training are necessary. One weakness of the education sector has been that it does not speak with one voice when it comes to the development of infrastructures, tariffs or operating standards. Much can be done in this area:

- **An educational "user" telecommunications alliance should be established to speak on behalf of a broad range of users.** It could be formulated on the basis of the Business Telecommunications Alliance or the Canadian Consumer's Association and intervene at regulatory, policy and research forums of the federal and provincial governments. Such an organization should represent users, e.g. school boards, colleges, human resource and training professionals, rather than suppliers, e.g. courseware producers.
- **Policy and regulatory direction should be linked to benefits to the learning system.** For example, a service such as the Classroom Management System developed by BCTel could be made available to all Canadian businesses. Another example can be taken from the U.S., where major cable operators are committed to providing cable service to schools and classrooms in their franchise areas within the next five years.

### 5.4 Human Resources

Human resources are the final component of the infrastructure. The key issues to be resolved are professional development and labour relations.

- Initial training as well as the professional development of teachers appears to be lacking when it comes to the use of learning technologies and their applications. **Universities, colleges and professional associations of teachers and trainers should be called upon to combine their expertise and to launch a major effort along these lines (using learning technologies to do so).**
- The effective use of technologies will shift the role of the teacher from lecturer to course developer, tutor or mentor. As well, established working hours and vacation times will no longer be suitable. **Unions and school boards should begin discussions to resolve these issues.** Unless they are addressed, commercially-operated learning centres may become not only more cost-effective than schools, but also the vehicle of choice for those who have the option to choose.

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