

État de la situation sur l'apprentissage virtuel

Rapport final

Le 30 août 2006

Rossiter Consulting
146 av. Hinton, Nord
Ottawa ON K1Y 1A1

Tél. : 613-722-9655 Courriel: rossiterconsulting@sympatico.ca

Cet état de la situation est disponible grâce à la participation financière
du Conseil canadien sur l'apprentissage

Tous les documents produits par le Conseil canadien sur l'apprentissage (CCA) seront disponibles en anglais et en français.

Toutefois, les documents produits pour le CCA par d'autres organismes ne seront affichés en ligne que dans leur langue d'origine. Si une traduction du texte en entier n'est pas disponible, le CCA s'assurera que le sommaire soit traduit dans l'autre langue officielle.

Résumé

En septembre 2005, le Conseil canadien sur l'apprentissage (CCA) a financé la rédaction de plusieurs examens de l'état de la situation dans ses principaux domaines d'étude. Le présent rapport traite du thème de l'apprentissage virtuel qui est commun à tous ces domaines :

- l'apprentissage chez les jeunes enfants;
- l'apprentissage chez les élèves du primaire et du secondaire;
- l'apprentissage postsecondaire;
- l'apprentissage chez les adultes;
- la santé et l'apprentissage

L'approche adoptée pour ces examens comportait trois volets :

- un examen de l'information en ligne provenant de sites Web à caractère éducatif;
- un examen de la documentation courante par la consultation de bases de données existantes;
- des entrevues structurées menées auprès de spécialistes canadiens.

Les examens ont abouti à l'établissement d'une bibliographie annotée dans les cinq domaines indiqués ci-dessus ainsi qu'à une évaluation des principales conclusions, et notamment à une évaluation des progrès accomplis par le Canada dans le but de devenir une « société de l'apprentissage virtuel ».

L'apprentissage virtuel a beaucoup évolué au cours des dix dernières années. Malgré l'absence de données empiriques complètes, les faits démontrent de plus en plus clairement que les technologies de l'information et des communications (TIC) présentent, pour l'apprentissage, des avantages incomparables dont les principaux sont les suivants :

- *Meilleur accès à l'apprentissage.* L'apprentissage virtuel permet d'offrir d'excellentes possibilités d'apprentissage aux apprenants vivant dans des régions éloignées, aux apprenants handicapés ainsi qu'à ceux pour qui la souplesse des horaires revêt une importance capitale.
- *Affectation plus efficace des ressources pédagogiques.* On pourra en partie remédier à la pénurie imminente, à tous les niveaux, d'enseignants et de professeurs compétents, pénurie qu'aggraveront, au cours des dix prochaines années, les départs à la retraite et l'augmentation des inscriptions dans les établissements postsecondaires, par une affectation plus efficace des ressources consacrées à l'enseignement et à l'élaboration des contenus, notamment par le partage des ressources entre les établissements d'enseignement.
- *Partage des contenus d'apprentissage.* Il est possible de faciliter l'accès à des contenus d'apprentissage approuvés de qualité en créant des dépôts d'objets

d'apprentissage que se partageront les établissements d'enseignement des provinces et des territoires.

- *Apprentissage durable.* Les divers types de simulations permettent des approches personnalisées dans le domaine de l'apprentissage par lesquelles l'apprenant peut sans risque mettre en pratique un processus jusqu'à ce qu'il l'ait maîtrisé. Cette approche éducative donne accès à des modes d'apprentissage qui sont pratiquement inaccessibles par d'autres moyens et peut favoriser un apprentissage durable et/ou une acquisition plus rapide des connaissances.
- *Élément social de l'apprentissage.* De nombreux modèles d'apprentissage hybrides et combinés ainsi que toute une gamme de communautés d'apprentissage sont actuellement mis à l'essai. Ces approches reconnaissent l'importance de l'interaction interpersonnelle dans l'apprentissage, même dans le contexte de l'apprentissage virtuel.

La question de savoir si l'apprentissage virtuel permettra ou non à long terme de réduire le coût de l'apprentissage ou d'enrichir sensiblement cet apprentissage demeure encore sans réponse. Il est cependant évident que les organismes et les particuliers exploitent l'infrastructure des TIC à des fins d'apprentissage dès que cette infrastructure est mise à leur disposition. Après en avoir fait l'expérience, très peu d'entre eux reviennent aux approches traditionnelles.

Voici les recommandations découlant de cette étude.

1. Une bonne part de la recherche sur laquelle s'appuie cette étude est axée sur l'usager. Il est donc nécessaire de faire des recherches empiriques et longitudinales sur l'apprentissage virtuel. Si la question de l'efficacité de ce mode d'apprentissage se posera toujours, l'établissement de normes quantitatives sérieuses présente des difficultés de taille. Les études visant à mieux comprendre les éléments suivants sont susceptibles d'être plus utiles :
 - la façon dont les apprenantes et apprenants peuvent tirer le meilleur parti des moyens d'apprentissage virtuel;
 - les situations dans lesquelles l'apprentissage virtuel est le plus efficace;
 - les modes combinés d'apprentissage convenant le mieux lorsque les conditions diffèrent quant au contenu, à l'accès, à la population d'apprenants, etc.
 - les cas où les simulations, l'apprentissage par cas et les jeux peuvent être efficaces.
2. À mesure que l'apprentissage virtuel s'intègre à la pratique organisationnelle traditionnelle, les questions entourant le changement organisationnel acquièrent de plus en plus d'importance, surtout pour les aspects suivants :
 - Quelles sont les structures organisationnelles convenant le mieux pour tirer parti des approches fondées sur l'apprentissage virtuel?
 - Quels sont les modes de formation des enseignants les plus efficaces?

- Comment les établissements d'enseignement peuvent-ils, au moyen de l'apprentissage virtuel, favoriser l'apprentissage chez les apprenants non traditionnels?
 - Comment les établissements d'enseignement peuvent-ils établir des partenariats efficaces dans le but de partager les contenus d'apprentissage ainsi que les autres ressources pédagogiques?
3. La mobilisation du savoir efficace, autant par les chercheurs et les praticiens que par les responsables de l'élaboration des politiques, est une question clé dans le domaine en effervescence de l'apprentissage virtuel. L'établissement d'un centre d'échange national pour la diffusion des règles de l'art en matière d'apprentissage virtuel aiderait à réduire les obstacles à la diffusion rapide des résultats de recherche.
 4. Le Canada a clairement besoin d'une stratégie nationale en matière d'apprentissage virtuel étant donné qu'il semble se laisser devancer par d'autres pays dans ce domaine, et même par des pays où les compétences en matière d'éducation sont partagées. Il serait donc avantageux pour le Canada que l'on crée une tribune où les divers gouvernements et établissements pourraient discuter des moyens d'entraide qui s'offrent à eux, par exemple sous forme de dépôts de contenus d'apprentissage communs.

(Le rapport qui suit n'est disponible qu'en anglais.)

Table of Contents

	Page
État de la situation sur l'apprentissage virtuel.....	1
Résumé.....	3
Remerciements.....	6
1. Introduction.....	7
2. Methodology.....	9
3. Results.....	10
3.1 Introduction.....	10
3.2 Early Childhood Learning.....	10
3.3 Elementary and Secondary Learning.....	12
3.4 Post-secondary Learning.....	15
3.5 Adult Learning.....	16
3.6 Health and Learning.....	19
4. General Conclusions.....	21
4.1 Research Gaps.....	21
5. Status Report for Canada.....	23
6. Recommendations.....	25
References.....	26
Appendix 1. List of Contacts.....	27
Appendix 2. Annotated Bibliography by Theme.....	28
Appendix 2.1 Early Childhood Learning.....	28
Appendix 2.2 Elementary and Secondary Learning.....	36
Appendix 2.3 Post-secondary Learning.....	48
Appendix 2.4 Adult Learning.....	51
Appendix 2.5 Health and Learning.....	58

Remerciements

Rossiter Consulting désire remercier Monique Bélanger et Deirdre Green pour leur contribution à la recherche lors de la préparation du présent rapport.

1. Introduction

In September 2005, the Canadian Council on Learning (CCL) commissioned Rossiter Consulting to conduct a state of the field review of e-learning in Canada. In particular, the project was to assess the status of e-learning across CCL's major themes of:

- Early childhood learning
- Elementary and secondary learning
- Post-secondary learning
- Adult learning
- Health and learning

(Another major CCL theme, Work and learning, was not included in this study.)

E-learning is defined in the box to the right. In this context, it is not limited to a particular technology; it goes beyond delivery of content; and it can be a component of blended or hybrid learning (i.e., need not be delivered exclusively online).

***E-learning:** the development of knowledge and skills through the use of information and communication technologies (ICTs) to support interactions for learning – interactions with content, with learning activities and tools, and with other people.*

Over the past ten years, numerous studies and projects have discussed the role of e-learning as a component of education and skills development systems. Several task forces, organizations, councils and committees have enunciated visions for the evolution of e-learning in Canada, which were summarized in a CANARIE discussion paper (2002).

The 2002 CANARIE paper also presented a vision of an “E-learning Society” in which:

- **Anytime, anyplace, lifelong learning** is facilitated by widely accessible e-learning and supports a civil society.
- **High-quality e-learning content** is universally available through shared repositories overcoming the barriers of opportunity, resource capacity, and accessibility.
- **Ubiquitous broadband networks**, complete with appropriate tools, applications, and standards, provide access to rich e-learning opportunities for all Canadians.
- **Canada is internationally recognized** for its excellence in e-learning technologies, expertise and standards-based content.

This report examines where Canada is today with respect to the elements of an “e-learning society” against CCL's themes, and points out key gaps that remain, particularly assessed against the following questions:

- What are the main modes of e-learning in each theme area?
- How prevalent are these modalities?
- How successful are they in reaching learning objectives?
- How has efficacy been assessed? Have there been formal research trials?
- What are the barriers to greater uptake where warranted?
- What research questions are most critical?
- What would be the outcome of better and/or better known research results?
- How could research results be best disseminated to practitioners in this area?

The goal is:

- To uncover generalizations that might be reliably drawn from empirical evidence
- To identify major gaps in knowledge
- To suggest the most profitable lines of inquiry.

Given that the field is rapidly evolving, much of the current literature is less formal than in more established fields. In spite of that limitation, this study attempts to outline the current state of the field in a way that will be useful to the Canadian learning sector.

2. Methodology

Three complementary approaches to the work were taken. First, a general search was conducted on the Internet, using the search words “online learning” and “e-learning”, and refining the search with qualifiers such as “barriers”, “modalities”, “outcomes” and “results”. As well, a more targeted search was undertaken with the names of prominent researchers in the area of e-learning (such as Marlene Scardamalia, Robert Kozma and Larry Cuban). In addition, the databases of various Canadian and international organizations and associations were searched, including:

- Council of Ministers of Education, Canada (CMEC)
- Canadian Education Association (CEA)
- Industry Canada’s SchoolNet
- HRSDC Office of Learning Technology
- CANARIE
- Education Commission of the States (ECS)
- Organization for Economic Cooperation and Development (OECD)
- Ministries of education/training in Canada and abroad (Australia, Ireland, England).

Second, the ERIC and OVID international databases were searched, using the following search terms, for the period 2000-2005:

e-learning OR online learning OR distance education
AND evaluation OR results OR outcomes.

Refinements included trying to identify Canadian papers.

Third, a number of structured interviews were held with several acknowledged Canadian experts, listed in Appendix 1. The questions posed were:

- Could you highlight any relevant research in your area of expertise – not just published research but any research that you know is happening currently but hasn’t been reported?
- What is the state of implementation of ICTs in learning in your area of expertise? What are some of the barriers to implementation? How do you assess the impact of implementation on student learning?
- What are the best or exemplary practices?
- Are there any major gaps in the research, areas that you feel should be explored or explored more fully?
- Do you know of any promising lines of inquiry for addressing these gaps?

3. Results

3.1 Introduction

It is clear that the amount of material that could be reviewed is enormous, especially if one considers international publications and less formal reports. A partial list of publications located and studied is given in the annotated bibliography, with a table for each of the five major CCL themes being addressed. In this section, the key results from both the literature and from interviews are summarized for each theme.

3.2 Early Childhood Learning

The use of technology with young children is not a new concept. Colleagues scoffed at Seymour Papert when he proposed to use computers with young children, suggesting that it would completely change education. In 1968, he developed *Logo*, a child-friendly computer language that used discovery or self-direction as a method of teaching and learning. Over the years, he continued to refine *Logo*, which is still used today (Gillespie, 2004).

Papert notwithstanding, researchers, practitioners and parents alike are divided as to the merits – and hazards – of using ICTs with young children. On the one hand, researchers contend that technology use should be limited with young children. Their view is that technologies are harmful to young children, that they limit the use of imagination, foster passive behaviour and impede normal psycho-social development (Cordes and Miller, 2002; Healy, 2002; Suomala, et al., 2000). Much of the debate centres on whether technology can meet or support the needs of young children or whether it may detract from the developmental process.

“I see Logo as a *means* that *can, in principle*, be used by educators to *support the development* of new ways of thinking and learning [...] During the 1970s, we had demonstrated that children of almost any age could learn to program in Logo under good conditions with plenty of time and powerful research computers [...] I have seen hundreds of elementary school children learn very easily to program, and evidence is accumulating to indicate that much younger children could do so as well.”

Papert, Seymour (2003), *Mindstorms: Children, computers, and powerful ideas* (2nd edition), New York: Basic Books, pp. xiv, xvi, 13.

“Computers are reshaping children’s lives, at home and at school, in profound and unexpected ways. Common sense suggests that we consider the potential harm, as well as the promised benefits, of this change.”

Cordes, C. and E. Miller (2000), *Fool’s Gold: A Critical Look at Computers in Childhood*,

Alliance for Childhood

www.allianceforchildhood.net/projects/computers/computers_reports_fools_gold_download.htm

On the other hand, researchers argue that young children are already exposed to technology, that ICTs have positive effects on certain aspects of early childhood development such as imagination, socialization and fine motor skills, and that ICTs should be harnessed to benefit young children (Clements and Sarama, 2003; Halewood, et al., 2002; Bergen, 2001; Siraj-Blatchford and Whitebread, 2003).

“[...] computers can serve as a catalyst for positive social interaction and emotional growth. [...] Computers can facilitate both social and cognitive interactions – each to the benefit of the other. Good software encourages children to talk about their work as well as engage in more advanced cognitive types of play than they do in other centers.”

Clements, D. G. and J. Sarama (2003), *Young Children and Technology: What Does the Research Say, Young Children*, Vol. 58, No. 6, November 2003.

There is consensus, however, on the fact that any use of ICTs must be developmentally appropriate. Researchers and practitioners are seeking to find the best and most appropriate means of integrating technology into the everyday learning experiences of young children.

“[...] technology is playing an important role in the lives of our children. How can we channel their curiosity and use technology to help them grow intellectually, socially, and emotionally? How do we integrate technology into our instruction to go beyond consumers and gaming to using technology as tools for creative production?”

Hertzog, N. and M. Klein (2005), *Beyond Gaming: A Technology Explosion in Early Childhood Classrooms, Gifted Child Today*, Vol. 28, No. 3, Summer 2005, p. 24.

There is also much discussion among researchers of how technology may actually be changing the way children think (Judge, et al., 2004; Huyn and Davis, 2005; Healy, 2002; Kritt, 2001; Lefever-Davis and Pearman, 2005; Bergen, 2001).

“As yet no one has attempted to demonstrate less dramatic brain changes from a heavy diet of video and rushed adult-directed activities or from immersion in thoughtful conversation and spontaneous creative play, but it is eminently possible that they exist.”
Healy, J. (2002), *Endangered Minds*, Creating the Future, New Horizons for Learning
www.newhorizons.org/future/Creating_the_Future/crfut_healy.html

One promising area of exploration has been the use of ICTs with children with disabilities. This includes children with language, speech and motor difficulties, as well as disadvantaged children (Pierce, et al., 2003; Beck, 2002; Hutinger, et al., 2002; Martin, et al., 2002; Van Scoter, et al., 2002).

Researchers are also considering how best to support educators and practitioners as they use ICT with young children (Hertzog and Klein, 2005; Ljung-Djarf et al, 2005; Laffey, 2004; Hutinger et al., 2002; Boldu, 2002).

In early learning, researchers, practitioners and parents agree that, “Technology cannot and should not replace human interaction or relationships, or take the place of activities such as reading stories together or sharing conversations with children. Properly used, however, computers and software can serve as catalysts for social interaction and conversations related to children’s work.” (Van Scoter, et al., 2001, p. 9).

3.3 Elementary and Secondary Learning

According to the practitioners interviewed, effective implementation includes ensuring not only adequate hardware, connectivity and software but also teacher pre-service and in-service training, pedagogical and curriculum integration, and fostering a culture that encourages technology integration. Effective implementation, however, begins with the development of a vision which can be revised and amended as needed.

Researchers and practitioners alike differ among themselves as to the state of ICT implementation in the elementary-secondary sector in Canada. Some claim that ICT integration is practically non-existent or spotty at best. Others prefer to see the glass half-full, stating that integration is being achieved in some classrooms but not in others. All seem to agree that the use of technology in learning at the K-12 level in Canadian schools has not reached its full potential – there is still much work to be done.

The practitioners interviewed in the course of this study agree that the barriers to implementation haven’t changed over time. The barriers can be summarized in one word: *access* -- access to knowledgeable educators who in turn have access to adequate training and a school culture that supports technology implementation; access in terms of the digital divide, with all students having access to computers and the Internet both at home and at school; access in terms of the lived experience of policy makers versus that of “digital natives” (Prensky, 2001) in the classroom; access to adequate funding to ensure effective

integration and implementation by providing the needed tools (software as well as hardware and connections).

“Some researchers have claimed that computer literacy, however defined, pays off in higher wages, further strengthening the educational rationale for using computers in schools. Yet schools can hardly claim full credit for students’ growing technological literacy, when many also pick up computer knowledge and skills at home and in part-time jobs. The contribution that school courses and experiences have made to computer literacy and competitiveness in the workplace remains, at best, murky.”

L. Cuban, 2001, *Oversold & Underused: Computers in the Classroom*, Harvard University Press, p. 178.

Recent research has focused on the impact of ICT on student learning and success (US Department of Education, 2005; Davies, 2004; Quellmalz and Kozma, 2003; Harrison, et al., 2003; Kozma, 2003). Whether the studies are qualitative (Cavanaugh, et al., 2004; Kozma, 2003) or quantitative (Statistics Canada, 2005, 2004, 2003; Davies, 2004), they seek to provide policy makers, decision makers and stakeholders with an answer to the question: is the investment in technology actually paying dividends in terms of student achievement?

While the question of the impact of technology use continues to be debated and researched, the focus is shifting somewhat to include research on how best to design a learning environment that fosters the development of a knowledge society. In Canada (and internationally), Bereiter and Scardamalia are at the forefront of this discussion, through the Institute for Knowledge Innovation and Technology (IKIT), a “global network of organizations committed to the advancement of knowledge building technology and practices in all sectors of society” (IKIT Web site, www.ikit.org).

Some researchers are examining structural and management changes that may be related to ICT use or that may be needed in order to accommodate or facilitate effective ICT integration (Prensky, 2005, 2004; Ilomäki and Hakkarainen, 2003, Bereiter, 2003). In the words of one practitioner, “the bell drives effective implementation.”

“Our students have changed radically. Today’s students are no longer the people our educational system was designed to teach.”

M. Prensky, 2001, *Digital Natives, Digital Immigrants*, from *On the Horizon*, NCB University Press, Vol. 9, No. 5, October 2001, p.1.

Researchers are also exploring how students learn and how then to design learning technologies and materials to meet these needs (Quellmalz and Kozma, 2003; Chan, 2003, Scardamalia and Bereiter, 2003).

“Today’s children learn in 3D. This whole linear concept of learning – that you pick up a book that’s a narrative, and it’s static – it’s limiting to children who were brought up in the information era. It doesn’t reflect reality, and that’s problematic, because we should be educating our kids for the future, not the past.”

Interview with Dr. Heather Lotherington, *Globe and Mail*, Wednesday, November 30, 2005.

One area that has garnered considerable interest recently is gaming. Some practitioners stated that gaming is a false lead because learning is not the point of games. However, researchers counter this argument by saying that they are examining games for the lessons that can be learned regarding the design of learning materials that correspond to the evolving learning styles of students.

“... we can make school and workplace learning better if we pay attention to good computer and video games. This does not necessarily mean using game technologies in school and at work ... It means applying the fruitful principles of learning that good game designers have hit on, whether or not we use a game as a carrier of these principles.”

J. P. Gee, 2005, *Learning by Design: good video games as learning machines*, E-Learning, Vol. 2, No. 1, 2005, p. 6.

Some researchers (e.g., Lotherington, 2005) go further. In a recent *Globe and Mail* article, Dr. Lotherington, commenting on the results of a study she conducted with Toronto elementary school students, suggested that “digital games could be reviewed and presented in English class, just as books are reviewed. Video games featuring racing or snowboarding could be used to help children understand mathematical and scientific concepts [...] Games requiring children to create a socio-geographical context, such as a city, could help them learn to solve complex design problems with social consequences.”

Much of the research on gaming is not found in refereed journals. Rather, discussions are ongoing and evolve on discussion or blog sites such as those hosted by Stephen Downes (www.downes.ca/), George Siemens (www.elearnspace.org) and Marc Prensky (www.marcprensky.com), where short papers are posted for discussion and viewpoints can be aired.

On a different topic, a number of the practitioners interviewed question whether research always has to be scalable and replicable. Considerable on-the-ground or action research is being conducted at the local school or district level, most notably in Alberta (<http://projects.cbe.ab.ca/sss/edtech/>) and Quebec (www.cefrio.qc.ca/projet.cfm). Action research is attractive because it responds to a particular need – the solutions proposed or developed as a result of this pinpointed research can be more readily implemented over time, given the buy-in of local stakeholders generated by having participated in the process.

That having been said, the practitioners interviewed also concur on the merits of broader research in pushing the limits and moving the bar forward (Bell and Bull, 2005; Bailey and Rhine, 2005; UNESCO, 2002, 2001). The difficulty remains how to disseminate the products or findings of this broader research to practitioners in the field in a useful and effective manner.

Most countries (including Canada, USA, Australia, UK and Ireland) are developing statistical databases and reporting on connectivity and infrastructure (Statistics Canada, 2005, 2004, 2003; SchoolNet, 2001, 2002). The practitioners interviewed agree that statistics and indicators provide some valuable information to help policy and decision makers arrive at enlightened decisions. However, they stressed that counting the number of computers is very different from determining whether ICTs are being used effectively.

Another important body of research, both domestic and international, is being conducted on preparing and training teachers to use ICT effectively (CEFRIO, 2005, 2004, 2003; Bailey and Rhine, 2005; Chan, 2003; Law, et al., 2003; Laferrière and Breuleux, 2002; UNESCO, 2002, 2001). As well, research (particularly at the international level) has focused on student achievement (Downes, 2005; OECD/PISA, 2004; Quellmalz and Kozma, 2003; ISTE, 2002).

3.4 Post-secondary Learning

Again, in the post-secondary system, adoption of e-learning is uneven, even though broadband infrastructure is typically in place both within institutions and inter-institutionally. In a major change over the past five to ten years, virtually every educational institution has adopted some form of e-learning in at least some of its offerings. However, institution-wide, let alone jurisdiction-wide, e-learning strategies are not the norm, even though many institutions have adopted Learning Management Systems (LMS) on an institutional basis. Many of these are vendor-provided products, although there are also a number of open source products, such as Sakai and Moodle that are also being adopted.

One of the major findings over the past few years is the significant uptake of some component of e-learning by students who are on campus. There is clearly value to students of being able to access learning materials, interactions, and assignments in flexible ways.

One of the major perceived challenges in the post-secondary sector is faculty professional development, and many institutions have offices to support this type of training. Materials to assist this process have been developed through the Collaborative Content Creation Lab (<http://www.c3l.ca>) and through several projects at the University of Ottawa. The latter have formed the Institute for the Advancement of Teaching in Higher Education (<http://www.iathe.org>), with sustaining support from a major Canadian publisher. These tools are finding interest from institutions across Canada.

“Within education and labour market policies, adult learning is becoming a priority for economic growth and social development in many OECD countries.”

Pont, B. and R. Sweet (2003), *Adult learning and ICT: How to respond to the diversity of needs?*, OECD/NCAL International Roundtable on ICT in Non-formal and adult education: Supporting out-of-school youth and adults, Philadelphia, 12-14 November, 2003.

One of the key values of broadband networks is the possibility of sharing resources across institutions – to date structural inter-institutional collaboration is not a common practice. There are, however, encouraging signs. For example, Canada’s four colleges of veterinary medicine have been sharing teaching resources, both synchronously and asynchronously, for several years (<http://www.ovc.uoguelph.ca/Canarie/Phase2/Web>). Another example is the sharing of health informatics modules across a number of institutions (<http://www.health.bcit.ca/hic>).

Tools for development of powerful, relatively inexpensive simulations are emerging that provide forms of e-learning that are difficult to replicate any other way. A small Montreal company, Virtuel-Âge International, is pioneering use of virtual reality for inexpensive training about complex machinery (<http://www.virtuelage.com/elive>), and Royal Roads University has developed a toolset that allows easy development of case-based modules (<http://www.logicproject.ca>). McGill University is developing case-based approaches for teaching the process of differential diagnosis to medical students (<http://vault.mmi.mcgill.ca/Construct/Case1/cases/v2.html>).

Part of the driver for these latter activities has been the shortage of qualified faculty. The Association of Universities and Colleges of Canada (<http://www.aucc.ca>) expects this challenge to become widespread in post-secondary institutions over the next decade as many current faculty members retire.

3.5 Adult Learning

Adult learning is a vast area that can include general and vocational education, formal, non-formal and informal learning. The needs of adult learners cover a broad range, from adult literacy and basic education to adult continuing education, from just-in-time work related learning to degree- and certificate-granting programs. Adult learning programs may be provided by the public education system, through postsecondary institutions and through private providers.

E-learning for adults covers a variety of terms such as virtual education and schooling, online education programs, telelearning, Web-based learning and Internet learning. The advantages of e-learning for adults could include increased access to educational opportunities, individualization of learning and content, targeted skills development, and accommodation of differing learning styles.

The principles that guide adult e-learning are similar to those of face-to-face learning. Adults need to know why they are learning something. They have to be self-directed and self-motivated. Adults often bring work-related experiences to the learning situation. They enter the learning situation with a problem-centred, life-centred and task-centred approach to learning.

Many adult learners, particularly people in white-collar and high-skill occupations, voluntarily engage in training for career or job-related reasons. However, a number of adult learners are people with low skills who earn low wages, people not in the labour market or people over 40 who either do not have many learning opportunities or do not tend to take advantage of them (Berge, et al., 2002; Pont and Sweet, 2003).

“Distance education is the popular option for non-traditional learners. With many traditional industries such as manufacturing and textiles going offshore, 20-year veterans of the workplace are being laid off and going back to school to learn a new trade. Distance education—through Internet and video courses—helps those who have to work a job and go to school at the same time better schedule their learning opportunities. These people are usually older, in their 30s or 40s, and are learning to use technology, like the Internet and computers, while training for a new career.”

McNeely, B. (2005), *Using Technology as a Learning Tool, Not Just the Cool New Thing*, *Educause*, February 23, 2005

www.educause.edu/UsingTechnologyasaLearningTool,NotJusttheCoolNewThing/6060

According to a study conducted for ABC Canada on the link between e-learning and adult literacy (ABC Canada, 2005), approximately 55,000 Canadians across the country were served by AlphaRoute (ABC Canada’s e-learning portal) in 2003. However, a number of learners are accessing e-learning directly and are not easily tracked.

“eLearning services are increasing in number and variety and there is, consequently, growing support, and demand from learners, for such services.”

ABC Canada (2005), *Linking Adult Literacy and eLearning: Research Study on the Use of eLearning Tools in Adult Literacy Programs*

www.abc-canada.org/media_room/news/elearning_exec_summary.shtml

It would appear that the use of e-learning with adults, particularly in relation to literacy skills, is somewhat limited in Canada. There appear to be few formal teaching/learning programs online, although the trend is for increased use of e-learning in adult literacy (ABC Canada, 2005).

However, recent studies have found that ICTs reinforce existing learning patterns and are of most benefit to those people who are already learners

or who would have become learners even without the availability of technology (e.g. Adult Learning@Home project in the UK).

An earlier study (Chang Barker, HRDC, 1999) found that interest for e-learning was high, although many providers questioned the effectiveness of using technology. The recent ABC Canada study reports that online technologies are used in an increasing number of programs and that the issues of cost, training of instructors, and access have been addressed sufficiently for implementation to have become fairly ubiquitous. In particular, e-learning has the potential of facilitating access for certain groups, such as the disabled (Straetz, et al., 2004), at-risk learners (Li, 2004), the disaffected (Englebright, 2004; Armstrong, 2000), learners with low literacy skills (ABC Canada, 2005) and learners in developing countries (Wagner and Kozma, 2003).

The focus of non-formal and informal adult e-learning has been primarily to bring content to people, to allow learners to access content anywhere, anytime. However, while e-learning has the capacity to provide greater access and to reach a wider audience, it raises a number of issues.

The overall quality of e-learning experiences has been uneven and providers have not capitalized on emerging technologies such as video streaming (Greenagel, 2002). In the rush to provide “e-learning”, the consensus among some researchers seems to be that the focus has been more on the “e” and less on the “learning”. Many adult e-learning situations overlook social inclusion (Englebright, 2004) and the particular needs of adult learners (Greenagel, 2003; Mauger, 2004). Borrowing the words of the title of 2002 Greenagel article – “E-learning is about people not technology”. One of the motivating factors for adult e-learners is the possibility of interacting with other learners with similar learning and living experiences. Programs are not necessarily designed to foster social interaction and communities of practice (Gray, 2004; McNeely, 2005; OLT, 2004).

As with other theme areas, the barriers have not changed much over time, even with improved and evolving technologies. Some of the barriers cited include access to knowledgeable educators who in turn have access to adequate training; access in terms of the digital divide, with all learners having access to computers and the Internet; access to adequate funding to ensure effective integration and implementation by providing the needed tools (software and hardware); learner motivation and acceptance of responsibility for learning; accommodation of varying learning needs and literacy levels (both language literacy and computer literacy); accommodation of varying levels of experience (both life experience and experience with learning in a formal/non-formal setting); organizational structure that supports/fosters a learning culture and encourages social interaction and the maintenance of communities of learning and practice (Lockitt, 2004; Berge, et. al., 2002; Greenagel, 2002).

Current research is focusing on making adult e-learning a more enriching experience for the learner. Some of the promising lines of inquiry include gaming and the use of strategies from gaming (Squire, 2005); learning styles and adapting the learning experience to various learning styles (Greenagel, 2003; Mauger, 2004); communities of practice (Wenger, 2005; Gray, 2004); adapting e-learning to the needs of various groups (ABC Canada, 2005; Li, 2004; Straetz, et. al., 2004; Englebright, 2004); return on investment (Chang Barker, 2004).

3.6 Health and Learning

The use of e-learning in with respect to health encompasses three major forms:

- Training of healthcare practitioners
- Education as a component of healthcare
- Education as a component of health.

Although training of healthcare practitioners is not fundamentally distinct from post-secondary learning (see above), it does have some specific attributes. Training is often (although not always) at the graduate level, it can be very expensive, and is usually integrated with practicum training.

In an effort to provide increasing numbers of practitioners (particularly doctors) in remote areas, two initiatives have been started in Canada recently, the Northern British Columbia Medical School and the Northern Ontario School of Medicine. Both of these schools are at an early stage, but will use e-learning as an integral component of the training, especially when the students are not on campus. They expect to use both synchronous and asynchronous delivery extensively. The hope is that students educated primarily in a remote location will continue to practice there after graduation. How well this goal will be achieved is still uncertain, but it would likely not be possible without significant use of e-learning as an integral component of education. The implications in terms of healthcare for residents of remote communities could be significant in the long term.

There is growing interest in use of simulators for delivering realistic training at potentially lower cost. The University of Ottawa is using a simulated patient in its anaesthesia training. One of the interesting aspects of this type of training is that it often teaches unexpected skills; for example, although skill in handling a complex case from a medical perspective might be the primary learning goal, secondary goals, such as teamwork in an operating-room setting, are also learned.

Given the recent incidences of actual and potential pandemics such as SARS and avian flu, there is a growing interest both in Canada and internationally in providing continuing education opportunities, via the Internet and e-learning, to front-line public health practitioners. In Canada, the Skills Enhancement for Public Health Program (<https://skills.phac-aspc.gc.ca/>) provides online facilitated modules to public health practitioners across the country, focusing on essential functions such as population health assessment and health protection. In the US, the Public Health Foundation's Train National (www.train.org/DesktopShell.aspx) provides online courses, many leading to certification.

E-learning is also an increasing component of many kinds of healthcare delivery – both for patients and practitioners. Numerous studies have examined the advantages of using e-learning in assisting with patient care, either to provide just-in-time information or to assist

with follow-up. Of course, there is significant use of e-learning – increasingly through hand-held devices – for practitioners, to access the latest information on a specific situation or condition. And increasingly, practitioners are using e-learning techniques for continuing education (for example, the Royal College of Physicians and Surgeons of Canada, <http://plp.mainport.org/rcpsc/index.html>).

Finally, there are a huge number of sources of health information now available to the public, through health centres, specialty health organizations, and educational institutions. Whether these all provide qualified or authoritative information is moot; they are being used extensively to complement more traditional health and wellness care.

4. General Conclusions

E-learning has made a remarkable transition over the past decade. In spite of a lack of definitive, empirical research, there is growing practical evidence that use of ICTs can provide advantages to the learning process that are not readily available in other ways. The most prominent of these are:

- *Greater access to learning.* E-learning can be used to provide excellent learning opportunities to learners in remote regions, to those with disabilities, and to those for whom time flexibility is critical.
- *Better allocation of teaching resources.* The looming crisis of a shortage of qualified teachers and faculty at all levels of education, exacerbated by retirements over the coming decade and increased enrolment rates (particularly in post-secondary), can be partially addressed through more efficient allocation of teaching and content development resources; for example, by sharing across institutions.
- *Sharing learning content.* Access to rich, high-quality, approved learning content can be improved through structured learning object repositories that can be shared both across institutions and across jurisdictions.
- *Deeper learning.* Simulations of various kinds are enabling case-based approaches to learning in which a learner can practice a process safely until it is perfected. This approach to education offers ways of learning that are difficult (or even impossible) to achieve any other way and can lead to deeper learning and/or more rapid acquisition of expertise.
- *Social component to learning.* Numerous models of hybrid and blended learning (Bersin, 2004), as well as communities of learners, are being implemented. These approaches recognize the importance of person-person interaction in learning, even within an e-learning framework (Rosenberg, 2006).

Whether e-learning can, over the long haul, reduce costs of learning, or increase learning in important ways, or both, is still to be seen. However, what is clear is that as ICT infrastructure is put in place, organizations and individuals use it for learning activities. Having done that, few return to traditional approaches.

4.1 Research Gaps

Researchers are beginning to delve into the impact of ICTs on learning across the five themes. This aspect of research seems particularly important in the formal education system – policy and decision-makers want to know if the considerable investment in ICTs is actually paying dividends. However, many practitioners feel that before researchers can

assess the impact of ICT on learning, the goals of learning must first be clearly defined, and the goals of learning with ICTs must then be determined within them. The issue is complicated by the difficulties of assessing the effectiveness and impact of learning strategies in general. Longitudinal studies may be helpful over the longer term.

Another gap in the research is how the massive exposure to ICTs is changing the way people of all ages view and use technology. Some researchers such as Marc Prensky maintain that the brains of “digital natives” are actually different from those of “digital immigrants”. If this is so, what impact will that have on learning? How can formal learning be adapted to meet and support these changing needs? How can ICTs be embedded effectively in learning at all levels and across the five themes?

Gaming and simulations are emerging as important tools, both in their own right and as learning modalities. What implicit learning takes place in a gaming environment? Can the kinds of interaction used in gaming be used for other types of learning (and learners)? Should uses of technology outside of the formal education system be reflected within the formal system?

Teacher education and training, both pre-service and in-service, constitutes another research gap. There is still much to be learned about how to teach effectively using ICTs. Which methodologies work best in which situations to teach what kinds of materials? What is the optimum mix of e-learning with face-to-face instruction? How can the two best be blended to optimize learning and learning opportunities? How can ICTs accommodate various learning styles and meet the needs of different learners?

Another area of importance is that of communities of practice and communities of learning. How can ICTs be used to foster, support and maintain such communities? What are some of the tools that can be used? What are the benefits of such communities? How can peer-to-peer learning be facilitated?

There is growing evidence that inter-organizational cooperation is highly important in the effective use of ICTs. How can or should that be reflected in policies that affect learning? How can the needs for local (and provincial) autonomy in education be maintained, while still taking advantage of tools and content that come from regional, national or international sources?

Finally, in a field that is very fast-moving, how can research results effectively be disseminated to practitioners and policy makers? What format and terminology is most practical and useful to practitioners?

5. Status Report for Canada

In Chapter 1, the notion of an “E-learning Society” (CANARIE, 2002) was presented. In this section, a brief assessment of where Canada is at this point is made.

Anytime, anyplace, lifelong learning

Although there have been gains made over the past decade, there are still barriers of access, prior learning recognition, lack of institutional support, and lack of appropriate content. E-learning may be an important stimulus in overcoming these, and many institutions are starting to reorganize in ways that may take advantage of e-learning to facilitate lifelong learning.

High-quality e-learning content

The concept of a network of shared, linked learning object repositories based on open standards is still some distance in the future. However, significant progress has been made over the past few years in Canada, and is continuing through the LORNET project (www.lornet.org). Connections to work in other countries, through the GLOBE and MERLOT projects, for example, are also continuing to grow. Cultural, library, and archive organizations are starting to consider how their rich collections can be made more generally available for educational purposes. Lack of a co-ordinating framework or a natural lead organization is a significant barrier in Canada.

Ubiquitous broadband networks

Canada has very good (although not fibre-to-the-home) connectivity in major urban areas, but not yet to most other areas including those areas near urban centres. Institution-to-institution connectivity is excellent through CA*net, and some campuses are moving to campus-based wireless networks. Canada is recognized internationally for the “Connecting Canadians” initiative. The vision of the National Broadband Task Force (2002) has not been implemented. However, wireless mesh networks are being planned for blanket coverage of large urban centres and are being trialed in small communities where landline access is expensive.

Canada is internationally recognized

Canada has played an important part in the development of e-learning both domestically and internationally. In 2003, the Economist Intelligence Unit (<http://www.eiu.com/>) ranked Canada second in e-learning readiness (after Sweden), using measures of:

- Connectivity – the quality and extent of Internet infrastructure
- Capability – the ability to deliver and consume e-learning based on literacy rates, and trends in training and education
- Content – the quality and pervasiveness of online learning materials

- Culture – the behaviours, beliefs and institutions that support e-learning development within country

It is not clear that Canada would achieve such a high rating today as other countries have moved forward more quickly and Canada has no clearly articulated strategy for the development of e-learning *per se*. Other national governments, including those with shared responsibilities for education, are moving forward with e-learning strategies. For example, in March 2005, the UK announced a comprehensive e-learning strategy (<http://www.dfes.gov.uk/publications/e-strategy>) to improve access, improve learning outcomes, and to improve efficiency in the learning system at all levels with the following six priorities:

- an integrated online information service for all citizens
- integrated online personal support for children and learners
- a collaborative approach to transforming teaching and learning
- a good quality training and support package for practitioners
- a leadership and development package for organizational capability in ICT
- a common digital infrastructure to support transformation and reform.

Overall, Canada might earn a grade of “promising work” against this set of criteria. It appears that Canada is moving toward a strategy that will see the development of e-learning occur as a component of traditional learning approaches. While possibly not ideal, it likely reflects the realities of the Canadian learning landscape. The findings of this study lead us to recommend that the advantages offered by the use of ICTs in learning not be lost to Canada because of the complexities of our institutional, administrative and jurisdictional structures.

6. Recommendations

The following are the recommendations that flow from this study.

1. Much of the research located in this study is practitioner based. Therefore, there is a need for relevant empirical and longitudinal research on e-learning. Although issues of effectiveness will always be present, the difficulties of determining meaningful quantitative measures are substantial. More useful might be studies to understand better:
 - How learners can take best advantage of e-learning opportunities
 - In what situations e-learning is most effective
 - What blended modalities work best under differing conditions of content, access, learner population, etc.
 - Where simulations, case-based learning, and games technologies can be effective.
2. As e-learning is subsumed into traditional organizational practice, issues of organizational change become increasingly important, including questions such as:
 - What organizational structures are best adapted to take advantage of e-learning approaches?
 - What forms of teacher training are most effective?
 - How can institutions decrease barriers to non-traditional learners using e-learning?
 - How can institutions partner effectively to share content and other teaching resources?
3. Effective mobilization of knowledge from researchers to practitioners and policy makers is a persistent issue in the rapidly-moving field of e-learning. A national clearinghouse for access to leading practice in e-learning could help reduce barriers to rapid dissemination of research results.
4. Canada is clearly lacking a national strategy in e-learning, and appears to be falling behind other countries, even those with distributed responsibility for education, that have put in place a strategy. Canada could benefit by having some kind of focal point for bringing together its various jurisdictions and institutions in order to discuss mutually beneficial ways of working together; for example, in the field of shared content repositories.

References

Note: Most references are included in Appendix 2.

Bersin, Josh, *The Blended Learning Book*, Pfeiffer, 2004, 319 pp.

CANARIE Inc., “An E-Learning Vision: Towards a Pan-Canadian Strategy and Action Plan”, 24 pp., November 2002.

(<http://www.canarie.ca/funding/elearning/elearningvision.pdf>)

Industry Canada, e-Commerce to e-Economy: Strategies for the 21st Century Conference, “e-Learning in the e-Economy, Summary Report from the Thematic Workshop”, 24 pp.,

January 2004. ([http://www.e-economy.ca/epic/internet/inec2ee-ceace.nsf/vwapj/elearning_final_report.pdf/\\$FILE/elearning_final_report.pdf](http://www.e-economy.ca/epic/internet/inec2ee-ceace.nsf/vwapj/elearning_final_report.pdf/$FILE/elearning_final_report.pdf))

National Broadband Task Force (NBTF), *The New National Dream: Networking the Nation for Broadband Access*, February 2002 (<http://www.broadband.gc.ca/>)

Rosenberg, Marc J., *Beyond E-Learning*, Pfeiffer, 2006, 375 pp.

Appendix 1. List of Contacts

Dr. Francis Lau, University of Victoria
Ms Brenda Pfaus, Spectra Interactive
Dr. Thérèse Laferrière, Laval University
Mr. Garry Popowich, Alberta Learning (retired)
Mr. Wayne Poncia, Etraffic Solutions
Ms. Robin Gardiner-Poncia, Etraffic Solutions
Mr. Lionel Sandner, Edvantage Press
Ms. Robyn Gordon, Linkages Consulting
Mr. David Beattie, David Beattie Consulting

Appendix 2. Annotated Bibliography by Theme

Appendix 2.1 Early Childhood Learning

Reference	Aim of article	What was studied/discussed?
<p>Beck, J. (2002)</p> <p><i>Emerging Literacy through Assistive Technology</i></p> <p><i>TEACHING Exceptional Children</i>, Vol. 35, No. 2, pp 44-48, December 2002</p>	<p>Discussion of how assistive technology can affect literacy skills of children with disabilities</p>	<p>Case study of 10 preschoolers (age 3) with multiple disabilities</p>
<p>Bergen, D. (2001)</p> <p><i>Learning in the Robotic World: Active or Reactive? Technology in the Classroom</i></p> <p><i>Childhood Education</i>, Vol. 77, No. 4, pp 249-250, Summer 2001</p>	<p>Discussion of technology-enhanced “smart toys”</p>	<ul style="list-style-type: none"> • Description of a range of “smart toys, from simple interactive toys to those simulating actions of real animals • Discussion of current research on effects of these toys • Description of the impact of these toys on children’s learning • Discussion of the implications for education
<p>Brooker, L. (2003)</p> <p><i>Integrating New Technologies in UK Classrooms: Lessons for Teachers from Early Years Practitioners</i></p> <p><i>Childhood Education</i>, Vol. 79, No. 5, pp 261-267, 2003</p>	<p>Examine the successful implementation of technology in early childhood settings</p>	<p>Case studies</p>
<p>Buldu, M. (2002)</p> <p><i>Young Children’s Computer Use: Perspectives of Early Childhood Teacher Educators</i></p> <p>In <i>Proceedings of SITE 2002 Conference</i>, 13th International Conference of the Society for Information Technology and Teacher Education, Nashville, Tenn., March</p>	<p>Explore the perspective of early childhood teacher educators on computer use with young children</p>	<p>Interviews with three early childhood educators</p>

Reference	Aim of article	What was studied/discussed?
18-23, 2002 www.eric.ed.gov/ERICDocs/data/ericdocs2/content_storage_01/0000000b/80/28/0b/af.pdf		
Clements, D. G. and J. Sarama (2003) <i>Young Children and Technology: What Does the Research Say?</i> <i>Young Children</i> , Vol. 58, No. 6, November 2003	Summarize the research on the effects of computer use by young children	Literature review
Cordes, C. and E. Miller (2000) <i>Fool's Gold: A Critical Look at Computers in Childhood</i> Alliance for Childhood www.allianceforchildhood.net/projects/computers/computers_reports_fools_gold_download.htm	Examine the risks and hazards of using computers with young children	Present the view that technology use should be limited with young children, based on current research
Gillespie, C. W. (2004) <i>Seymour Papert's Vision for Early Childhood Education? A Descriptive Study of Head Start and Kindergarten Students in Discovery-based, Logo-rich Classrooms</i> <i>Early Childhood Research and Practice</i> , Vol. 6, No. 1, Spring 2004	Describe implementation of Papert's vision	<ul style="list-style-type: none"> • Observe in classrooms attempting to implement Papert's vision using Logo • Nine Kindergarten and five Head Start children • Examine what children are doing and with whom, throughout the school year
Halewood, C., R. Reeve, M. Scardemalia (2003) <i>Building knowledge and literacy skills: Junior Kindergarten</i> Poster session, IKIT Summer Institute, 2003	Support literacy development in JK students	Two-year pilot study at Institute of Child Study
Healy, J. (2002) <i>Endangered Minds</i> Creating the Future, New Horizons for Learning	Discussion of the dangers of pushing academically demanding subjects,	Present educational psychology viewpoint, based on research on children's brains

Reference	Aim of article	What was studied/discussed?
www.newhorizons.org/future/Creating_the_Future/crfut_healy.html	including the use of ICT, in the early years	
Hertzog, N. and M. Klein (2005) <i>Beyond Gaming: A Technology Explosion in Early Childhood Classrooms</i> <i>Gifted Child Today</i> , Vol. 28, No. 3, pp 24-31, Summer 2005	Provide examples of how technology has been integrated into the curriculum	Report on use of technology by three to six-year-olds enrolled in the gifted program at the University Primary School at the University of Illinois
Hutinger, P. L. Robinson, C. Schneider and J. Johanson (2002) <i>The Early Childhood Interactive Technology Literacy Curriculum Project: A Final Report</i> www.eric.ed.gov/ERICDocs/data/ericdocs2/content_storage_01/0000000b/80/27/b0/54.pdf	Final report describing the activities and outcomes of the Interactive Technology Literacy Curriculum Project	<ul style="list-style-type: none"> • Five-year project • Three demonstration sites and three replication sites in rural and urban locations in Illinois • 291 children, 289 families and 18 early childhood team members
Hyun, E and G. Davis (2005) <i>Kindergarteners' Conversations in a Computer-Based Technology Classroom</i> <i>Communication Education</i> , Vol. 54, No. 2, pp 118-135, April 2005	Examine emerging inquiries and dialogue of five and six-year-old kindergarteners	In a technology-rich classroom in the U.S., discourse analysis of the conversations of 9 boys and 9 girls aged five and six
Judge, S., K. Puckett, B. Cabuk (2004) <i>Digital Equity: New Findings from the Early Childhood Longitudinal Study</i> <i>Journal of Research on Technology in Education</i> , vol. 36, No. 4, pp 383-396, Summer 2004	<ul style="list-style-type: none"> • Examine young children's access to computers in school and home • Study the varying conditions that affect how children experience computers 	Sample size: 9,840 public school kindergarten and first grade students
Kankaanranta, M. and M. Kangassalo (2003)	Describe the use of ICT in Finnish	<ul style="list-style-type: none"> • Review Finnish national policies on ICT use

Reference	Aim of article	What was studied/discussed?
<p><i>Information and Communication Technologies in Finnish Early Childhood Environments</i></p> <p><i>Childhood Education</i>, Vol. 79, No 5, pp 287-292, 2003</p>	<p>early childhood environments</p>	<ul style="list-style-type: none"> • Describe the current level of implementation, based on the results of international and national surveys • Present examples of innovative uses of ICT
<p>Kritt, D. W. (2001)</p> <p><i>Technology's Covert Socialization of Children: High-Tech Toys</i></p> <p><i>Journal of Thought</i>, Vol. 36, No. 3, pp 53-61, Fall 2001</p>	<p>Discussion of how high-tech toys may be changing the nature of children's play</p>	<p>Review and discussion of the interactive capacities of high-tech toys and the quality of relationships formed when using high-tech toys</p>
<p>Laffey, J. (2004)</p> <p><i>Appropriation, Mastery and Resistance to Technology in Early Childhood Preservice Teacher Education</i></p> <p><i>Journal of Research on Technology in Education</i>, Vol. 36, No. 4, pp 361-382, Summer 2004</p> <p>www.eric.ed.gov/ERICDocs/data/ericdocs2/content_storage_01/0000000b/80/2c/e4/f4.pdf</p>	<p>Describe how early childhood pre-service teachers appropriate, master and/or resist learning to use technology in teaching</p>	<ul style="list-style-type: none"> • Part of three-year study • Survey data from all students in the program • Focus groups and interviews with a cohort of early childhood pre-service teachers • Two case studies of two early childhood pre-service teachers
<p>Lai, C-C. (2002)</p> <p><i>Kindergartener's Technology Education in Taiwan</i></p> <p>www.eric.ed.gov/ERICDocs/data/ericdocs2/content_storage_01/0000000b/80/27/a4/95.pdf</p>	<p>Examine the use of the National Taiwan Normal University's technology education curriculum developed for the kindergarten affiliated with it</p>	<p>Review of the development and implementation of a developmentally appropriate technology education curriculum for kindergarten students</p>
<p>Lefever-Davis, S. and C. Pearman (2005)</p> <p><i>Early Readers and Electronic Texts: CD-ROM Storybook Features That</i></p>	<p>Explore the impact of CD-ROM storybook features on the reading</p>	<p>Explore the advantages and disadvantages of six categories of features: tracking, electronic feature dependency, distractibility, spectator stance, electronic feature limitations</p>

Reference	Aim of article	What was studied/discussed?
<p><i>Influence Reading Behaviors</i></p> <p><i>Reading Teacher</i>, Vol. 58, No. 5, pp 446-454, February 2005</p>	<p>behaviours of six and seven-year-olds with limited exposure to CD-ROM storybooks</p>	<p>and electronic features as tools</p>
<p>Leung, W. M. (2003)</p> <p><i>The Shift from a Traditional to a Digital Classroom: Hong Kong Kindergartens</i></p> <p><i>Childhood Education</i>, Vol. 80, No 1, pp 12-17, Fall 2003</p>	<p>Describe current computer use in kindergartens in Hong Kong</p>	<p>Discussion of issues such as parental support, availability of resources and software and teacher training</p>
<p>Ljung-Djarf, A. L. Aberg-Bengtsson and T. Ottosson (2005)</p> <p><i>Ways of Relating to Computer Use in Pre-School Activity</i></p> <p><i>International Journal of Early Years Education</i>, Vol. 13, No 1, pp 29-41, March 2005</p>	<ul style="list-style-type: none"> • Analyze the way teachers relate to the computer as a tool in pre-school activity • Describe the learning environments in which computers are used 	<p>Three Swedish pre-schools where one computer was available in each department</p>
<p>Marsh, J., G. Brooks, J. Hughes, L. Ritchie, S. Roberts and K. Wright (2005)</p> <p><i>Digital Beginnings: Young children's use of popular culture, media and new technologies</i></p> <p>University of Sheffield, Literacy Research Centre www.digitalbeginnings.shef.ac.uk/DigitalBeginningsReport.pdf</p>	<p>Present findings of study on use of technology by young children</p>	<ul style="list-style-type: none"> • Survey of 1,852 parents and caregivers whose children attended 120 individual maintained and non-maintained early years settings in England between September 2004 and July 2005 • Survey of 524 early years practitioners working in 104 of these settings
<p>Martin, S. S., R. L. Seevers and C. M. Crawford (2002)</p> <p><i>Computer Use Within Learning Environments: Early Childhood Case Study</i></p>	<p>Study the seeming disparity between availability and types of computer use within childcare settings and preschool</p>	<p>Survey a random sample of special education teachers and child care administrators</p>

Reference	Aim of article	What was studied/discussed?
<p>In <i>Proceedings of SITE 2002 Conference</i>, 13th International Conference of the Society for Information Technology and Teacher Education, Nashville, Tenn., March 18-23, 2002</p> <p>www.eric.ed.gov/ERICDocs/data/ericdocs2/content_storage_01/0000000b/80/28/0b/af.pdf</p>	<p>programs for children with disabilities</p>	
<p>McMaken, J., K. Kauerz, D. DeCesare and G. Hale (2002)</p> <p><i>Technology and Early Childhood Professional Development: A Policy Discussion</i></p> <p>Education Commission of the States, Denver, CO, July 2002</p> <p>www.eric.ed.gov/ERICDocs/data/ericdocs2/content_storage_01/0000000b/80/27/f9/c9.pdf</p>	<ul style="list-style-type: none"> • Summarize presentations and discussions held at meeting of key stakeholders • Meeting organized by Knowledge Works Foundation and Education Commission of the States 	<ul style="list-style-type: none"> • Focus on using technology to better prepare early childhood professionals • 10 recommendations for action
<p>Pierce, P., C. Catlett and P. J. Winton (2003)</p> <p><i>Resources Within Reason</i></p> <p><i>Young Exceptional Children</i>, Vol. 6, No. 4, pp 28-29, Summer 2003</p>	<p>Describe resources for use with children with disabilities</p>	<p>Describe eight resources using assistive technology to support the development and participation of young children with disabilities</p>
<p>Plowman, L. and C. Stephen (2005)</p> <p><i>Children, Play and Computers in Pre-School Education</i></p> <p><i>British Journal of Educational Technology</i>, Vol. 36, No. 2, pp 145-157, March 2005</p>	<p>Inform the development of an information and communication technology strategy for the pre-school years</p>	<ul style="list-style-type: none"> • Observations at seven pre-schools • Interviews with at least two practitioners at each site
<p>Romeo, G., S. Edwards, S. McNamara, I Walker and C. Ziguras (2003)</p> <p><i>Touching the Screen: Issues Related to</i></p>	<p>Investigate the use of touchscreens by children in early childhood</p>	<ul style="list-style-type: none"> • Introduce touchscreens in five classrooms in Melbourne, Australia • Discuss implementation along

Reference	Aim of article	What was studied/discussed?
<p><i>the Use of Touchscreen Technology in Early Childhood Education</i></p> <p><i>British Journal of Educational Technology</i>, Vol. 34, No. 3, pp 329-339, June 2003</p>	and junior primary settings	five themes: developmental issues, input device performance, technical issues, individual differences in children's use of touch screens and issues of collaboration
<p>Schiller, J. and B. Tillett (2004)</p> <p><i>Using Digital Images with Young Children: Challenge of Integration</i></p> <p><i>Early Childhood Development and Care</i>, Vol. 174, No. 4, pp 401-414, 2004</p>	Describe an action research project in a metropolitan South Australian school	<ul style="list-style-type: none"> • Over a six-month period, observe and report on the activities of a class of seven and eight-year-olds as they create digital images to record perceptions of their school • Discuss challenges from both the student and teacher perspectives
<p>Sheridan, S. and I. P Samuelsson (2003)</p> <p><i>Learning through ICT in Swedish Early Childhood Education from a Pedagogical Perspective of Quality</i></p> <p><i>Childhood Education</i>, Vol. 79, No. 5, pp 276-282, 2003</p>	Examine the critical role of ICT in Swedish early childhood classrooms	Observation of both students and teachers
<p>Siraj-Blatchford, J. and D. Whitebread (2003)</p> <p><i>Supporting Information and Communications Technology in the Early Years.</i></p> <p>Open University Press, Supporting Early Learning Series. McGraw-Hill Education, Maidenhead, UK</p>	Provide information on how children age 0 to 6 develop an early awareness, knowledge skills and understanding of ICT	<ul style="list-style-type: none"> • Present evidence that use of ICT by young children is compatible with the principles of developmentally appropriate curriculum • Argue that many ICT applications can make significant and unique contributions to children's cognitive and social development
<p>Suomala, J. A., R. B. Korhonen and H. C. Ketamo (2000)</p> <p><i>New Media in Early Childhood Education</i></p> <p>Paper presented at the 10th European Conference on Quality in Early Childhood Education, London, England, August 29-September 1, 2000</p>	Explore whether ICTs are appropriate for use with young children	Review current literature in relation to defining new media, the constructivist approach and the dimensions of ICT input

Reference	Aim of article	What was studied/discussed?
www.eric.ed.gov/ERICDocs/data/ericdocs2/content_storage_01/0000000b/80/22/92/80.pdf		
<p>Van Scoter, J. D. Ellis and J. Railsback (2001)</p> <p><i>Technology in Early Childhood Education: Finding the Balance</i></p> <p>By Request Series, Northwest Regional Educational Laboratory, Portland, OR</p> <p>www.eric.ed.gov/ERICDocs/data/ericdocs2/content_storage_01/0000000b/80/0d/88/7c.pdf</p>	<ul style="list-style-type: none"> • Focus on technology in the early childhood classroom • Discuss technology and child development, technology in the curriculum and technology-related inequities 	<ul style="list-style-type: none"> • Booklet format • Review research and literature • Discuss policy and practical implications • Highlight exemplary educators • Provide selected resources

Appendix 2.2 Elementary and Secondary Learning

Reference	Aim of article	What was studied/discussed?
<p>Ashburn, A. and R. Floden eds., in press</p> <p><i>Meaningful Learning Using Technology: What Educators Need to Know and Do</i></p> <p>New York: Teachers College Press</p>		
<p>Bailey, M. and S. Rhine (2005)</p> <p><i>Integrated Technologies, Innovative Learning: Insights from the PT3 Program</i></p> <p>ISTE, ISBN 1-56484-218-5</p>	<p>Explore new ways to harness the potential of technology to transform teaching and learning</p>	<ul style="list-style-type: none"> • Case studies on teacher professional development • Exemplary practices in teacher professional development
<p>Barrett, H. C. (2005)</p> <p><i>Researching Electronic Portfolios and Learner Engagement</i></p> <p>http://electronicportfolios.org/reflect/whitepaper.pdf</p>	<p>Provide the theoretical background for a study of student learning through the use of e-portfolios</p>	<ul style="list-style-type: none"> • Overview of research • Description of several technological tools such as blogging and digital storytelling
<p>Becta (2005)</p> <p><i>Learning lessons from digital games: What can games teach us about narrative?</i></p> <p>Becta</p> <p>www.becta.org.uk</p>	<p>Review key features of video games to support learning through effective narrative design</p>	<p>Examples of games and approaches</p>
<p>Bell, L. and G. L. Bull (2005)</p> <p><i>Teaching with Digital Images: Acquire, Analyze, Create, Communicate</i></p> <p>ISTE, ISBN 1-56484-219-3</p>	<p>Showcase the effective use of digital cameras in the classroom</p>	<p>Present technical, logistical and pedagogical strategies</p>

Reference	Aim of article	What was studied/discussed?
<p>Bereiter, C. (2003)</p> <p><i>Bringing Classrooms Into the Knowledge Age</i></p> <p>Proceedings of the Reform and Initiatives in Teaching and Learning Conference (pp 1-10). University of Macau: Macau, China.</p>	<p>Sketching the difference between a stable, slowly evolving society and 20th Century society, in which the rate of change has accelerated considerably</p>	<ul style="list-style-type: none"> • Social condition • Curriculum change • Long-term challenges for education
<p>Bouthillier, F. and K. Shearer (2002)</p> <p><i>Understanding knowledge management and information management: the need for an empirical perspective</i></p> <p><i>Information Research</i>, Vol. 8, No. 1, October 2002</p>	<p>Respond to question: Is knowledge management an emerging discipline or just a new label for information management?</p>	<p>Summarize empirical evidence of how knowledge management is practiced in several types of organizations</p>
<p>Bull, G., G. Knezek, M. D. Roblyer, L. Schrum and A. Thompson (2005)</p> <p><i>A Proactive Approach to a Research Agenda for Educational Technology</i></p> <p>Journal of Research on Technology in Education, Vol. 37, No. 3, Spring 2005</p>	<ul style="list-style-type: none"> • Review the state of research in educational technology in light of the U.S. Department of Education's National Education Technology Plan • Propose a pro-active research approach 	<p>Review of educational technology journals</p>
<p>Cavanaugh, C., K. J. Gillan, J. Kromrey, M. Hess, R. Blomeyer (2004)</p> <p><i>The Effects of Distance Education on K-12 Students Outcomes: A Meta-Analysis</i></p> <p>The Learning Point Associates, Naperville, Illinois www.learningpt.org</p>	<p>Study the factors that affect student learning in virtual-schooling environments</p>	<ul style="list-style-type: none"> • Statistical review of 116 classes in 14 Web-delivered K-12 distance education programs studied between 1999 and 2004 • Factors tested include academic content area, grade level of student, role of distance learning program, role of instructor, length of program, type of school, frequency of distance learning experience, pacing of instruction, timing of instruction, instructor preparation and experience in distance education, setting of students

Reference	Aim of article	What was studied/discussed?
<p>Chan, C. (2003)</p> <p><i>Changing Pre-service teachers' beliefs about teaching and learning through building discourse</i></p> <p>In S. Cacciamani (Chair) <i>Towards a knowledge building culture: Knowledge Forum across contexts and cultures</i>. Symposium conducted at the meeting of the European Association for Research on Learning and Instruction (EARLI), Padova, Italy</p>	<ul style="list-style-type: none"> • Design a learning environment that fosters the development of knowledge building discourse • Assess and characterize knowledge building inquiry and discourse among pre-service teachers • Investigate whether pre-service teachers changed their beliefs and develop a deeper understanding 	<ul style="list-style-type: none"> • 210 pre-service teachers taking a course in educational psychology at UofT • Instructional design: engaging student in collaborative, problem-centred inquiry using Knowledge Forum; asking them to work as experts specializing on different problems; using constructivist assessment to scaffold collaborative knowledge construction
<p>The Children's Partnership (2005)</p> <p><i>Measuring Digital opportunity for America's Children: Where we stand and where we go from here</i></p>	<p>Answer the question: how can the Internet help our children succeed?</p>	<ul style="list-style-type: none"> • Literature review • Original analysis of available survey data • Analysis of latest and most comprehensive national household survey data • Input from Project Advisors and other national experts
<p>Comber, C. R. Watling, T. Lawson, S. Cavendish, R. McEune and F. Paterson (2003)</p> <p><i>ImpaCT2: Learning at Home and School: Case Studies</i></p> <p>Department for Education and Skills, UK</p>	<ul style="list-style-type: none"> • Identify the impact of networked technologies on the school and out of school environment • Find out the degree to which these networked technologies affect the educational attainments of pupils at Key Stages 2, 3 and 4 	<p>Explore the nature of teaching and learning involving ICT in various settings, with a focus on the views of pupils, teachers, and parents</p>
<p>Council of Ministers of Education, Canada (2002)</p> <p><i>Information Technology and Learning: Symposium Report</i> CMEC, Report on the 2002 Pan-Canadian Education Research Agenda Symposium</p>	<ul style="list-style-type: none"> • Encourage educational stakeholders to learn about pan-Canadian trends in learning through ICT • Foster interaction and engagement regarding the impact of ICT on education 	
<p>Cuban, L. (2001)</p>	<p>Discuss certain</p>	<p>Through the presentation of</p>

Reference	Aim of article	What was studied/discussed?
<p><i>Oversold & Underused: Computers in the Classroom</i></p> <p>Harvard University Press, ISBN 0-674-00602-X</p>	<p>assumptions underlying the infusion of ICT in Silicon Valley schools</p>	<p>examples at all levels of schooling: preschool and kindergarten through to postsecondary education, explore answers to three questions:</p> <ol style="list-style-type: none"> 1. In schools where computers are readily available, how do teachers and students use the machines in the classrooms for instruction? 2. Have teaching and learning changed as a consequence of two decades of heavy promotion and investment in computers and other technologies? If so, how and why? 3. Has the investment been worth the cost?
<p>diSessa, A. (2001)</p> <p><i>Changing Minds: Computers, Learning and Literacy</i></p> <p>MIT Press, ISBN 0-262-54132-7</p>	<p>Explore answer to question: can education – particularly science education – be transformed by the computer so that children can learn more, learn more easily at an earlier age, and learn with pleasure and commitment?</p>	<ul style="list-style-type: none"> • Shows how computers can be the basis for a new literacy • Discusses the learning theory that explains why computers can be powerful catalysts for change • Provides examples from Boxer computer environment, an integrated system designed to investigate computational literacies
<p>Davies, A. (2004)</p> <p><i>Finding Proof of Learning in a One-to-One Computing Classroom</i></p> <p>Report submitted to Maine Learning Technology Initiative, April 2004</p>	<p>support the conversation of practitioners and researchers concerning how assessment supports learning in a one-to-one computing environment</p>	<ul style="list-style-type: none"> • 53 days of structured and unstructured observation notes (each were 1–5 typed pages) • 221 pages of unstructured observation notes (research assistant) • 15 hours of audio tape interviews, transcribed • E-mails from Eastern Elementary School participants and e-mail ‘interviews’ • 60 pounds of student evidence of learning, consisting of all student work that would fit in a flat

Reference	Aim of article	What was studied/discussed?
		envelope <ul style="list-style-type: none"> • 50 CD-ROMs and 9.0 GB of hard drive storage of students' digital work from the classroom which serves as evidence of learning
Gee, J. P. (2005) <i>Learning by Design: good video games as learning machines</i> E-Learning, Vol. 2, No. 1, 2005	<ul style="list-style-type: none"> • Review video and computer games • Explore lessons to be learned 	Use principles of learning to examine examples of video and computer games, drawing out the lessons to be learned for education
Harrison, C., C. Comber, T. Fisher, K. Haw, C. Lewin, E. Lunzer, A. McFarlane, D. Mavers, P. Scrimshaw, B. Somekh and R. Watling (2003) <i>ImpaCT2: The Impact of Information and communications Technologies on Pupil Learning and Attainment</i> Department for Education and Skills, UK	<ul style="list-style-type: none"> • Identify the impact of networked technologies on the school and out of school environment • Find out the degree to which these networked technologies affect the educational attainments of pupils at Key Stages 2, 3 and 4 	Develop and apply appropriate methods for evaluating the use of ICT in school and out of school, and to analyse the statistical relationship between the effective implementation of ICT and standards of performance in National Tests and GCSEs
Ilomäki, L. and K. Hakkarainen (2003) <i>Effects of the use of technology on school management practices: An inquiry</i> In H. P. Boshuizen (Chair) <i>Technology, learning and expertise.</i> Paper presented at the meeting of the European Association for Research on Learning and Instruction (EARLI), Padova, Italy	Consider management changes in schools that may be connected to ICT usage: do the characteristics of the new management culture already exist; what are these practices; how is ICT involved in it	Survey of 167 European school principals
Inchauspé, P., T. Laferrière, A. Breuleux, C. Hamel and S. Allaire (2004) <i>L'école éloignée en réseau : une contribution au maintien et au</i>	Explore the possibilities offered by using technology to improve the environment of small-town schools	Case studies of three schools located in three different school boards

Reference	Aim of article	What was studied/discussed?
<p><i>développement des petites écoles de village</i></p> <p>CEFRIO</p> <p>www.cefrio.qc.ca/rapports/EE_R-SYNTHESE.pdf</p>		
<p>ISTE (2002)</p> <p><i>Technology, Innovation and Educational Change: A Global Perspective</i> <i>A Report of the SITES Module 2</i></p> <p>A report of the Second Information Technology in Education Study: Module 2.</p> <p>International Society for Technology in Education (ISTE) www.iste.org</p>	<ul style="list-style-type: none"> • Identify and provide descriptions of innovative best practices • Provide information to national and international policy and decision makers • Provide teachers and other practitioners with new ideas on how to improve use of technology in classroom • Investigate the measurement quality of M1 indicators and contribute to development of M3 assessment 	<ul style="list-style-type: none"> • Survey of students (indicators and assessment) • Survey of teachers • Best practices
<p>Korea (2002)</p> <p>Adapting Education to the Information Age</p> <p>White Paper</p>	<p>Support Korea's nation human resource development program through ICTs</p>	<ul style="list-style-type: none"> • Summarizes current and domestic situation re: use of ICTs in education • Analyzes current statistics re: use of ICTs in education • Describes current tasks future vision and further steps
<p>R. Kozma (2003)</p> <p><i>Technology and Classroom Practices : An International Study</i></p> <p>International Society for Technology in Education (ISTE)</p>	<p>Provide case study evidence of the use and impact of ICTs in the classroom</p>	<p>Examine the findings of 174 case studies in 28 countries: how classrooms worldwide are using technology to change the practices of teachers and students</p>
<p>Laferrière, T., A. Breuleux and P. Inchauspé (2004)</p> <p><i>Rapport de recherche final du projet L'école éloignée en réseau</i></p> <p>CEFRIO</p>	<p>Explore the possibilities offered by using technology to improve the environment of small-</p>	<p>Case studies of three schools located in three different school boards</p>

Reference	Aim of article	What was studied/discussed?
www.cefrio.qc.ca/rapports/École_éloignée_en_réseau_Rapport_final_2004.pdf	town schools	
<p>Laferrrière, T. in collaboration with A. Breuleux and R. Bracewell (1999)</p> <p><i>Benefits of Using Information and Communications Technologies (ICT) for Teaching and Learning in K-12/13 Classrooms</i></p> <p>Prepared for Industry Canada's SchoolNet</p>	<ul style="list-style-type: none"> • Explore the linkages between advanced technology and advanced pedagogy • Set the foundations of a strategy to maximize technology and pedagogy to enhance student learning and performance 	<ul style="list-style-type: none"> • Benefits of ICT integration • Exemplary uses of ICT in teaching and learning • Benefits of ICT in learning and teaching • Develop framework for the teaching profession using the networked computer
<p>Law, N., A. Yuen and A. Chow (2003)</p> <p><i>Pedagogical innovations and use of ICT</i></p> <p>In B. M. Varisco (Chair) <i>Applying ICT to solve pedagogical problems.</i></p> <p>Paper presented at the meeting of the European Association for Research on Learning and Instruction (EARLI), Padova, Italy</p>	Promote acceptance and ease of use of the network oriented teaching and learning in polytechnic level	<ul style="list-style-type: none"> • developed a collection of custom-made concrete pedagogical models, based on teachers' conceptions • 9 polytechnic teachers and their students • pre and post interviews with all teachers and 18 students • analysis using content analyzing methodology
<p>The Learning Point (2002)</p> <p><i>E-Learning Policy Implications for K-12 Educators and Decision Makers</i></p> <p>The Learning Point Associates, Napierville, Illinois www.learningpt.org</p>	Provide policy makers with information to make enlightened decisions	<ul style="list-style-type: none"> • Start-up costs • Evidence of impact • Policy context
<p>Lotherington, H. (2004)</p> <p><i>What Four Skills? Redefining Language and Literacy Standards for ELT in the Digital Era</i></p> <p>TESL Canada Journal, Vol. 22 (1), pp 64-78</p>	Examine changing language conventions in English used in online environments	Review of traditional four-skills paradigm of English text-based grammar in light of evolving technologies

Reference	Aim of article	What was studied/discussed?
<p>Lotherington, H. (2001)</p> <p><i>Reshaping Literacies in the Age of Information</i></p> <p>TESL Ontario, Special Research Symposium Issue, Vol. 27, No. 2, Spring 2001</p> <p>www.teslontario.org/new/research/Special_Issue_2001.pdf</p>	<p>Examine literacy in light of new technologies</p>	<p>Data and information drawn from two studies conducted by author in Toronto schools in 2000</p>
<p>Mackenzie, W. (2005)</p> <p><i>Multiple Intelligences and Instructional Technology, Second Edition</i></p> <p>ISTE, ISBN 1-56484-188</p>	<p>Showcase the fit between multiple intelligences theory and educational technology</p>	<p>Lesson ideas and planning materials, Web sites, online resources and activities</p>
<p>Milton, P. (2002)</p> <p><i>Trends in the Integration of ICT and Learning in K-12 Systems</i></p> <p>Paper commissioned from the Canadian Education Association by Industry Canada's SchholNet</p>	<p>Describes current context of education policy in Canada, selected trends in the integration of ICTs for learning and presents views of author on emerging visions of effective ICT integration.</p>	<ul style="list-style-type: none"> • Present policy context • Discuss questions and barriers to integration
<p>Nason, R. and E. Woodruff (2003)</p> <p><i>Fostering Authentic, sustained, and Progressive Mathematical Knowledge-Building Activity in computer Supported Collaborative Learning (CSCL) Communities</i></p> <p>Journal of Computers in Mathematics and Science Teaching, Vol. 22, Issue 4, 2003</p>	<p>Report on the use of Knowledge Forum[®] Computer Supported Collaborative Learning (CSCL) Software</p>	<p>Twenty-one female Grade 6 students engaged in knowledge-building discourse to improve their models for ranking the cities of Canada in terms of their liveability</p>
<p>Paavola, S., L. Ilomäki, M. Lakkala and K. Hakkarainen (2003)</p> <p><i>Evaluating virtual learning materials through the three metaphors of learning</i></p>	<p>Present a framework for evaluating virtual learning materials</p>	<ul style="list-style-type: none"> • use as starting point the distinction between three general approaches to learning: <ul style="list-style-type: none"> - the acquisition metaphor - the participation metaphor - the knowledge creation metaphor

Reference	Aim of article	What was studied/discussed?
<p>Study part of a European project and a national project on evaluating virtual materials</p> <p>In L. Ilomäki (Chair) <i>Designing virtual learning material</i>. Symposium conducted at the meeting of the European Association for Research on Learning and Instruction (EARLI), Padova, Italy</p>		
<p>M. Prensky, work in progress (2005)</p> <p><i>Engage Me or Enrage Me</i></p> <p>www.marcprensky.com/writing</p>	<p>Presentation of a viewpoint for discussion</p>	<p>Discussion of how school can better engage today's youth</p>
<p>M. Prensky, work in progress (2004)</p> <p><i>The Emerging Online Life of the Digital Native: What they do differently because of technology and how they do it</i></p> <p>www.marcprensky.com/writing</p>		<p>Exploration of the areas of change regarding how young people engage in certain activities such as communicating, sharing, exchanging, creating, meeting, evaluating, learning, analyzing, reporting, socializing</p>
<p>M. Prensky (2004)</p> <p><i>Digital Game-Based Learning</i></p> <p>Paragon House, ISBN 0071454004</p>	<p>Provide a strategic and practical guide to combining content with video and computer games to more successfully engage students</p>	<p>Over 50 case studies and examples of how and why digital game-based learning is working</p>
<p>M. Prensky (2001)</p> <p><i>Digital Natives, Digital Immigrants</i></p> <p>From <i>On the Horizon</i>, NCB University Press, Vol. 9, No. 5, October 2001</p>		<p>Discussion of how the differences between digital natives and their digital immigrant teachers lies at the heart of today's educational problems</p>
<p>M. Prensky (2001)</p> <p><i>Digital Natives, Digital Immigrants, Part II: Do They Really Think</i></p>		<p>Presentation of evidence from neurobiology, social psychology and studies on the use of games in learning to support the view that</p>

Reference	Aim of article	What was studied/discussed?
<p><i>Differently?</i> From <i>On the Horizon</i>, NCB University Press, Vol. 9, No. 6, December 2001</p>		<p>the brains of digital natives are physically different as a result of the digital input they received while growing up</p>
<p>SchoolNet (2001) <i>Implementation of Information and Communication Technology (ICT) in Canadian K-12 Schools: An Overview</i> Industry Canada's SchoolNet</p>	<p>Provide a focus for new directions for the third phase of SchoolNet</p>	<ul style="list-style-type: none"> • consultations with provincial and territorial ministry/department representatives • review of relevant literature • review of provincial and territorial ministry and department Web site
<p>SchoolNet (2000) <i>SchoolNet's On-line Connectivity Survey, Final Report</i> Industry Canada's SchoolNet</p>	<ul style="list-style-type: none"> • identify the number of Internet capable and connected computers, the location of these connected computers and the access methods schools use to connect to the Internet. • present the conclusions and recommendations of the Connectivity Survey Review Panel that developed the survey 	<ul style="list-style-type: none"> • On-line survey mailed to 479 school boards/districts/ divisions • 328 school boards responded
<p>Siemens, G. (2004) <i>Learning Management Systems: The wrong place to start learning</i> Elearnspace, November 22, 2004 www.elearnspace.org/Articles/lms.htm</p>	<p>Discussion of the merits of learning management systems (LMS) in an elearning or blended learning program</p>	
<p>Squire, K. (2005) <i>Changing the Game: What Happens When Video Games Enter the Classroom</i> <i>Innovate</i>, Vol. 1, Issue 6</p>	<p>Examine current school organization based on experiences using <i>Civilization III</i> in a high school history class</p>	<p>Outline the benefits and obstacles to widespread use of games in high school curriculum</p>

Reference	Aim of article	What was studied/discussed?
(August/September 2005)		
Squire, K. and H Jenkins (2003) <i>Harnessing the Power of Games in Education</i> <i>Innovate</i> , vol. 3 (2003)	Examine how video games might be used in formal curriculum	Present five scenarios that illustrate the pedagogical potential of computer and video games
Statistics Canada (2005) <i>Connectivity and ICT integration in First Nations schools: Results from the Information and Communications Technologies in schools Survey, 2003/04</i> Catalogue no. 81-595-MIE2005034	Present information on the ICT infrastructure and reach in all responding First Nations schools in Canada	Data from the 2003/04 Information and Communications Technologies in Schools Survey
Statistics Canada (2004) <i>Connectivity and learning in Canada's schools</i> Catalogue no. 56F0004MIE2004011	Provides key indicators of connectedness for Canada's elementary and secondary schools	Data from the 2003/04 Information and Communications Technologies in Schools Survey
Statistics Canada (2003) <i>The digital divide in Canadian schools: factors affecting student access to and use of information technology</i> Catalogue no. 81-597-XIE	Examines extent to which inequities in use and access of ICT exist among Canadian high school students, based on gender, socio-economic status and rural-urban location	Three datasets: - Canadian portion of SITES - YITS/PISA - Cycle 14 of the General Social Survey (GSS)
Ungerleider, C. and T. Burns (2003) <i>A Systematic Review of the Effectiveness and Efficiency of Networked ICT in Education: A State of the-Field Report to the Council of Ministers of Education, Canada</i> CMEC	Address a number of research questions, including: <ul style="list-style-type: none">• Is on-line and networked learning as effective as classroom instruction?• Is on-line and networked learning as efficient as classroom instruction?• What are the implications for government	<ul style="list-style-type: none">• Review of journals, Web sites, and electronic databases• Direct communication with researchers in 15 countries

Reference	Aim of article	What was studied/discussed?
	partnerships and initiatives? • Are there promising practices?	
Wright, C. (ed.) (2000) <i>Issues in Education and Technology</i> Commonwealth Secretariat	Provide insights and understand key issues that affect policy development and implementation	Present the issues, highlighted through case studies from Commonwealth countries

Appendix 2.3 Post-secondary Learning

Reference Information	Aim	What was studied/discussed?
<p>OECD, 2005</p> <p><i>E-Learning in Tertiary Education: Where Do We Stand?</i></p> <p>OECD, ISBN 92-64-00920-5</p>	<p>Better understand e-learning practices and issues at the institutional level</p>	<ul style="list-style-type: none"> • 19 tertiary education institutions in 13 countries • Examined existing qualitative information, including the 2004 survey carried out by the Observatory on Borderless Higher Education (OBHE)
<p>N. Levenburg and H. Major, 1998</p> <p><i>Distance Learning: Implications for Higher Education in the 21st Century</i></p> <p>The Technology Source, November 1998 www.technologysource.org/article/distance_learning_implications_for_higher_education_in_the_21st_century/</p>	<p>Explore the implications for institutions that say that teaching is as important as research, based on the premise that the pedagogical procedures incorporated into distance learning offer opportunities for serious scholarship</p>	<ul style="list-style-type: none"> • What are the differences between traditional on-campus and non-traditional distance learning classrooms? • What are the implications of these differences for curriculum and instructional design? • What are the implications of these differences for decision-making concerning faculty hiring, training and tenure?
<p>M. Lakkala, H. Muukkonen, H. Lallimo and K. Hakkarainen, 2003</p> <p><i>Analysing the pedagogical implementation of progressive inquiry in a university course</i></p> <p>Invited symposium at the meeting of the European Association for Research on Learning and Instruction (EARLI), Padova, Italy, 2003</p>	<p>Examine the validity of a framework for analyzing the pedagogical arrangements of the collaborative inquiry on procedural, social, epistemological and technical aspects of a university course</p>	<ul style="list-style-type: none"> • Analysis of a university course in psychology, in which student activities were organized according to the principles of progressive inquiry and collaborative knowledge creation
<p>The Advisory Committee on On-Line Learning, CMEC, 2001</p> <p>The e-learning e-volution in colleges and universities</p> <p>Council of Ministers of Education, Canada</p>	<ul style="list-style-type: none"> • Discuss the opportunities that ICTs offer postsecondary institutions • Present a pan-Canadian action plan to increase quickly the use of ICTs in 	<ul style="list-style-type: none"> • Consultations with key stakeholders

Reference Information	Aim	What was studied/discussed?
www.cmec.ca/postsec/evolution.en.pdf	postsecondary institutions and in lifelong learning	
<p>R. M. Bernard, P. C. Abrami, Y. Lou, E. Borokhovski, A. Wade, L. Wozney, P. A. Wallet, M. Fiset and B. Huang, 2004</p> <p><i>How Does Distance Education Compare to Classroom Instruction? A Meta-Analysis of the Empirical Literature</i></p> <p>Centre for the Study of Learning and Performance, Concordia University, Montréal, Canada</p>	<p>Address the following questions:</p> <ul style="list-style-type: none"> • Is interactive distance education as effective, in terms of student achievement, student attitudes and retention, as classroom-based interaction? • To what extent and how do the findings vary? • What conditions contribute to making distance education more effective than classroom instruction? • How do conditions of synchronous and asynchronous distance education affect the overall results? • To what extent do media features and pedagogical features affect the influences of distance education on student learning? • What is the state of the literature? • Are there important implications for practice and future directions for research? 	<p>A meta-analysis of the distance education literature between 1985 and 2002 was conducted, analyzing 232 studies containing 599 independent achievement, attitude and retention outcomes</p>
<p>J. Frydenberg, 2002</p> <p><i>Quality Standards in eLearning: A Matrix of Analysis</i></p> <p>International Review of Research in Open and Distance Learning, October 2002</p>	<p>Explore how postsecondary institutions are creating or adopting quality statements, standards and criteria for elearning</p>	<ul style="list-style-type: none"> • Summarize current published standards in the US • Analyze and organize them into a nine-cell matrix

Reference Information	Aim	What was studied/discussed?
<p>ISBN 1492-3831</p> <p>M. A. Miller and S. W Gilbert, 1999</p> <p><i>Educational Uses of Information Technology: A View for State Leaders</i></p> <p>In <i>Briefing Papers – Transforming Postsecondary Education for the 21st Century</i>, Education Commission of the States</p> <p>www.ecs.org/clearinghouse/16/09/1609.pdf</p>	<ul style="list-style-type: none"> • Review of some of the critical policy issues facing state leaders • Exploration of some of the policy tools available to state leaders 	

Appendix 2.4 Adult Learning

Reference	Aim of article	What was studied/discussed?
<p>ABC Canada (2005)</p> <p><i>Linking Adult Literacy and eLearning: Research Study on the Use of eLearning Tools in Adult Literacy Programs</i></p> <p>www.abc-canada.org/media_room/news/elearning_exec_summary.shtml</p>	<ul style="list-style-type: none"> • Explore the link between adult literacy and elearning practices in Canada • Provide a snapshot of elearning in adult literacy in Canada 	<ul style="list-style-type: none"> • Two surveys of the literacy and elearning communities • Explore the issue of return-on-investment • Examine new services and tools • Analyze relevant adult literacy, elearning and lifelong learning literature and policies
<p>Armstrong, P. (2000)</p> <p><i>All Things Bold and Beautiful: Researching Adult Learning Through Soaps</i></p> <p>Presented at the AERC 2000 Conference, Vancouver, June 2-4, 2000</p> <p>www.edst.educ.ubc.ca/aerc/2000/armstrongp1-final.PDF</p>	<p>Explore informal lifelong learning outside of educational institutions</p>	<p>Examine the role of soap operas in lifelong learning</p>
<p>Barker, K. C. (2004)</p> <p><i>eLearning and Adult Literacy: Exploring Return on Investment (ROI)</i></p> <p>www.FuturEd.com</p>	<p>Provide a guide for analyzing ROI in elearning in adult literacy programs</p>	<ul style="list-style-type: none"> • Review relevant literature • Propose a methodology for determining ROI in adult literacy elearning
<p>Berge, Z. L., L. Y. Muilenburg and J. Van Haneghan (2002)</p> <p><i>Barriers to Distance Education and Training: Survey Results</i></p> <p>eModerators, May 15, 2003</p> <p>www.emoderators.com/barriers/barriers2002.shtml</p>	<p>Examine the barriers to distance education</p>	<p>A survey (n=2504) addressing six factors:</p> <ul style="list-style-type: none"> • Work place • Job function • Type of delivery system used • Expertise of individual regarding distance education • Status of organization in providing distance education • Area of work of respondent

Reference	Aim of article	What was studied/discussed?
<p>Burnside, R. M. (2001)</p> <p><i>e-Learning for Adults: Who Has the Goods?</i></p> <p><i>The Technology Source</i>, July/August 2001</p> <p>http://technologysource.org/article/elearning_for_adults/</p>	<p>Explore the gulf between traditional universities and online education providers</p>	<p>Discussion of who is better at providing online learning: universities or online providers</p>
<p>Englebright, L. (2004)</p> <p><i>Overcoming Social Exclusion Through Online Learning</i></p> <p>Summary report of Consultation Workshops held during the <i>Facing the Future: E-Learning for Adults</i> Conference, Leicester, June 16, 2004</p>	<p>Provide a summary of discussions</p>	<p>Explore questions on how best to reach adults who are disaffected or not interested in learning</p>
<p>ESRC (2004)</p> <p><i>Report of the Adult Learning@Home Project</i></p> <p>www.esrcsocietytoday.ac.uk/ESRCInfoCentre/PO/releases/2004/september/index5.aspx?data=2uB3pSZjwsAHbhhd%2fdv%2fPtfwS1XQCUQckwjHyhy7dswbdGTgW5sLKZolyVwN NWI5c5rYzARu9twFFAbald2TgMY9me3Wgw7le6VoFHP16iXNPqyo54ayg%3d%3d&xu=&isAwardHolder=&isProfiled=&AwardHolderID=&Sector=</p>	<p>Examine adult learning in a digital age</p>	<ul style="list-style-type: none"> • Door-to-door survey of 1001 adults in Bath, Cardiff and North Somerset • Semi-structured interviews with 100 respondents • Year-long in-depth ethnographic study of 25 ICT users, their friends and families
<p>Foley, G. (2004)</p> <p><i>Dimensions of Adult Learning: Adult Education and Training in a Global Era</i></p>	<p>Present a broad overview of adult learning in the workplace and the community</p>	<p>Examine adult education policy and research</p>
<p>Ginsburg, L., J. Sabatini and D. Wagner (2000)</p>	<p>Explore the digital divide among adults within and across many nations</p>	<p>Present examples taken from a number of countries but primarily from the USA</p>

Reference	Aim of article	What was studied/discussed?
<p><i>Basic Skills in Adult Education and the Digital Divide</i></p> <p>In <i>Learning to Bridge the Digital Divide</i>, OECD</p>		
<p>Gray, B. (2004)</p> <p><i>Informal Learning in an Online Community of Practice</i></p> <p><i>Journal of Distance Education</i>, Vol. 19, No. 1 (Spring 2004), pp. 20-35</p>	<p>Examine the role communities play in informal learning</p>	<p>Examine the experiences of 43 coordinators of Alberta Community Adult Learning Councils participating in an online community of practice</p>
<p>Greenagel, F. (2003)</p> <p><i>Lead Balloons, Stone Canoes, and Learning Styles</i></p> <p>Learning Circuits, September 2003 www.learningcircuits.org/2003/sep2003/greenagel.htm</p>	<p>Examine the concept of learning styles in an online environment</p>	<p>Discussion of adult learning styles in an online environment</p>
<p>Greenagel, Frank (2002)</p> <p><i>The Illusion of e-Learning: Why We Are Missing Out on the Promise of Technology</i></p> <p>www.league.org/publication/whitepapers/0802.html</p>	<p>Examine why e-learning has not kept pace with advances in technology</p>	<p>Discussion of options to improve e-learning's effectiveness, including learning styles</p>
<p>Lamping, A. and J. Keevill (2003)</p> <p><i>e-language learning for adults: a hybrid model</i></p> <p>The report of a joint project by BBC Factual & Learning and the Nuffield Languages Programme</p> <p>http://languages.nuffieldfoundation.org/filelibrary/pdf/e-languages.pdf</p>		
<p>Li, Q. (2004)</p> <p><i>At-Risk Learners, Technology, and Mathematics: The Effects and the</i></p>	<p>Examine the effects of computer-assisted instruction (CAI) on adult at-risk learners</p>	<ul style="list-style-type: none"> • 22 adult learners enrolled engaged in CAI in an adult high school • control group of 16 adults not

Reference	Aim of article	What was studied/discussed?
<p><i>Guidelines for Design</i></p> <p>Presentation at the Eleventh International Literacy and Education Research Network Conference, Havana, Cuba, June 27-30, 2004</p> <p>http://learningconference.com/PropoalSystem/Presentations/P000908</p>		engaged in CAI
<p>Lockitt, B. (2004)</p> <p><i>Adult, Community and Work Based Learning: e-learning</i></p> <p>www.3t.co.uk</p>	Examine the issues and barriers facing Adult and community learning	Review of Adult Learning Inspectorate's Chief Inspectors Reports
<p>Mauger, S. (2004)</p> <p><i>e-learning in the real world</i></p> <p>t-Magazine, 2004</p> <p>www.tmag.co.uk/articles/Apr04Pg28.html</p>	Discussion of non-formal e-learning	Provide personal views for discussion
<p>Mauger, S. (2002)</p> <p><i>E-learning is about people not technology</i></p> <p><i>Adults learning</i>, vol. 13, no 7, March 2002, pp. 9-11</p> <p>www.niace.org.uk/Publications/Periodicals/AdultsLearning/default.htm</p>	Explore the human element of ICT	Discussion of a broader approach using communication systems to underpin learner encouragement, care and motivation
<p>McNeely, B. (2005)</p> <p><i>Using Technology as a Learning Tool, Not Just the Cool New Thing</i></p> <p><i>Educause</i>, February 23, 2005</p> <p>www.educause.edu/UsingTechnologyasaLearningTool,NotJusttheCoolNewThing/6060</p>	Explore intergenerational use of technology	Discussion of how and why the Net Generation learns as opposed to how their parents and grandparents learn
<p>National Governors Association (2001)</p>	Report of the Commission on	<ul style="list-style-type: none"> • Draft a vision of e-learning for adults

Reference	Aim of article	What was studied/discussed?
<p><i>A Vision of E-Learning for American's Workforce</i></p> <p>NGA Center for Best Practices</p> <p>http://preview.nga.org/Files/pdf/ELEARNINGREPORT.pdf</p>	<p>Technology and Adult Learning</p>	<ul style="list-style-type: none"> • Present 13 recommendations on quality, assessment and certification and access
<p>OECD (2005)</p> <p><i>New Perspectives on ICT Skills and Employment: Report of the Working Party on the Information Economy</i></p> <p>OECD, April 22, 2005</p> <p>www.oecd.org/dataoecd/26/35/34769393.pdf</p>	<ul style="list-style-type: none"> • Provide overview of ICT skills and employment across OECD countries • Analyze impacts on economic performance 	<ul style="list-style-type: none"> • Develops two measures of ICT-skilled employment
<p>Office of Learning Technologies (2004)</p> <p><i>Learning and Skills Development Through Technology</i></p> <p>www.hrsdc.gc.ca/en/hip/lld/olt/Skills_Development/OLTResearch/learning_through_technology/learning_through_technology.pdf</p>	<p>Provide a snapshot of the outcomes of projects funded by OLT</p>	<ul style="list-style-type: none"> • 75 projects reviewed • analysis of effective strategies used to encourage the application of technology
<p>Pont, B. and R. Sweet (2003)</p> <p><i>Adult learning and ICT: How to respond to the diversity of needs?</i></p> <p>OECD/NCAL International Roundtable on ICT in Non-formal and adult education: Supporting out-of-school youth and adults, Philadelphia, 12-14 November, 2003</p> <p>www.literacy.org/ICTconf/PhilaRT_Pont_final.pdf</p>	<p>Examine how ICT is used in adult education programs in OECD countries</p>	<ul style="list-style-type: none"> • analyze unequal participation patterns in adult learning and reasons for non-participation • analyze differences in access and use of ICT • review policies • provide policy pointers
<p>Squire, K. (2005)</p>	<p>Document and describe</p>	<ul style="list-style-type: none"> • review existing work on

Reference	Aim of article	What was studied/discussed?
<p><i>Game-based Learning: State of the field</i></p> <p>XLearn Perspective Paper, eLearning Consortium, Masie Center</p> <p>www.masie.com</p>	<p>the contemporary games and learning movement</p>	<p>gaming cultures, technologies and e-learning</p> <ul style="list-style-type: none"> • interviews with three leading game developers
<p>Straetz, K., A. Kaibel, V. Raithel², M. Specht, K. Grote and F. Kramer (2004)</p> <p><i>An e-Learning Environment for Deaf Adults</i></p> <p>Fraunhofer Institute for Applied Information Technology</p> <p>http://ui4all.ics.forth.gr/workshop2004/files/ui4all_proceedings/adjunct/interactive_applications/77.pdf</p>	<p>Meet the special needs of deaf adult learners wishing to improve their mathematics and reading/writing skills</p>	<p>Present an LMS that offers German Sign Language videos corresponding to text in the learning environment</p>
<p>Wagner, D. E. and R. Kozma (2003)</p> <p><i>New Technologies for Literacy and Adult Education: A Global Perspective</i></p> <p>Prepared for TECH21 – National Technology Laboratory for Literacy and Adult Education (ED-01-R-0023), sponsored by the Office of Vocational and Adult Education, U.S. Department of Education, October 1, 2003</p>	<p>Present a set of “visions” on the ways that technology can support the development of youth and adult literacy and non-formal education in developing countries</p>	<ul style="list-style-type: none"> • Status and trends • Analysis of two approaches • New options of literacy and use of technology • Implications/options for policy makers
<p>Wenger, E., N. White, J. D. Smith and K. Rowe (2005)</p> <p><i>Technology for communities</i></p> <p>CEFRIO</p> <p>http://technologyforcommunities.com/CEFRIO_Book_Chapter_v_5.2.pdf</p>	<p>Summarize the findings of a study on communities of practice and the technologies they use</p>	<ul style="list-style-type: none"> • Discuss the various technologies used • Analyze the market and its structure • Describe examples of tools for communities

Reference	Aim of article	What was studied/discussed?
f		
<p>Wenger, E. (2001)</p> <p><i>Supporting Communities of Practice: A Survey of community-oriented technologies</i></p> <p>www.ewenger.com/tech/</p>	<p>Provide a guide to selecting and assembling a technological platform to support communities of practice</p>	<p>Practical guide to assessing a community of practice and its technology needs</p>
<p>Wurzberg, G. (2005)</p> <p><i>Sustainable Investment in Lifelong Learning: the Pivotal role of ICT</i></p> <p>Presentation at the EDEN 2005 Annual Conference on Lifelong Learning, Helsinki, Finland, June 2005</p>	<p>Examine whether e-learning can help to make lifelong learning a reality</p>	<p>Review of OECD data on adult learning</p>

Appendix 2.5 Health and Learning

Reference	Aim of article	What was studied/discussed?
Medinfo 2001: Proceedings of the 10 th World Congress on Medical Information (Studies in Health Technology and Informatics, 84)		
I. Masiello and K. Lonka, 2003, Sweden	E-Learning in medical education at Karolinska Institute	Understand the readiness and attitudes of students on the use of technology and Ping-Pong (e-learning environments)
A. Russell, 2003, Interprofessional knowledge building in health care	Explore how health care practitioners learn to become continuous learners and reflective practitioners	Two-year interprofessional knowledge building design experiment, with the aim to transform a hierarchical, static CPD documentation activity into a dynamic opportunity for interprofessional collaboration and learning Twenty educators, mentors and organizational change agents in bioethics, nursing, occupational therapy, physiotherapy and psychology
Donald Clark, 2002, Psychological Myths in e-Learning, <u>Medical Teacher</u>	Examines disconnect between educational theory and practice	
R. Shegog, K. Bartholomew, G. Parcel, M. Sockrider, L. Masse, S. Abramson, <u>JAMIA</u> , 2001	Impact assessment comparative study - Asthma self-management using interactive media	76 children in two groups
B. Geiger, C Petri, O. Myers, J. Lan, D. Binkley, C. Aldige, J. Berdebes, <u>J. School Health</u> , 2002	Evaluation of multimedia pilot	2,249 public school students

Reference	Aim of article	What was studied/discussed?
	game to enhance nutrition awareness to assess value of interactive games in teaching health education	
M. Napolitano, M. Fotheringham, D. Tate, C. Sciamanna, E. Leslie, N. Owen, A. Bauman, B. Marcus, <u>Soc. Behav. Med.</u> , 2003	Comparative evaluation between two groups to assess value of Internet-delivered health information	65 sedentary adults
J. Pellerito, <u>Occup. Therapy Intl.</u> , 2003	Comparison to baseline to assess use of computer instruction in health care and recovery	3 adults with spinal cord injury