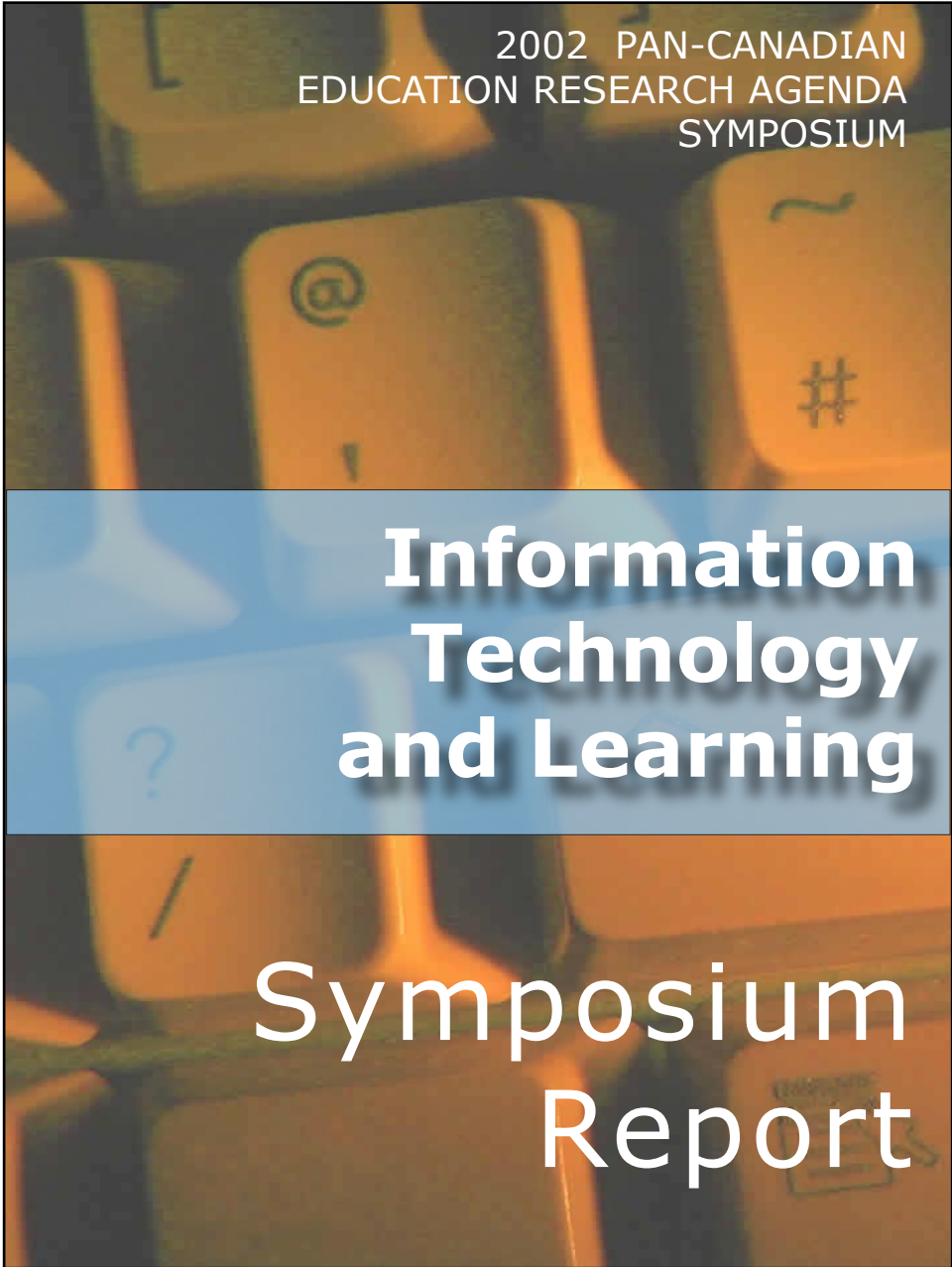


2002 PAN-CANADIAN  
EDUCATION RESEARCH AGENDA  
SYMPOSIUM

# Information Technology and Learning

## Symposium Report





2002 PAN-CANADIAN  
EDUCATION RESEARCH AGENDA  
SYMPOSIUM

**Information  
Technology  
and Learning**

**Symposium  
Report**



Statistics  
Canada Statistique  
Canada



Council of Ministers  
of Education, Canada

Conseil des ministres  
de l'Éducation (Canada)

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# Table of Contents

Introduction	1
Welcome Speeches	
Benjamin Levin	4
Mike Sheridan	5
Guy Hô Văn Hap	6
Keynote Presentation	7
Robert Kozma	
Discussion on Keynote Presentation	12
Research Presentations	13
Session 1: State-of-the-Field Research	
<i>ICT in K–12 education: What (little) we know</i>	13
Charles Ungerleider, Tracey Burns	
 <i>Canadian research on IT</i>	16
Margaret Haughey	
Discussant: Shannon Delbridge	18
Discussion Period: Session 1	19
Session 2: The Integration of ICT in the Classroom	
<i>The impact of a networked computer-assisted project-based pedagogy on motivational beliefs and work involvement of secondary-level students</i>	20
Frédéric Legault, Thérèse Laferrière	
 <i>The integration and effectiveness of ICT in Canadian postsecondary education</i>	21
Carl Cuneo, Brian Campbell, Delsworth Harnish	
Discussion Period: Session 2 (Part 1)	23
 <i>Integrating ICT in teacher training: A challenging balance</i>	24
Thierry Karsenti, Monique Brodeur, Colette Deaudelin, François Larose, Daniel Peraya, Maurice Tardif	
Panel Discussion – Session 2	
Nicole Lefebvre	25
Janice Sargant	26
Marine Perran	26
Discussion Period: Session 2 (Part 2)	27

Session 3: Computer Use and Literacy	
<i>The impact of computer use on reading achievement of 15-year-olds</i>	28
Patrick Bussière, Tomasz Gluszynski	
 <i>The use of computer technology for literacy intervention</i>	29
John Morgan, Nicolas White	
 Discussant: Michael Hayes	31
 Discussion – Session 3	32
Session 4: Equity Issues	
<i>The digital divide in Canadian schools</i>	33
E. Dianne Looker, Victor Thiessen	
 <i>Students' access to and use of ICT</i>	34
Bradley Corbett, J. Douglas Willms	
 Discussant: Britta Gundersen-Bryden	35
 Discussion: Session 4	36
Session 5: Capacity-building	
<i>Capacity-building within and across countries: research and development into the effective uses of ICT</i>	38
Alain Breuleux, Mary Lamon, Thérèse Laferrière	
 Discussant: Marian Fushell, Department of Education, Newfoundland and Labrador	39
 Discussion: Session 5	41
Group Thematic Discussions	
Group 1: Learning Enhancement	42
Group 2: Teaching and Technology	43
Group 3: Quality and Effectiveness	44
Group 4: Equity	45
Group 5: On-line Learning	46
Group Discussion on Themes	47
Summary and Conclusions	48
Closing Remarks	49
Participants	50

# Introduction

## History of the Pan-Canadian Education Research Agenda

The Canadian Education Statistics Council (CESC), a partnership between Statistics Canada and the Council of Ministers of Education, Canada (CMEC), initiated the **Pan-Canadian Education Research Agenda** (PCERA) in 1997 to bring interprovincial/territorial research issues that are important to ministers of education and training to the attention of the research community in Canada, and to promote open discussion of these issues with different partners in education.

Through consultations with the ministries and departments of education and training, seven research themes were developed to guide the work of the PCERA. These priority themes have been further defined through a consultation process involving the ministries and departments of education and training, as well as through the work of educational researchers and the PCERA Advisory Committee. They are currently:

- Learning Outcomes
- Transitions
- Teacher Education/Educator Training
- Diversity and Equity
- Special-Needs Programming
- Citizenship and Social Cohesion
- Technology and On-Line Learning

## PCERA Research and Symposia

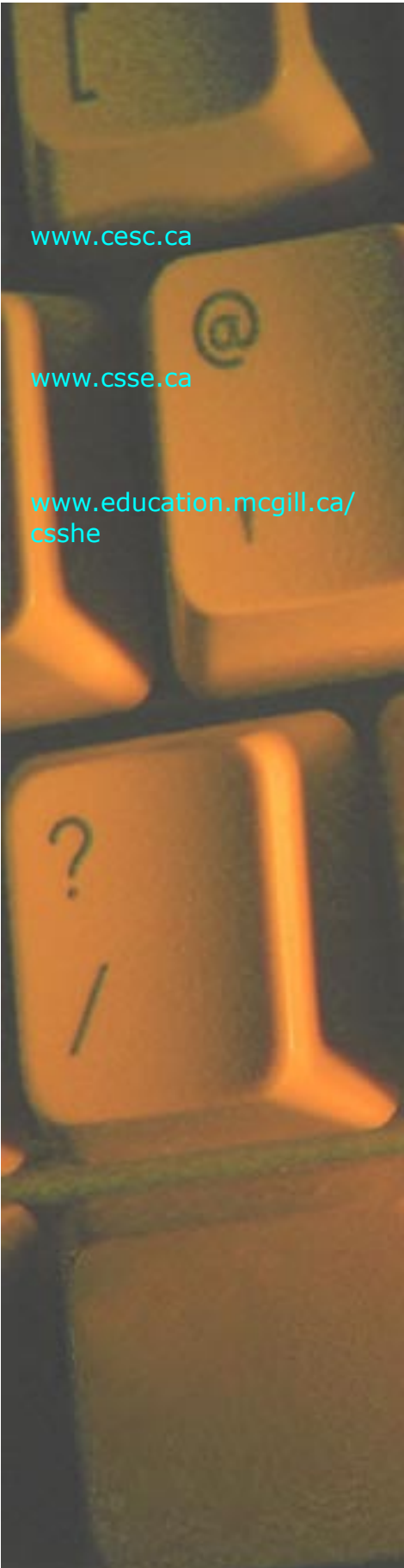
### 1999 PCERA Symposium

The first PCERA Symposium, held in Ottawa in February 1999, examined the seven PCERA priority research themes. CESC organized the symposium to promote informed dialogue among different partners in education on the direction that research on the priority themes might take, and to explore the possibilities for realizing the agenda. Twelve research papers were commissioned that both reviewed the current state of research and proposed research questions on the priority themes.

### 2000 PCERA Symposium: Children and Youth at Risk

The topic for the first round of research under PCERA was “Children and Youth at Risk.” The 2000 PCERA Symposium, held in Ottawa in April 2000, served as a forum for various stakeholders in education and sought to expand participants’ understanding of the “at-risk” concept, to share and disseminate current research findings, and to promote new research in this area.

Ten research papers were commissioned from experts on various aspects of children and youth at risk, including school-linked services, student loans, students with exceptional needs, and culturally diverse groups. A summary of the proceedings, including a synthesis written by Robert Crocker of Memorial University, is documented in *Children and Youth at Risk: Symposium Report*.



[www.cesc.ca](http://www.cesc.ca)

[www.csse.ca](http://www.csse.ca)

[www.education.mcgill.ca/  
csshe](http://www.education.mcgill.ca/csshe)

## **2001 PCERA Symposium: Teacher Education/Educator Training: Current Trends and Future Directions**

Teacher education/educator training is a high priority for ministries/departments of education and training and converges with a number of educational issues. For these reasons, this theme was selected as the focus of the next round of PCERA research.

CESC held the third PCERA Symposium in conjunction with the Canadian Society for the Study of Education (CSSE) and the Canadian Society for the Study of Higher Education (CSSHE) at Laval University in Quebec City on May 22 and 23 during the annual Congress of the Social Sciences and Humanities.

Fifteen research groups from both the academic and government sectors presented their findings at the symposium. Issues that were addressed by the researchers included teacher/educator supply and demand, the role of teacher education/educator training, teacher/educator professional development, indicators of success, and leadership.

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## **2002 PCERA Symposium: Information Technology and Learning**

The 2002 PCERA Symposium was held in Montreal at the Crowne Plaza Hotel from April 30 to May 2, 2002. The subject of this round of PCERA research was Information Technology and Learning, and the goal of the symposium was to encourage educational stakeholders to learn about pan-Canadian trends in learning through information and communications technology and to allow them to interact and engage in discussions with one another about the impact of these new technologies and communications systems on education. The participants were able to develop a deeper understanding of the influence of information technology on today's learners, to suggest future research on this topic, and to explore possibilities of collaboration on new research initiatives.



This symposium was attended by over eighty participants, including government representatives, educational organization representatives, university deans of education, practitioners, and researchers.

The event began with a keynote presentation from Dr. Robert Kozma of SRI International who is the International Coordinator for the SITES Module 2 study. During the following two days, participants listened to and discussed ten research papers and presentations from policy makers and a panel on the integration of information and communications technologies (ICT) in the classroom in various plenary and small groups.

The papers and discussions were grouped into five subtopics related to ICT:

- State-of-the-field research on IT and learning in Canada
- The integration of ICT in the classroom
- Computer use and literacy
- Equity issues
- Capacity-building

The 2002 PCERA Symposium was preceded by the **CMEC–OECD–Canada Seminar on “Future Challenges in Education and ICT”** that was organized by the Organisation for Economic Co-operation and Development (OECD) and CMEC and held April 28–30, 2002. The Seminar welcomed participants from over twenty countries, and twelve delegates from these countries stayed on in Montreal to attend the 2002 PCERA Symposium. Participants at the symposium enjoyed and benefited from the international perspective that these delegates provided.

This report documents the proceedings of the symposium, including information on the commissioned research, research presentations, research authors, and the discussions that took place.

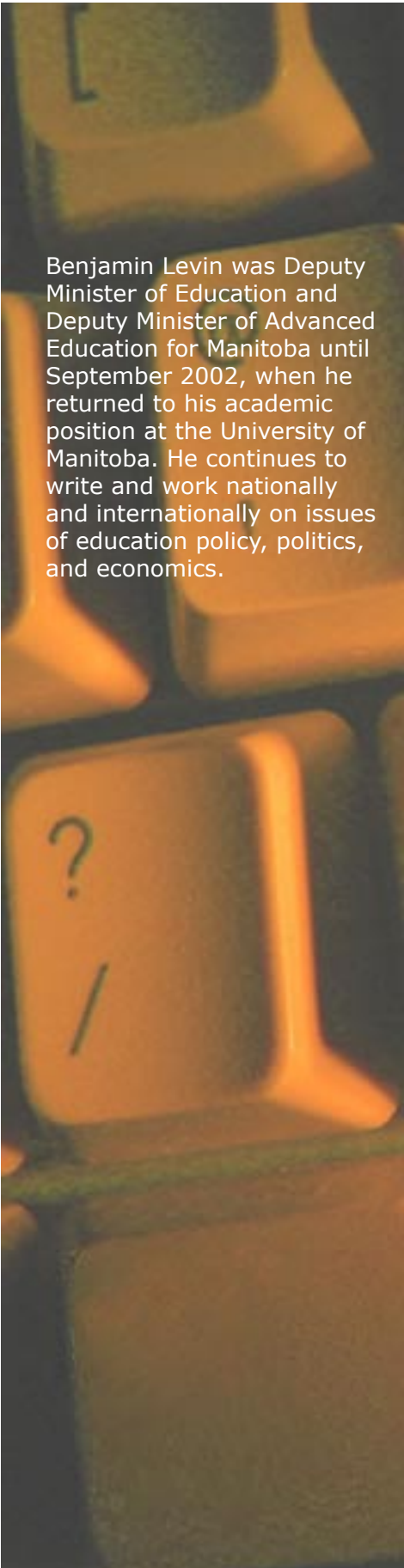
[sitesm2.org](http://sitesm2.org)

[www.cmec.ca](http://www.cmec.ca)

[www.oecd.org](http://www.oecd.org)

### **2002 PCERA Symposium Sessions:**

- State-of-the-field research on IT and learning in Canada
- The integration of ICT in the classroom
- Computer use and literacy
- Equity issues
- Capacity-building



Benjamin Levin was Deputy Minister of Education and Deputy Minister of Advanced Education for Manitoba until September 2002, when he returned to his academic position at the University of Manitoba. He continues to write and work nationally and internationally on issues of education policy, politics, and economics.

## Welcome Speeches

### **Benjamin Levin** **Deputy Minister, Manitoba Training, Education and Youth**

Benjamin Levin welcomed symposium participants to the event on behalf of Paul Cappon (Director General, CMEC) and CMEC, and extended a special welcome to international visitors who had chosen to stay after the CMEC–OECD–Canada Seminar to participate in the symposium as well.

“In Canada and other countries, governments are looking at ways in which they can make better use of research and evidence to guide decision-making in policy and practice,” he said. In Canada, the ministers of education try to accomplish this task through the Canadian Education Statistics Council (CESC). The mandate of the CESC, he noted, is to collect and disseminate education-related information at the pan-Canadian level to meet the needs of governments, students, parents, educators, and the public. This mandate is carried out through PCERA and the Pan-Canadian Education Indicators Project (PCEIP).

When describing CESC partners’ roles, Levin indicated that Statistics Canada provides the CESC partnership with data and Canadian education statistics, notably in the area of student assessment (the School Achievement Indicators Project [SAIP] and the Second Information Technology in Education Study [SITES]). Statistics Canada provides a precious source of data and information for PCERA research. “Our partners at the Centre for Education Statistics bring their experience in dealing with data and related education issues to the PCERA partnership process, and we look forward to continuing to work with them,” he told participants.

After briefly discussing previous symposia and their outcomes, Levin explained the main goal of the PCERA symposia — “...a collaborative forum to share and create bridges between policy makers, researchers, teachers, and funding agencies hoping to arrive at a better understanding of each other’s perspectives.”

In regards to ICT and learning, Levin noted that there are still many unanswered questions on this theme. Educators are still unsure of the role that information technology can and should play in the development of education in Canada and how they should use this technology to advance educational goals. The main objective of this symposium was to answer these questions and to continue to make progress in the support of policy-relevant research in Canada.

## **Mike Sheridan** **Assistant Chief Statistician, Social Institutions and Labour Statistics, Statistics Canada**

Mike Sheridan expressed his welcome to symposium participants on behalf of Statistics Canada and the Canadian Education Statistics Council. He then discussed the growing importance of science, technology, and innovation in education: “We really have some incredible opportunities here in terms of data and information, and the knowledge to be able to transform those data into information, relevant pieces of analysis and research that can indeed inform policy.”

Sheridan noted that eight to ten years ago, there was an absolute lack of new information on which to build policy. Today, however, with the number of new data sets that have been collected in the past few years (such as the Youth in Transition Survey [YITS] and the Programme for International Student Assessment [PISA]), the opportunities for research to guide policy-making are growing. According to Sheridan, “We are in a golden era with respect to the amount of information that is available to really contribute to evidence-based policy directions, and more importantly, policy decisions.”

Sheridan also announced the opening of nine research centres across Canada that are the result of a joint initiative between Statistics Canada, the Social Sciences and Humanities Research Council (SSHRC), and the Canada Foundation for Innovation — the Research Data Centres (RDC) Program. Data sets will be sent to these research centres with the hope that they will draw the interest of students and others who are working on both quantitative and qualitative research. These individuals will then be able to take this data and share it with education stakeholders who inform policy development.

[www.statcan.ca](http://www.statcan.ca)

Mike Sheridan is Assistant Chief Statistician responsible for Social Institutions and Labour Statistics at Statistics Canada.

[www.cmec.ca/pisa/indexe.stm](http://www.cmec.ca/pisa/indexe.stm)

<http://www.pisa.gc.ca>

[www.sshrc.ca](http://www.sshrc.ca)

[www.innovation.ca](http://www.innovation.ca)

[www.statcan.ca/english/rdc/](http://www.statcan.ca/english/rdc/)



## **Guy Hô Vàn Hap**

### **Director, Research and Assessment, Quebec Ministry of Education**

Guy Hô Vàn Hap is Director, Research and Assessment in the Quebec Ministry of Education. An economics and industrial relations graduate of Laval University, Mr. Hô began his career in that institution where he was a faculty relations officer from 1973 to 1977. Entering the public service, Mr. Hô held the position of economist in the Ministry of Social Affairs (1978), the Ministry of Education (1979-1980) and the Treasury Board Secretariat (1981-1984). He was then appointed Director, Information Systems at the Treasury Board Secretariat (1984-1995).

[www.meq.gouv.qc.ca](http://www.meq.gouv.qc.ca)

Guy Hô Vàn Hap welcomed participants to the event and to Montreal, the second largest French-speaking city in the world. Montreal is a city that is very focused on learning; the city is home to four universities (McGill University, Concordia University, the Université du Québec à Montréal, and the Université de Montréal) as well as many large schools, institutes, and research centres.

Mr. Hô noted that this symposium represented an invitation to clarify the role of information technology in learning in the “context of a changing world where knowledge and information occupy a predominant position, a world where technology is now and will continue to be omnipresent,”

In Quebec, as in a majority of western countries and Canadian provinces and territories, both primary and secondary education are undergoing significant reform. This reform has many implications for teacher pre-service training programs and in-service training programs. In this regard, information and communications technologies constitute a constant preoccupation for the Quebec ministry of education and for Quebec’s school boards. In particular, some of the questions the Ministry is facing include: How do we approach information and communications technologies as tools for learning? What are the ideal conditions for the development of appropriate competencies for the optimal use of ICT in teaching and learning situations?

Mr. Hô also noted that policy makers were particularly interested in the discussions that would take place over the two-day symposium and he emphasized that the PCERA initiative permits partners in education to work together collaboratively to “mutually enrich our understanding and knowledge, experiences, and each of our realities.”

Mr. Hô concluded by wishing all participants an excellent symposium and a pleasant stay in Quebec.



# Keynote Presentation

## Robert Kozma

### Principal Scientist, Center for Technology in Learning, SRI International

The International Study Coordinator for the Second Information Technology in Education Study (SITES) Modules 2 and 3, Robert Kozma, led off the 2002 PCERA Symposium with the keynote presentation. Kozma, who is particularly concerned about the role of ICT in a research and policy context, began the presentation with the question that was on the mind of every symposium participant: “We’ve given them computers; we’ve hooked them up; what more do we need to do?”

Kozma noted that many countries around the world have made official statements regarding the role of ICT in education. For example, in 1997, Singapore developed a [master plan for education reform](#) entitled “Thinking Schools, Learning Nation.” According to Kozma, Singapore is very engaged in strategic planning for technology integration in schools. He quoted the Singapore policy statement on technology integration: “We will use IT to help equip our young people with learning skills, creative thinking skills, and communication skills.”

Singapore also supports the idea that “...the development of new teaching and learning strategies will open new possibilities for curricula and assessment. IT-based learning strategies will help to develop pupils’ ability to think flexibly and innovatively, to cooperate with one another, and to make sound value judgments.”

Norway has also launched an [ICT integration plan](#). Kozma noted that Norway recognizes the need to raise the level of information technology expertise in order to increase flexibility and to help the labour force adapt to meet high demands from the business sector. To meet these challenges, Norwegian policy makers have proposed that “the education system must adopt new methods, develop new content, new types of teaching, and new methods of collaboration. Research and project results show that ICT can function as a catalyst for change and the development of new roles for students and teachers.”

[www.sri.com](http://www.sri.com)

[sitesm2.org](http://sitesm2.org)

Robert Kozma is a Fulbright Senior Specialist and Principal Scientist at the Center for Technology in Learning at SRI International. His research expertise includes international educational technology research, the evaluation of technology-based reform, and the design of advanced interactive multimedia systems. He has consulted with the ministries of education in Thailand, Singapore, and Chile and with the Ford Foundation on the use of technology to improve educational systems. Dr. Kozma currently directs the Second Information Technology in Education Study: Module 2 (SITES M2), a study of technology-based classroom innovation in 28 countries, sponsored by the International Association for the Evaluation of Educational Achievement (IEA). He has directed or co-directed more than 20 projects including the evaluation of a national virtual high school, the evaluation of technology-based reform in undergraduate chemistry, and the development of multimedia technologies to support learning in chemistry and to aid collaborative distance learning.

Chile has also issued a report that reviews the reform of the Chilean education system. Kozma quoted a policy statement from this review: “Students need to be furnished with the tools that will allow them to handle the digital world and perform competently in it. In order to achieve this goal, students will be given the opportunity to work with computers, to become independent users, and discover through personal experience their potential and contributions.”

In the United States, a range of policies foster investment in ICT. These policies were motivated by changes in the American economy and labour force. In 1996, the U.S. Department of Education issued a report about ICT goals and policies that read, according to Kozma, “Our economy is characterized by rapidly changing technologies and increasing international competition. Our society is complex, diverse, and mobile. Our success as a nation will depend substantially on our students’ ability to acquire the skills and knowledge necessary for high-technology work and informed citizenship.”

Kozma proceeded to describe the challenges associated with trying to create policy within a federalist context. Countries such as Singapore, Norway, and Chile can view education from a national level, unlike Canada and the United States where the responsibility for education lies respectively with the provinces and territories or is shared between a federal body and state bodies. This distributed policy process shared by Canada, the United States, and other countries creates unique challenges in terms of the relationship between policy and practice in the classroom.

Despite these challenges, Canada is one of the nations leading the way by investing in ICT integration. According to the SITES Module 2 study (a qualitative study that collected case studies from 28 countries around the world), in Canada the ratio of student to computer-with-Internet-access is 8:10 for primary students, 7:10 for lower secondary students, and 3:1 for upper secondary.

Kozma explained some of the other findings from the SITES Module 2 study. The study also examined innovative classrooms where technology was being used to make noteworthy changes to what teachers and students are doing. According to the study, there were a number of different clusters of activity in these classrooms:

1. Project-based Learning Cluster	<p>In this cluster, students collaborated with other students in their class to conduct research projects. Together they collected and analyzed data, solved problems, and published results.</p> <p>Teachers in this cluster played a dual role as a “guide on the side” and a “sage on the stage.” Teachers introduced a structure for students to follow when creating their research projects using ICT. Once the structure for the projects was provided, the teachers “stepped to the side” to monitor student activity and provide guidance as needed.</p> <p>Students in this cluster gained subject-matter skills, communication skills, and information-handling skills. Teachers in this cluster also reported that they acquired new pedagogical and ICT skills.</p>
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## 2. Collaborative-based Learning Cluster

Students in the collaborative-based learning cluster collaborated with other students in their class, but most of their interactions occurred with students in other classrooms, schools, and countries.

In this cluster, the study found that teachers were also collaborating with other teachers using ICT. Teachers interacted with teachers in their own school to prepare classroom material, and they also interacted with teachers in other schools and countries while engaged in joint projects with their students.

This cluster was associated with the development of collaborative skills and team-building skills both by the teachers and the students.

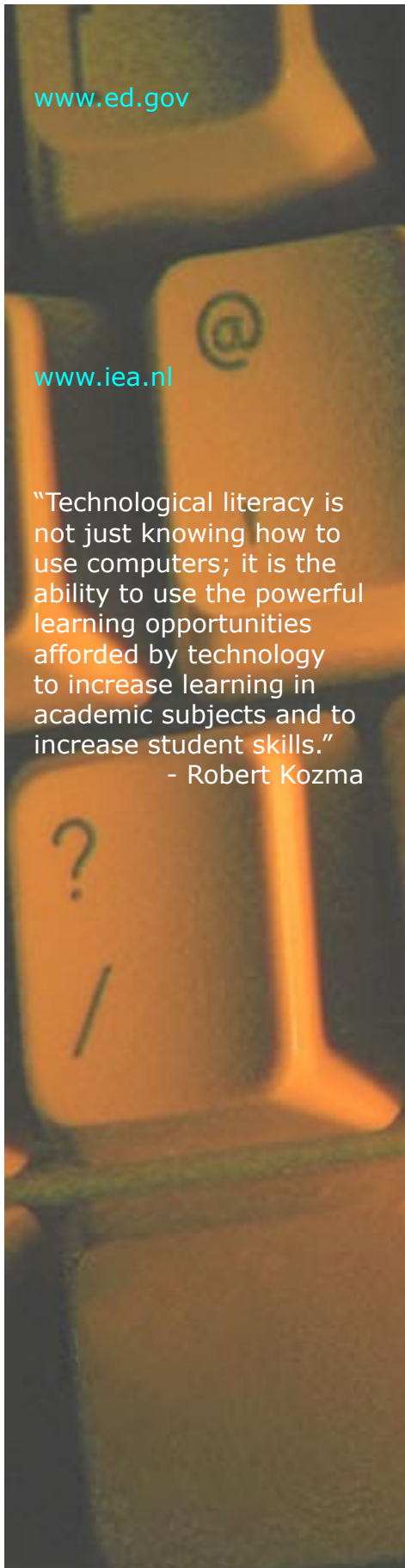
There is much less descriptive detail available for the last two clusters, the Web-based Projects Cluster (3) and the Web-based Resources Cluster (4). According to Kozma, this lack of descriptive detail is due to the fact that teachers in these clusters were “turning the students loose on the computers.” Each classroom varies in its approach to ICT use. However, in the fourth cluster, the students engage in even less structured activities than the other three clusters as they used the Internet mostly for Web surfing.

In the Web-based Projects Cluster, teachers were more likely to report increases in their students’ information-handling skills along with Cluster 1. The other two clusters were less likely to report this outcome.

The four clusters mentioned above represent an interesting range of activities that are beginning to evolve as teachers struggle to use new technologies in the classroom and make changes to their own teaching methods. For teachers, a dichotomy exists between monitoring student activity and creating more structured activities, and allowing for more unstructured learning opportunities in the classroom.

Kozma continued by noting that the results reported in the clusters complements the results from other U.S. studies. For example, the 1995 U.S. Educational Testing Survey found that the frequency of computer use was negatively related to academic achievement. However, they did find that the use of learning games was positively related to achievement levels in math and science for certain grade levels. This is very important, he told participants, because this finding tells policy makers that “just putting the computers in the classroom and making them accessible isn’t enough. Where we are right now isn’t yet where we need to be if we’re going to see this investment pay off.... It is not just having the computers there or just using them — it is using them in certain ways, in ways we don’t fully understand yet.... These results are encouraging, they let us know that we’re not there yet [but they also] let us know that we’re going in the right direction.”

Kozma next discussed another study funded by the U.S. Department of Education known as the **Virtual High School Project**. The department created 150 secondary-level courses to be taught on-line. By the end of the fifth and final year of the project, these courses were offered to 3,000 students attending 200 selected schools across the country. For every school, one teacher was offered the opportunity to take part in the project and teach one of the selected courses on-line. The department hoped to evaluate the impact of the on-line courses on student learning. In particular, they wanted to compare virtual on-line courses to the traditional face-to-face format.



www.ed.gov

www.iea.nl

“Technological literacy is not just knowing how to use computers; it is the ability to use the powerful learning opportunities afforded by technology to increase learning in academic subjects and to increase student skills.”  
- Robert Kozma

The Department of Education found that of the 150 courses, only 15 were economically feasible to offer on-line. They also found that both groups reported significant amounts of interaction between teachers and students, and most students were satisfied with this level of interaction. The dropout rate was low in both groups, despite what is generally thought about dropout rates being higher in on-line learning environments. However, the study also found that students in the on-line courses were less likely to form relationships with other students and the teacher than in the face-to-face courses.

In terms of assessment, there was no significant difference between the students in the two groups. Kozma noted that perhaps this finding is not necessarily negative, “if we can deliver education on-line without significantly losing impact on learning, then this could be a positive thing.” This finding also has interesting policy implications — “...new measures are needed to evaluate the kinds of skills, thinking, and capabilities that the use of ICT might foster and that regular courses may not,” said Kozma.

Robert Kozma then asked how the gap between policy and practice should be addressed when it comes to integrating ICT in education. According to Kozma, teachers need to actually be shown how to implement the new policies in the classroom; it is not enough for them to just know about the policy. To do this, he recommends two approaches that must be employed together:

### 1. **Bottom-up approach (Local Level)**

In this approach, schools and school districts need to clearly articulate their ICT plans and develop vision statements (i.e., envisage how technology will change learning/teaching in their school, not just where the computers will be located and how many computers and how many support staff will be needed). School principals need to champion ICT planning; their support, participation, and leadership are crucial. Finally, extensive teacher training focused on classroom practice and technical/instructional support should be available to all teachers.

### 2. **Top-down approach (National Level)**

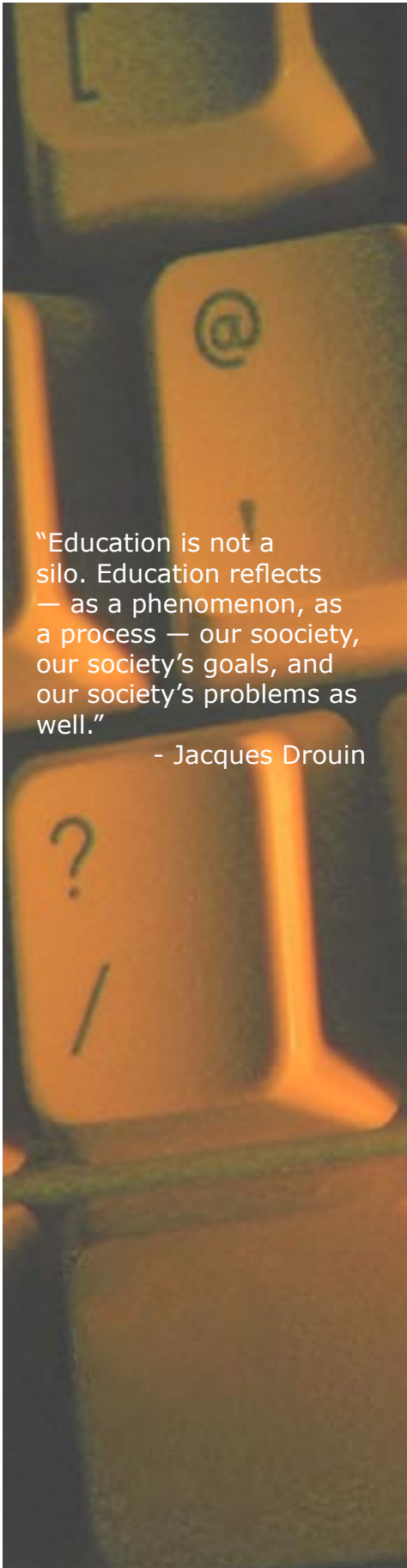
This approach emphasizes major efforts at the national level to introduce ICT tools and activities that are focused on and designed specifically for education. New curriculum should be developed that is focused on what new kinds of knowledge and abilities students can acquire as a result of using ICT. Evaluation and assessment policies should then be brought into alignment with the new curriculum to reflect the changes in the curriculum’s focus. In particular, new assessment models should be developed to measure the skills that proponents claim ICT can improve such as problem-solving, communication, and information-handling skills.



Kozma also spoke briefly about the changing role of universities in terms of the integration of ICT in education. One of the traditional roles of most universities is to provide teacher education programs. Universities today need to integrate ICT into teacher education programs as much as possible. It is not enough to send education students to a distinct computer science or information systems course. ICT must be integrated into the student teachers' science methods classes, mathematics methods classes, social studies methods classes, and so on. At university, student teachers need to learn not only how to use the technology, but also how to integrate the technology into their teaching and lesson plans.

In addition, universities must also continue to create new learning tools that are based on principles of cognition and learning sciences, and help bridge the gap between policy and practice. This is not a role that universities are used to playing because they are not grounded in policy, according to Kozma. Kozma indicated that university faculty need to know what policy requirements and constraints exist in their own countries, and they should use this information to implement application-based research in classrooms. They can bring classroom-based experiences and information back to policy makers so that they can make informed policy decisions.

In conclusion, Kozma noted, "There is an integral relationship between research and policy-making. It is not uni-directional; it is complementary and collaborative. Policy tells us what kind of research [needs] to be done in the classroom, and that research should inform policy development. This is where we will begin to see major payoffs in the kinds of investments we've made in ICT."



"Education is not a silo. Education reflects — as a phenomenon, as a process — our society, our society's goals, and our society's problems as well."

- Jacques Drouin



## Discussion on Keynote Presentation

The discussion following Robert Kozma's presentation focused mainly on expected timelines for the full integration of ICT in education. Kozma was asked what kind of delay should be expected between the point where research results are introduced and the point when these results will impact policy. Kozma reminded participants that the integration of ICT in learning does not simply require policy changes; it requires social change, which takes much longer. "We are only at the beginning...we need to recalibrate our thinking of when this is likely to pay off," he noted.

Kozma was also asked how long he expected the integration of ICT in the classroom to take, especially when teachers are overloaded with changing classroom practices, changing technology, changing roles, and so on. He responded, "From a classroom perspective, it will change as we get younger teachers. Children are quick to learn new software, they grew up with it, so teachers will start doing the same because the newer [teachers] will have grown up with it also. If policy is trying to hurry this process along, then we need to focus on teachers, pre- and in-service.... Our future is really the students now in pre-service who have grown up with technology already and who will bring it to the classroom with them."

The discussion then turned to the available data on ICT and education such as the SITES studies. Raynald Lortie of Statistics Canada spoke of two measurements that are missing from most of today's analyses of ICT. The first measurement that is missing, according to Lortie, is how many total dollars and how much effort have already been spent on ICT integration in education. Raynald Lortie explained that such figures are highly relevant since policies are often based on dollar amounts. The second measurement is the relationship between investment in pre-/in-service training in the use of ICT and the impact of the use of ICT on student achievement. The discussion concluded with Kozma's explanation of the proposed components of the [SITES Module 3 Survey](#).

# Research Presentations

## Day 1

The first day of the symposium was chaired by Maryanne Webber, Director of Culture, Tourism, and the Centre for Education Statistics at Statistics Canada. “We’re looking at ICT in the classroom and in education, but also at ICT and connectivity in society at large, issues of future social cohesion, and the role of technology in productivity and economic growth,” she said. She noted the importance of linking research and policy and closing the gap between policy and practice. Finally, she reminded participants that PCERA is still relatively young and that the combined efforts of all participants would lead to the greater “development of a robust and evidence-based research tradition for the field of education.”

## Session 1: State-of-the-Field Research

### ICT in K–12 education: What (little) we know

**Presenter: Charles Ungerleider, University of British Columbia**

**Authors: Tracey Burns, Charles Ungerleider**

Charles Ungerleider began his presentation by stating that both he and his co-author “view educational policy as social policy that occurs in an area of scarcity.” The research that they presented emphasized the general concern about whether policy makers are able to justify expenditures on ICT with data on the actual benefits for students and teachers.

Ungerleider discussed the link between ICT and Canada’s productivity and his concern that we have begun to see ICT in elementary and secondary schools as a means of improving economic productivity. He claimed that ICT “...have fueled incredible expectations on the part of the public. These claims have encouraged local and provincial jurisdictions to spend large sums of public money on ICT.... It’s time for us to take stock of where we are and see what kinds of policy claims can be supported.”

One of their major research findings was that, despite years of trying to engender positive attitudes among females toward ICT and improve their efficacy in using them, boys and men still have higher computer self-efficacy and more positive attitudes toward computers than girls and women, and these differences remain although computer use by both groups is about equal. It appears that simple exposure to computers does not guarantee positive attitudes toward them or that the positive attitudes for girls and women are being mitigated.

Ungerleider also discussed studies that addressed the question “Does access to a computer improve academic achievement?” According to a large-scale student assessment in Ontario, one of the studies reviewed indicated that there is no relationship between the presence of a computer in the classroom and academic achievement of students in this particular Grade 3 assessment. A US NAEP study found that students who use computers in class at least one time per week did not perform any better on reading tests than those who used them less than once a week.

Charles Ungerleider, Professor of the Sociology of Education in the Faculty of Education at the University of British Columbia, has studied and written about educational governance, student assessment, race relations, inter-group relations and multiculturalism, and the impact of media on Canadian society and has used a wide range of qualitative and quantitative research methods including large-scale student assessment, sample surveys, interview designs, and meta-analyses.

From November 1998 until June 2001, he served as Deputy Minister of Education for the Province of British Columbia. Prior to assuming responsibility as Deputy Minister, Dr. Ungerleider was Associate Dean for teacher education (1993-98) at the University of British Columbia.

Dr. Ungerleider is author of numerous articles, chapters, and technical reports. He is co-author of the text *Television and Society: An Investigative Approach* and has produced television programs promoting the critical analysis of teaching and promoting teaching as a career. Dr. Ungerleider's most recent book is entitled *Failing our kids: How we are ruining our public schools* (McClelland & Stewart, 2003).

In terms of the effectiveness of technology-enhanced instruction in secondary science teaching, many studies were not well designed and could not offer any significant conclusions due to a lack of a control group and the non-random selection of students for interviewing purposes. The faulty data collection methods that were employed limit the kinds of claims that can be made about the effectiveness of teaching with ICT.

Ungerleider also spoke about the long-standing argument that the use of computers for instructional purposes increases motivation in children. He explained that although it is intuitively reasonable that children without access to computers at home will find it more difficult to be motivated to use computers in classes when they have the opportunity to use them, there is no experimental evidence to support this claim. Ungerleider also mentioned that where experimental evidence exists, there are no control groups for the basis of comparison.

In language arts, children in kindergarten with reading and spelling computer programs dramatically improved their performance relative to their peers who were not given access to the same programs. Furthermore, the writing performance of those with regular computer access outperformed others in writing ability, the fluency with which they wrote, and were more likely to edit their own compositions than those with little access.

The available research on mathematics drill and practice programs offers no clear answers, according to Ungerleider. There were some positive effects observed, but some drill and practice programs that use technology have a negative effect on achievement and are not as cost effective as tutoring, which is a relatively low-cost alternative in comparison. However, there is one area where there is a great deal of confidence regarding the positive effects of technology in mathematics. For grade 8 students and higher, applications and simulations in math seem to have a positive effect on achievement and improve higher-level conceptual functioning.

Ungerleider spoke of support for only four unambiguous claims:

1. Student attitudes toward computers and computer-related technology improve as a consequence of exposure to them.
2. The use of ICT for group work can be beneficial if teachers are able to take into account the complex interplay among the age of the students, the kind of task, and the amount of independence allowed. ICT cannot be implemented without regard to the conditions of the particular classroom.
3. The use of ICT for mathematics instruction has a significantly positive effect on teaching high-level concepts to students in grade 8 or above.

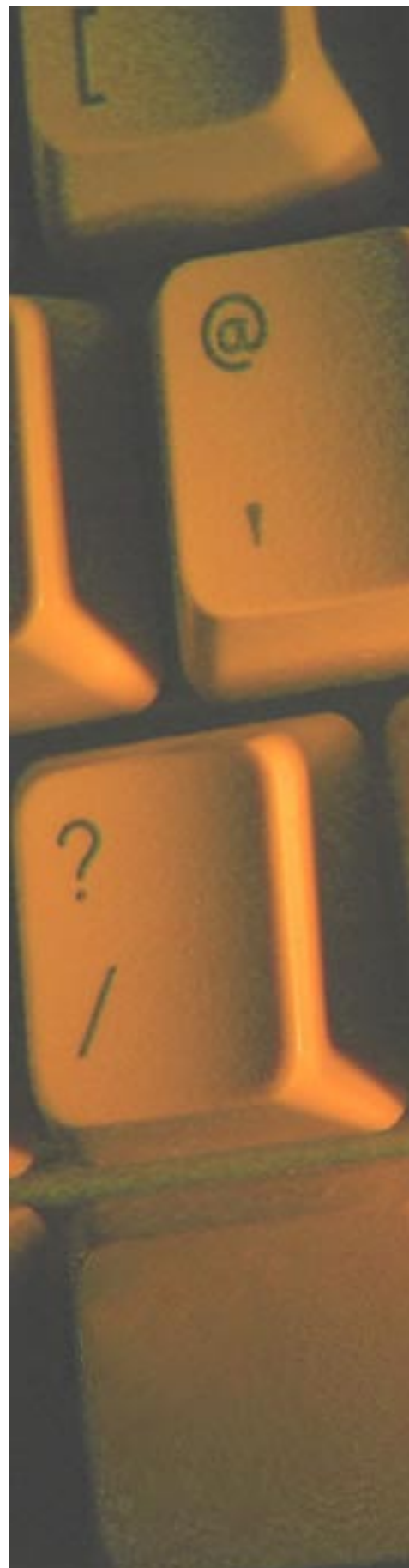


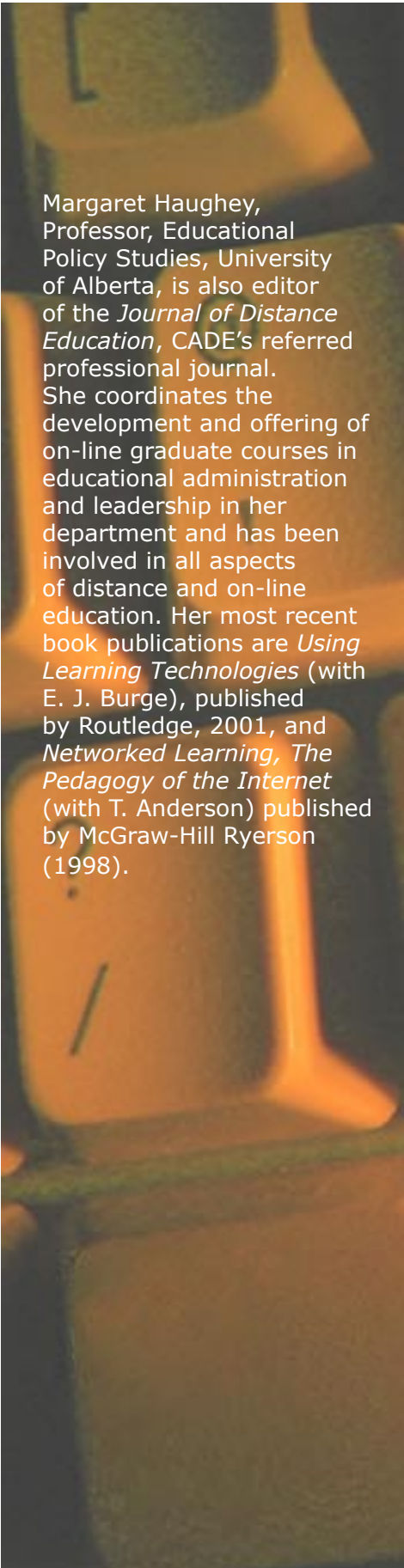
4. The majority of research reviewed is contradictory and/or seriously flawed.

Charles Ungerleider also identified the following areas that require further research:

1. the relationship between gender and attributions to task performance and beliefs about success
2. large-scale student assessments showing no or negative effects of the access to computers on student achievement
3. the impact of ICT on student motivation and how this can be measured
4. the novelty effect of ICT in learning, whether it wears off, and when it wears off
5. the relationship between meta-cognitive skill enhancement and the learning environments constructed for youngsters
6. the role of ICT in subject areas other than math or language arts

In conclusion, Dr. Ungerleider addressed the implications of the currently available research for policy development. “Much of the research has been conducted outside of Canada...; it doesn’t provide a ... pan-Canadian perspective,” he said, “because of Canada’s bilingual status, high immigration, and the country’s traditional heritage.” According to Ungerleider, “There are simply too few studies of rigorous design to permit informed policy choices.”





Margaret Haughey, Professor, Educational Policy Studies, University of Alberta, is also editor of the *Journal of Distance Education*, CADE's referred professional journal. She coordinates the development and offering of on-line graduate courses in educational administration and leadership in her department and has been involved in all aspects of distance and on-line education. Her most recent book publications are *Using Learning Technologies* (with E. J. Burge), published by Routledge, 2001, and *Networked Learning, The Pedagogy of the Internet* (with T. Anderson) published by McGraw-Hill Ryerson (1998).

## Canadian research on IT

**Presenter/Author: Dr. Margaret Haughey, University of Alberta**

The second state-of-the-field research paper was prepared by Dr. Margaret Haughey. This paper highlights the move from a focus on the technology to its pedagogical possibilities, the continuing need for an adequate infrastructure and sufficient equipment, and the importance of time and purpose as factors influencing the speed of technology integration in education.

Haughey began her research presentation by describing the Canadian context for the use of ICT. In terms of on-line courses, Canada is second in the world based on the number of on-line courses that are offered. All schools and libraries that wished to be connected to the Internet have been since 1999. In Canadian schools, the average student to computer ratio is 8:1. Students spend on average three hours per week working with computers at school, and nine hours per week working with a computer at home.

Dr. Haughey noted some of the gaps in the research she reviewed while preparing this paper. For example, there is little information available on ICT and education on Native reserves and in the territories in comparison to what is available for the 100-km strip of land north of the U.S. border. Also, there is little research available in French or Inuktitut. This being noted, some of the conclusions drawn in the research may not apply for all communities.

Dr. Haughey continued her presentation by discussing ICT and the K–12 sector. She noted that classroom applications in this area were “disappointing in some ways.” There were two major research areas in the K–12 sector, namely the a) application of cognitive theories, and b) on-line learning. In the K–12 sector, the barriers to ICT integration are straightforward; difficulties lie in the increasing pressure on teachers to learn how to use the technology rapidly to access information and prepare lesson plans once they can use it. Other difficulties include the pressures for curriculum completion, the lack of funding for hardware and software upgrades, and limited access to computers with Internet access.

In teacher professional development, some interesting trends are being monitored, such as the move from a focus on technology to a focus on pedagogy, the move from casual in-class use of ICT to planned and structured ICT use, and the move from one-time classroom ICT use (i.e., Friday afternoons) to year-long, long-term involvement.

In the area of teacher education the “jurisdictions have begun to put pressure on the teacher education programs — often through legislation — in terms of IT integration both for faculty of education programs in the development of competencies for pre-service teachers...”, said Haughey. In teacher education programs, there is also a range of ICT integration in pre-service courses. For example, in some courses professors only post additional materials on-line whereas in other courses there is a significant reduction in face-to-face classes. There are also courses available that are 100% on-line. “Overall, what can be said about on-line courses in terms of outcomes is that [with ICT integration] there is a revitalization of both the curriculum and the faculty member, increased student responsibility, redistribution of learning time, and an increase in instructor workload,” she added.

At the postsecondary level, the major barriers to the integration of ICT in the classroom were:

1. perceived limitations of the technology
2. lack of time
3. lack of rewards
4. lack of skill
5. lack of resources/equipment
6. lack of coordination
7. neglect of motivational issues
8. individual focus
9. disruptive technology

Haughey noted, however, “where people already would use software programs to display their data, then they see...a great advantage [in] bringing this into the classroom so that students can also work through problem areas. It is those who see ICT as a disruption of their pedagogical style who experience the most difficulty.”

Dr. Haughey continued her presentation by speaking about some policy concerns that she developed during her research. Her major concern was that money is being spent on ICT in education in a haphazard manner; “...we get a checkmark for ‘spent enough money on that’, and then we move on to something else.” She also expressed concern about infrastructure issues: do we need access for every student at all times? Should computers be located in the classroom or in computer labs? Do we need desktop or handheld computers in the long-term? What are our final goals when it comes to infrastructure? Other concerns include administration, sustainability, and technical support. Haughey also noted that all education stakeholders need to consider the bigger issue of “what do we want education to be?”

According to Dr. Haughey, there are many research questions related to ICT and education that remain unanswered. More research is required on access in different geographical locations across Canada. More information is also needed on when computers should be introduced to students (as Haughey noted, in Alberta students are exposed to computers in grade 1, in Ontario they first use computers at grade 7). Furthermore, what are the implications for teachers and policy makers of introducing ICT to students?

More research should be conducted on how to measure the development of problem-solving skills, creativity skills, and collaborative group work skills, through student use of ICT. Other research areas of interest include working conditions for teachers and copyright issues.

“I think it’s an exciting area, but I think we are only at the beginning and I hope that [as] policy makers look into this area that they can use these ideas to begin the process of developing a long-term program [for] ICT in Canada”, she said to conclude her presentation.

## **Discussant: Shannon Delbridge, Department of Education, Nova Scotia**

Shannon Delbridge acted as a discussant for both the Ungerleider and Haughey presentations. She remarked that for the past 10 to 15 years policy makers have focused primarily on getting computers into the classrooms, with the goal of reaching the 1:1 ratio of students per computer, and increasing Internet access in schools without fully considering how ICT should be used to enhance student success.

Some key policy questions she posed included the following:

- If we had one more dollar for education, where should it be spent? Should it be spent on putting more technology in classrooms, or should it be spent on areas such as special-needs education?
- Should spending on ICT be focused on developing infrastructure, or on increasing teacher training?
- Does increasing student exposure to technology increase student achievement? If so, under what circumstances?
- How do we use ICT to enhance student success? When should ICT be used? In what grade levels? What educational outcomes are being sought?

Questions were also raised surrounding the critical role of the teacher in the success of ICT integration.

- How do we ensure that teachers are well prepared to integrate ICT into their instructional practices?
- How do we help teachers overcome their fears of using technology?
- How do we create value for teachers so that the impetus for using ICT in the classroom is theirs, so that they take ownership and initiative?
- How willing are teachers to change their curriculum delivery methods?

With regard to the student characteristics that are favorable for successful ICT integration, Delbridge asked:

- Are there economic or cultural factors that should be examined prior to attempting to integrate ICT into education?
- How do students with different learning styles react to ICT integration?
- Are there any general student characteristics that contribute to positive outcomes when using ICT?

Another research area that requires further investigation involves how learning environments are structured to facilitate success. “Student achievement won’t improve simply because we’ve put computers in classrooms,” said Delbridge, “so what other environmental factors do we need to consider?”

Ms. Delbridge concluded by mentioning that “...more needs to be done if we are going to move beyond simply measuring the ratio of students to computers and look at improving student outcomes.... We also need to know what factors to adjust if the outcomes are not acceptable.”



## Discussion Period: Session 1

Several issues were raised during the discussion period for Session 1. Eight key issues were identified:

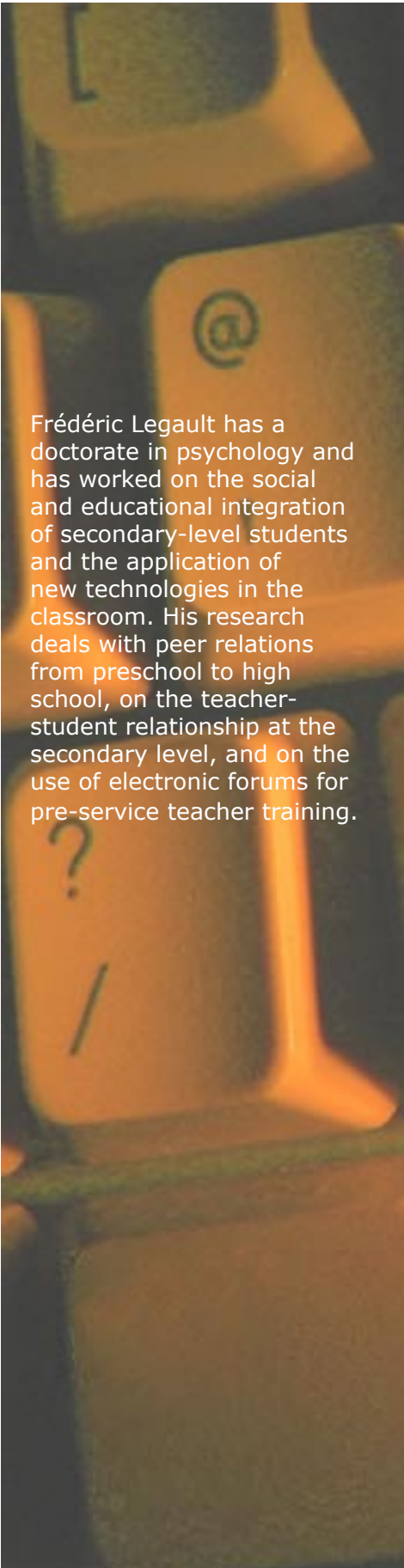
1. The opportunity cost of investing in ICT
  - What have we given up, do we and will we give up in order to invest in ICT?
  - Are education dollars better spent elsewhere?
  - Under what conditions is ICT worth the investment?
2. Research issues
  - What are the barriers that prevent long-term sustained research on ICT in education?
  - A pan-Canadian programmatic research initiative is needed for ICT and education.
  - More rigorous and controlled research is needed specifically on communications technologies and the Internet.
3. Adoption and integration of ICT use by teachers
  - What are the best methods for teachers to integrate ICT?
  - How can teachers be encouraged to develop a sense of ownership and control over the integration of ICT and learning?
  - How can more support, resources, and training be delivered to teachers?
4. Changing educational values
  - Learning, educational values, and the structure of the education system are shifting. How should policy makers address this shift in terms of ICT integration?
5. Cost issues
  - The costs of ICT integration are expected to grow. How should policy makers address the costs of maintaining new hardware and software for students?
  - What is the norm in terms of spending on technical support?
6. Development of ICT standards and guidelines
  - What is the ideal student to computer ratio?
  - What standards should be used for classroom organization and the placement of computers in the classroom?
  - What standards should be used when selecting learning software, networking systems, communications technologies?
  - Have any benchmarks emerged from the research on ICT and learning at the classroom or school board level?

## Session 2: The Integration of ICT in the Classroom

### The impact of a networked computer-assisted project-based pedagogy on motivational beliefs and work involvement of secondary-level students

**Presenter: Frédéric Legault, Université du Québec à Montréal**

**Authors: Frédéric Legault, Thérèse Laferrière**



Frédéric Legault has a doctorate in psychology and has worked on the social and educational integration of secondary-level students and the application of new technologies in the classroom. His research deals with peer relations from preschool to high school, on the teacher-student relationship at the secondary level, and on the use of electronic forums for pre-service teacher training.

The research study that Dr. Legault presented at the symposium was designed to examine the repercussions of introducing networked computer-assisted project teaching in secondary level classes on instructional organization of the classroom, student motivation, the learning strategies adopted by students, the satisfaction of student learning needs, their choice of academic goals, motivational beliefs, and engagement. This study, entitled the “Protic Project,” was not based on performance results, but rather on the beliefs and motivation of students.

Legault noted that a growing need exists for pedagogical approaches that foster students’ participation and empowerment because as students make the transition to secondary school, there is a loss of interest in learning and motivation due to:

- more educational control by teachers
- cooler relationships between teachers and students
- more impersonal teaching approaches
- less time devoted to struggling students
- less demanding (cognitively) schoolwork
- social comparison evident in the assessment of learning

The main research question in this study was “does the use of networked computer-assisted project teaching in secondary-level classes increase student motivation in comparison to students in traditional classrooms?” After comparing Protic classes with enriched and regular classes in French and mathematics, the main findings were:

- In Protic classes, avoidance goals were less evident and mastery goals were more evident in math.
- Protic students expressed more satisfaction of their needs in math classes, accorded higher value to French and math, and were more engaged in French classes.
- Protic boys were noticeably more motivated and involved in their learning.
- The conditions in the Protic classrooms led to greater valuing of school subjects and greater involvement in studies.

- The role of the students in Protic classrooms became more active as they interpreted information from the outside world.
- In traditional classes, competition and performance goals (e.g., getting As) are considered key priorities.

The overall results of the study suggest that relationships between the teaching process and the learning process are similar from one context to another, but that achievement levels are higher in classes using networked computer-assisted project teaching. The study also suggests that collaborative and project-based learning should go hand-in-hand with ICT. Technology alone is not enough to motivate, or teach students. Therefore, in the future, teachers with higher quality ICT skills will be in high demand.

The Protic classes encouraged collaboration and participation, both of which are key competencies required for the future labour market. According to Legault, the Protic program is highly relevant for preparing young people to meet the challenges of the 21<sup>st</sup> century.

## The integration and effectiveness of ICT in Canadian postsecondary education

**Presenter: Carl Cuneo, Network for the Evaluation of Education and Training Technologies**

**Authors: Brian Campbell, Carl Cuneo, Delsworth Harnish**

Dr. Carl Cuneo began his presentation by drawing links between the Seven Principles for Good Practice in Undergraduate Education (American Association for Higher Learning, 1996) and the communication and information technologies that can facilitate the adoption of these principles:

Principle	ICT
1. Promote contact between students and faculty	E-mail
2. Promote student cooperation	On-line collaborative projects and group work
3. Promote active learning	On-line searching and exploring
4. Promote prompt feedback to students	Real time chat, e-mail
5. Promote time on task	Efficient remote access to course materials
6. Promote high expectations among students	Use of web publishing as displays to class and others
7. Promote diverse learning	Linear and non-linear hyperlinking

He continued by discussing the kinds of ICT that students and faculty use, their preferred method of communication between groups and within groups, as well as student learning styles and teaching styles, and the appropriate technologies to employ for each different style.

Dr. Cuneo also discussed the six stages of technology integration on campus. He indicated that by successfully completing each stage, the institution and its faculties would be more successful in the overall integration of the technology on campus.

Carl Cuneo is the Director of **EvNet, the national Network for the Evaluation of Education and Training Technologies**. He has directed national studies of information, communication, and learning technologies in higher education and has carried out campus-specific studies into open and on-line learning. He has written a report on the infrastructure of on-line learning for Industry Canada and developed best practices guidelines for Web-based and on-line learning. In 2002, he wrote and delivered the 33<sup>rd</sup> Pitirim Sorokin Lecture at the University of Saskatchewan, an analysis of the global digital divide. Frequently interviewed for radio, television, and newspapers, he is currently working on policies and practices in information, communication, and learning technologies in higher education and on

“Professors don’t want to risk integrating technology if they think the outcome will be negative. If it is, they could risk losing tenure. This is the reality. It is seen as too risky by some professors.”  
- Carl Cuneo

The stages are:

<b>Stage 1:</b>	Purchase of site license
<b>Stage 2:</b>	Adoption of software by instructors
<b>Stage 3:</b>	Integration of software into course design
<b>Stage 4:</b>	Easy student access to the technology
<b>Stage 5:</b>	Easy navigation and efficient use of the software by students
<b>Stage 6:</b>	Positive impact on student learning is observed

To conclude his presentation, Dr. Cuneo presented various recommendations for policy makers. His primary concern was that many campuses purchase technology and install educational software without giving serious consideration to teaching and learning goals. Instead of only investigating cost and administrative issues, policy makers and those responsible for implementation of ICT on campus need to consider whether the technology in question is actually useful, why teachers want to use the technology, and what they want students to learn from it. Criteria should be developed to assess technologies that are being considered for use on campus that evaluate more than just how much they will cost, who will use them, and what support workers will assist in their installation and maintenance. “Too often, decisions are made by technical and administrative staff with little awareness of learning and pedagogical practices,” noted Cuneo.

Dr. Cuneo also recommended that institutions of higher education make the purchase and installation of technologies that are most facilitative for communication a priority. As stated in the Cuneo paper, communications technologies will do the most to advance the skills needed for the new economy and Canada’s international competitiveness.

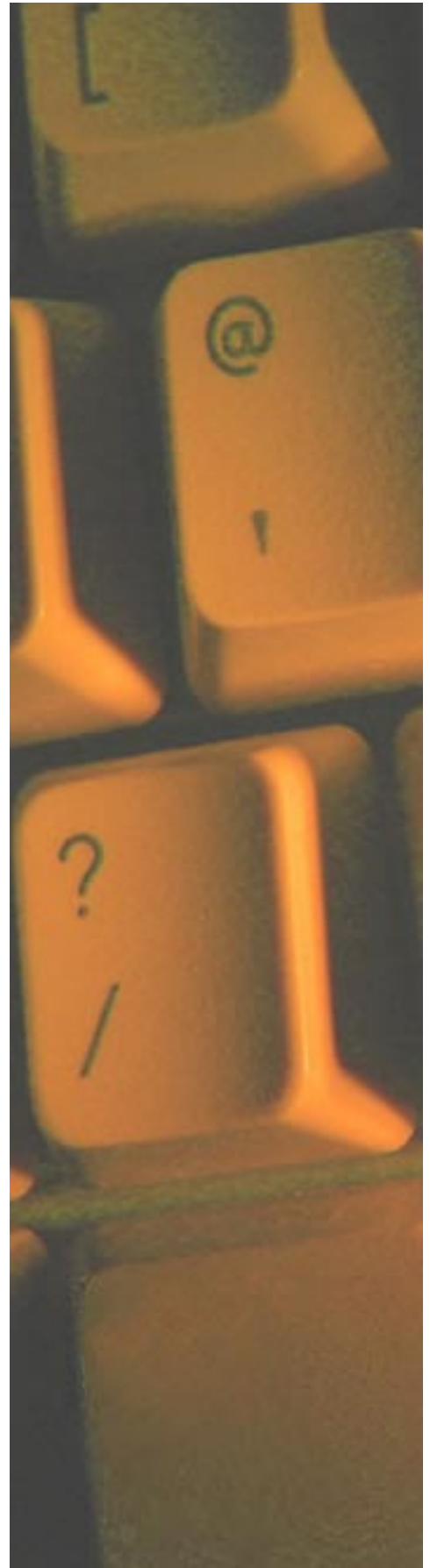
Finally, Dr. Cuneo recommended that different technologies be implemented to accommodate different types of learners and teachers, namely the deep/comprehension learners and surface/syllabus-bound learners, and the “sages on the stage” and “guides on the side” teachers. “Teachers and learners may be at risk if they are forced to work with technologies [that are] inappropriate for their learning and teaching styles,” he warned.

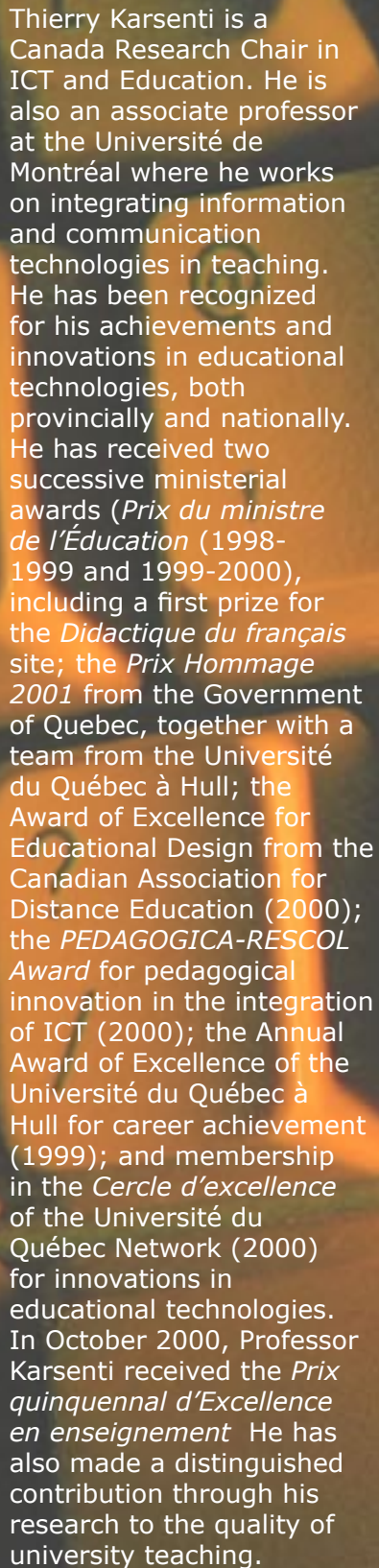


## Discussion Period: Session 2 (Part 1)

During the second discussion period on the first half of Session 2, three major issues were raised:

1. Student assessment and ICT
  - Policy makers want to know whether students who learn a subject using computers are more or less successful in learning the subject than those who do not use a computer.
  - Should different assessment instruments be developed to determine the effectiveness of ICT in the classroom? If policy makers want to compare students who use ICT results to those who do not, then an assessment tool that can effectively measure outcomes in both groups is required.
2. ICT integration planning
  - Teachers and professors must take into consideration the pedagogical benefits they seek, their own teaching styles, and their students' learning styles before integrating ICT into the classroom. ICT should not be integrated into the classroom just for its own sake.
  - A step-by-step approach to ICT integration should be adopted at all levels of education to avoid making poor planning decisions (e.g., buying several copies of specific software to then discover that it is not appropriate for the intended users).
  - Distance learners and face-to-face learners have different needs and issues to consider.
3. Barriers to ICT integration
  - Among the more obvious barriers (lack of funding, lack of technical support, lack of training) to ICT integration, it was noted that some professors avoid ICT integration because of a fear of failure and loss of tenure.
  - ICT integration is considered risky by some educators.
  - Program directors and school administrators should work to reduce the barriers to integration and champion ICT integration if they wish their faculty and schools to adopt the new technology.





Thierry Karsenti is a Canada Research Chair in ICT and Education. He is also an associate professor at the Université de Montréal where he works on integrating information and communication technologies in teaching. He has been recognized for his achievements and innovations in educational technologies, both provincially and nationally. He has received two successive ministerial awards (*Prix du ministre de l'Éducation* (1998-1999 and 1999-2000), including a first prize for the *Didactique du français* site; the *Prix Hommage 2001* from the Government of Quebec, together with a team from the Université du Québec à Hull; the Award of Excellence for Educational Design from the Canadian Association for Distance Education (2000); the *PEDAGOGICA-RESCOL Award* for pedagogical innovation in the integration of ICT (2000); the Annual Award of Excellence of the Université du Québec à Hull for career achievement (1999); and membership in the *Cercle d'excellence* of the Université du Québec Network (2000) for innovations in educational technologies. In October 2000, Professor Karsenti received the *Prix quinquennal d'Excellence en enseignement*. He has also made a distinguished contribution through his research to the quality of university teaching.

## Session 2 (continued)

### Integrating ICT in teacher training: A challenging balance

**Presenter: Thierry Karsenti, Université de Montréal**

**Authors: Monique Brodeur, Colette Deaudelin, Thierry Karsenti, François Larose, Daniel Peraya, Maurice Tardif**

Dr. Thierry Karsenti presented research that his team had undertaken to address how a better understanding of the pedagogical integration of ICT can be achieved at the university level for pre-service education students. His research sought answers to the following research questions:

- Do instructor practices have an impact on the practices of future teachers?
- Have the obstacles associated with change and the pedagogical integration of ICT evolved in recent years?
- Are faculties of education meeting the professional development needs of future and practicing teachers?

Dr. Karsenti reminded participants that faculties of education (compared to other faculties in Canada) use ICT least. This is unfortunate, especially since according to Karsenti, pre-service students who use technology in their university courses are more likely to integrate ICT into their teaching and classrooms once they begin their teaching careers. “The potential benefits of technology can only be achieved if university instructors are aware of their importance and specific contribution to teacher education”, noted Karsenti.

The five characteristics that are likely to foster motivation among future teachers to integrate ICT in their classrooms include:

- pedagogical integration of ICT by associate teachers
- degree or level of future teacher’s computer literacy
- pedagogical integration of ICT by instructors when educating future teachers in universities
- future teachers’ expectations of success in integrating ICT
- the value placed on ICT by future teachers

The problem, according to Dr. Karsenti, is that even though future teachers may have training and/or experience with ICT (e.g., word processing, PowerPoint), they often do not know how to integrate ICT into the classroom or their teaching styles. Karsenti also noted that ICT use should not be reserved for technical courses (e.g., a data processing course) only; education students should have ICT integrated into their curriculum as well.

Karsenti's study also found that greater pedagogical integration of ICT by teachers requires:

- suitable training
- access to ICT
- ongoing support and advice to encourage progress beyond pre-service education

It was noted that pre-service training is not sufficient; teachers need in-service training in order to further encourage ICT integration and to ensure that they keep their ICT skills current and relevant.

Karsenti concluded his presentation with a discussion of major findings from his research:

- ICT provide added value to the pre-service education of future teachers.
- Many future teachers continue to receive inadequate training for pedagogical integration of ICT.
- ICT are often marginalized in pre-service teacher training.
- Policy makers should focus future policy development on the pedagogical integration of ICT into the education of future teachers.
- A balance between successful integration of ICT and the basic mission of education and research in the universities must be found.
- The integration of ICT will be worthwhile only if it enhances pedagogy by enabling learners to forge a better relationship with knowledge.

## **Panel Discussion – Session 2**

Panellists for the Session 2 discussion were asked to provide policy comments on the three research papers and presentations from Session 2, and to provide insight and information about how their own provinces and territories are currently addressing ICT issues related to education and learning.

### **Nicole Lefebvre, Ministry of Education, Quebec**

Ms. Lefebvre provided symposium participants with a description of the current educational reforms taking place in Quebec regarding the role of ICT in the changing educational environment.

The Quebec Ministry of Education has chosen to initiate a broad reform project by focusing on the development and implementation of a new curriculum that is based on the development of competencies centred on student learning processes. The program is consistent with trends in education in western Canada and takes into account the latest research, including on the cognitive psychology of learning.

The implementation of the new curriculum poses major challenges for school personnel, which include, among others, the need to:

- review and critically analyze existing educational practices
- rethink the modalities and functions of learning assessment
- review school organization
- open schools to their communities through increased participation by parents

The educational reform is highly demanding for school personnel, and the change process requires substantial professional development and support. So Lefebvre asks, "In this context of major upheaval in the school system, to what extent should ICT be used in teaching and learning [in order to] avoid the risk of breaking down the process of change [that was] initiated as part of the ongoing school reform? What is the right place for this one piece in the huge puzzle of education reform?"

Ms. Lefebvre noted that she perceives the need to initiate – through a well-defined context – a partnership between the Quebec Ministry of Education and other ministries across Canada with shared educational concerns, a partnership with universities, and a partnership with the private sector. She argued that the private sector must also take responsibility for some of the current social concerns in Canada.

**Janice Sargant, Department of Education, Culture and Employment, Northwest Territories**

Janice Sargant began her presentation by noting that the integration of ICT into classrooms is just as important in the Northwest Territories as it is in the rest of Canada. “We recognize that ICT integration is fundamental, and that this integration is in cognition with maintaining the quality of our educational mandates,” she said.


“It would seem that...the investment in research into ICT integration should produce a substantive return. The return would be policy commitment in each of our jurisdictions to maximize the benefits of ICT integration for students and educators.”

In closing, Ms. Sargant expressed her wish for continued sharing and increased collaboration among all education stakeholders in the future.

**Marine Perran, Ministry of Education, Ontario**

Marine Perran told symposium participants that the research presented in this session reinforced, in her mind, the troubling news about ICT strategies and their implementation. She offered a summary of the researchers’ findings from her point of view:

1. When properly integrated, ICT have a significant impact on school effectiveness. However, effective ICT integration is only sporadically implemented in a small number of classrooms across Canada, often on a pilot basis.
2. The teacher is key to effective ICT integration but most are poorly prepared to effect this integration.
3. The postsecondary education system is only marginally effective in the consistent use of ICT in advanced courses, if at all, and the use of computers in postsecondary courses is often used in rather negative ways. For example, where computers substitute for teaching assistants, they reduce the administrative work for professors without particularly enhancing student learning.
4. Large investments have been made in technology in schools but much of that technology is not effectively used in learning.



“In some ways, schools have the social responsibility of providing computers and making them available to those who don’t have them at home. Even having kids become more computer literate, if nothing else, is worth it”

- Thierry Karsenti

“Canadian governments are...promoting e-commerce and ICT in the economy but are hesitant to promote ICT in the classroom in a meaningful and comprehensive way.”

- Marine Perran



“We are in the very early stages of the revolution that Dr. Venezky [spoke of]. So far, ICT strategies have been unable to scale the fortress of the education system in order to effect true structural changes to schools,” she remarked. To Perran, it also seems that the research on the impact of ICT in the classroom so far has tended to be somewhat anecdotal, small in scale, and conducted over relatively short time periods. “In spite of this, results show that when ICT are used properly students learn more, they learn faster, more deeply, classroom morale is better, attendance improves, classroom management is made easier, and students become more autonomous, self-managed learners.”

Perran also noted “virtually no one secures employment in Canada without using [some form of] computer” at some point on the job, even for basic tasks. She also commented that ICT have the potential to alter socio-cultural and political structures and achieve the most significant impact on schools in Canada since universal public education was established in the 19<sup>th</sup> century.

Ms. Perran left symposium participants with the following questions:

- Why does the introduction of ICT in the classroom seem so tentative, ad hoc, and lacking in a sweeping vision?
- How do we encourage government to make the scaled up investment in ICT?
- Why are governments hesitant to achieve true “lift-off” on a comprehensive ICT strategy?
- What is the role of research in assisting in the requisite policy changes that would result in the sweeping and powerful implementation of a new strategy?

## **Discussion Period: Session 2 (Part 2)**

The major issues raised during the third discussion period included:

1. The role of the private sector
  - How do governments see the role of the private sector in helping to integrate ICT in classrooms?
  - Should the private sector be involved through the public consultation process or should it work directly with school boards?
  - Does having the private sector fund ICT initiatives cause disparities and differences between service levels by school and school district?
  - Should the private sector fund education only through taxation so as to maintain equality for all schools and districts?
2. The role of ICT in encouraging the development of critical thinking skills
  - How does using ICT prepare people to think critically? How does this differ from how people learn to think critically without ICT?
  - Can ICT complement the learning and teaching that takes place in traditional classrooms without ICT, rather than substitute for them?
  - Can we build on what we do now without ICT and supplement this with ICT to improve outcomes?
3. Cost-benefit analysis of ICT integration
  - Some participants noted a lack of research that would indicate that investment in ICT is any better than other possible investment options.

- Some participants noted that the cost of computers continues to drop, which should make it easier to justify investing in ICT.
  - What evidence is there that investments in ICT have paid off, or will pay off in the future? Six forms of evidence were identified:
    - parental satisfaction
    - improved critical thinking
    - improved access to information and quality content
    - changed pedagogy
    - equity of access
    - greater efficiency
  - Once it becomes clear what can be considered as evidence, then policy makers can begin to consider whether ICT are the most efficacious way to accomplish learning objectives.
  - What exactly are the costs involved in ICT integration? How much do hardware, software, training, maintenance, and hardware and software updates cost over the short- and long-term?
4. Parental role in ICT integration
- What are parents' expectations with respect to ICT integration in schools?
  - What value do parents place on ICT integration?
  - How much investment do they expect will be made in ICT integration on behalf of their children?
  - Do some parents rely on schools to provide computer and Internet access for their children? If schools do not provide this access, will the digital divide grow worse?
5. Systematic research
- There seem to be numerous micro-experiments by professors in a few universities on the topic of ICT integration, but there are no system-wide studies.
  - Formal ICT planning requires setting goals and measures that are well thought out before beginning widespread adoption.

## Session 3: Computer Use and Literacy

### The impact of computer use on reading achievement of 15-year-olds

**Presenters: Patrick Bussière and Tomasz Gluszynski,  
Human Resources Development Canada**

The research presented by Bussière and Gluszynski used data from the Programme for International Student Assessment (PISA 2000) to provide insight into the impact of computer use on reading achievement. PISA is a project of the Organisation for Economic Co-operation and Development that is designed to provide policy-oriented international indicators of the skills and knowledge of 15-year-old students from over 30 countries.

The research project sought to answer the following questions:

- Is frequent usage of computers associated with higher scores on PISA tests?
- What is the impact of different types of computer usage on achievement?
- Are students who are more familiar with computers able to perform at a higher level than students who are less familiar with computers?
- Does computer familiarity correlate more highly with one of the three types of reading outcomes (retrieving information, interpreting text, and reflecting on text)?

- When other variables such as family background are considered, how does computer usage and computer familiarity influence achievement?

The key findings that Bussière and Gluszynski presented included the following:

- Most 15-year-old Canadians have a computer and Internet access at home, and they use these tools often.
- Having a computer in the home is important, but using it productively is key to improving achievement.
- Multivariate analyses show positive effects on reading achievement scores for frequent use of a computer at home, and comfort and perceived ability of computer use.
- Multivariate analyses also show a negative effect on reading achievement scores for computer use for learning purposes.
- Enjoyment of reading has the greatest effect on reading achievement scores.

To conclude, the researchers presented three policy implications derived from their research. First, the new economy relies on knowledge workers with both good reading skills and good computer skills. Second, the chances of improving reading scores through the provision of computers alone are not high. Finally, since computers are widely available to students, policy should be directed toward encouraging their use.

## The use of computer technology for literacy intervention

**Presenters: John Morgan and Nicolas White, Toronto Catholic District School Board**

**Authors: Jennifer Lasenby, John Morgan, Andrew Portal, Marina Vanayan, Nicholas White**

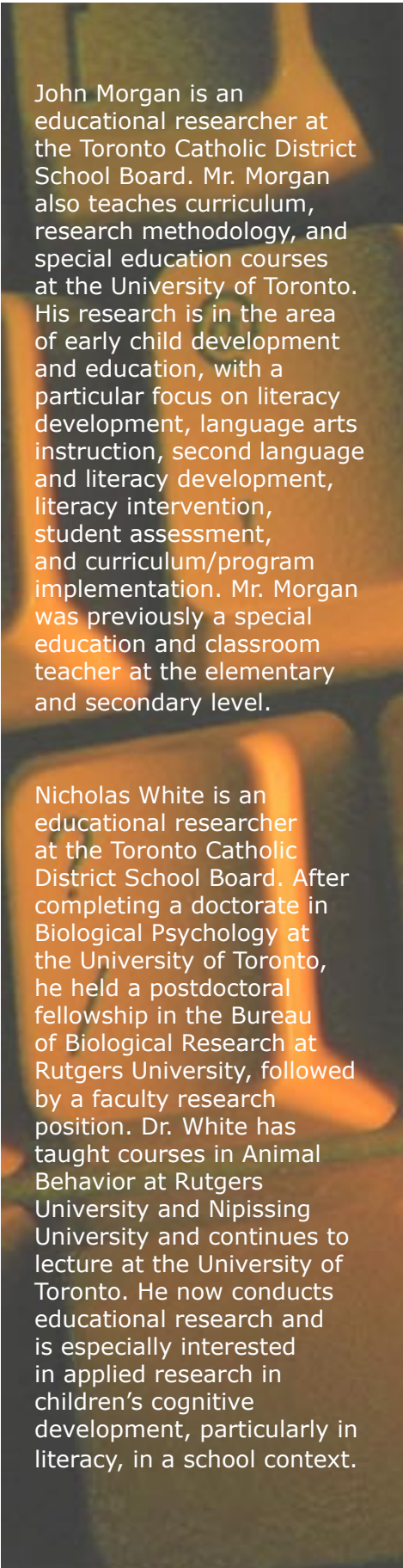
This research study was somewhat different from the other research presented at the symposium because it focused specifically on literacy. The researchers noted that many studies show that a relatively large percentage of the Canadian adult and adolescent population is below grade/age level expectations in reading and writing. There are many literacy programs available to improve these statistics including software packages such as the “Academy of Reading,” upon which this study was based.

While evaluating the effectiveness of this computer-based literacy intervention tool in the Toronto Catholic District School Board, the researchers noted the following challenges to ICT integration:

- Teachers perceive a lack of funding for professional development in ICT.
- Teachers do not feel they have been adequately trained to integrate ICT in the classroom.

Patrick Bussière is a senior research officer for the Child, Youth and Social Development studies group in the Applied Research Branch of Human Resources Development Canada. His current responsibilities include the Programme for International Student Assessment (PISA), supervising the memorandum of agreement between HRDC and the Council of Ministers of Education, Canada on the School Achievement Indicators Program, and a number of other youth-related issues. Since joining Human Resources Development Canada, he has also worked on planning and administering a number of other surveys including the Youth in Transition Survey.

Tomasz Gluszynski is a research officer for the Child, Youth and Social Development studies group in the Applied Research Branch of Human Resources Development Canada. His current responsibilities include content development and management of the Youth in Transition Survey (YITS) as well as data analysis from the Programme for International Student Assessment (PISA).



John Morgan is an educational researcher at the Toronto Catholic District School Board. Mr. Morgan also teaches curriculum, research methodology, and special education courses at the University of Toronto. His research is in the area of early child development and education, with a particular focus on literacy development, language arts instruction, second language and literacy development, literacy intervention, student assessment, and curriculum/program implementation. Mr. Morgan was previously a special education and classroom teacher at the elementary and secondary level.

Nicholas White is an educational researcher at the Toronto Catholic District School Board. After completing a doctorate in Biological Psychology at the University of Toronto, he held a postdoctoral fellowship in the Bureau of Biological Research at Rutgers University, followed by a faculty research position. Dr. White has taught courses in Animal Behavior at Rutgers University and Nipissing University and continues to lecture at the University of Toronto. He now conducts educational research and is especially interested in applied research in children's cognitive development, particularly in literacy, in a school context.

- Teachers have not seen reliable evidence that ICT integration is beneficial.
- There is not enough technical support in the schools.
- There are not enough computers to run the software.
- There is not enough time for teachers to try out the software.
- Academic subjects suffer as teachers take time to teach students and themselves how to use ICT.
- Some teachers believe that ICT are not individualized and that they reduce personal contact with students.
- Teachers find it difficult to find software that meets individual student and teacher needs.

Morgan and White shared their main findings with the group. In terms of attitudes, 16% of teachers believed that computer-based literacy interventions were more effective than non-computer-based interventions; 18% said they were less effective than non-computer-based interventions, and 43% indicated they were not sure.

The main reasons why teachers did not implement the Academy of Reading software included: lack of staff time, lack of workspace, administrative issues, computer hardware issues, lack of staff, lack of student interest, lack of time, and the belief that other kinds of interventions are more effective.

Some of the other impediments to the implementation of this software were: insufficient training, monitoring difficulties, lack of personnel, network problems, computer hardware and software difficulties, lack of computer hardware and peripherals, lack of staff interest, lack of an implementation plan, loss of student data, lack of student interest, and difficulty in registering students. Furthermore, not all of the secondary teachers felt that teaching literacy was their responsibility. The most significant problem, however, was that most teachers did not feel that they have the training necessary to use this computer-based literacy intervention tool.

The researchers also noted that when teachers do not have reliable evidence that the computer-based intervention works, or if they are uncertain about the tool's efficacy, they are more likely to hesitate to implement the software. Therefore, it is recommended that teachers be made explicitly aware of the benefits of using computer-based interventions in the classroom so that they understand how the software can be used to meet specific academic goals and objectives.

In conclusion, the researchers noted that the more common general computer/ICT concerns tend to be the greatest impediments to the integration of computer-based interventions.



## **Discussant: Michael Hayes, Saanich School District, British Columbia**

Mr. Michael Hayes, a teacher and president of his local teachers' association in Saanich, British Columbia, commented on the Bussière/Gluszynski and Morgan/White research papers. "Systemic change does not come about as a result of policy shifts, unless policy implementation is supported by planning, resources, and involvement of the teacher at the classroom level," he noted. "There is a tremendous need to improve pre-service and in-service training and professional development to focus, energize, and empower our teaching profession, especially in the area of information and communications technologies."

Hayes noted that the Bussière/Gluszynski paper reported some very noteworthy findings – that there is a correlation between reading achievement and the frequency of and comfort with computer use, with Internet access, and the number of computers in the home. However, since causality was not shown to exist, Hayes asked, "does this help us formulate policy or change practice?"

Other questions Hayes posed to the group included:

- Do the PISA results suggest that we should now be trying to foster a love of Internet surfing?
- Does heavy Internet use lead to a better appreciation of Shakespeare or Atwood, or to more effective creative writing skills?
- Is the positive correlation between reading achievement and the number of computers in the home perhaps more directly related to socio-economic status than to reading ability and computer use?
- Should we be looking at ways to encourage teachers to integrate computer use in homework assignments or should we be pressing the government to find ways to hook up the remaining 20-30% [of students without access to the Internet or a computer at home]?

Mr. Hayes remarked that he found the Morgan/White research very encouraging, especially since a school district undertook this research project that has value to the district and also makes a contribution to the research field. The perceived problems with ICT integration that were noted by Morgan and White "are issues that teachers know, intuitively or experientially, to be true," said Hayes. "These challenges are real and pose a significant hurdle to the successful use of [ICT] in schools, at all levels."

Michael Hayes suggested that in order to ensure successful ICT integration in schools, ministries and departments of education and school districts should allocate one dollar for training and technical support for every dollar committed to ICT when budgets are developed. "It is appalling how little we, in education, spend retraining our workforce. Can you imagine Ford or Honda, when introducing a new product line, asking workers to learn new technologies on their own time and largely at their own expense?" he asked.

Mr. Hayes also commented on the disturbing trend noted in the Morgan/White paper, this trend being that many secondary school teachers do not consider the teaching of literacy to be their responsibility. Because more students with literacy problems are entering secondary schools today, "policy makers must decide whether they are prepared to break away from old models of accountability measurement and encourage all teachers and all students to be successful," he remarked.

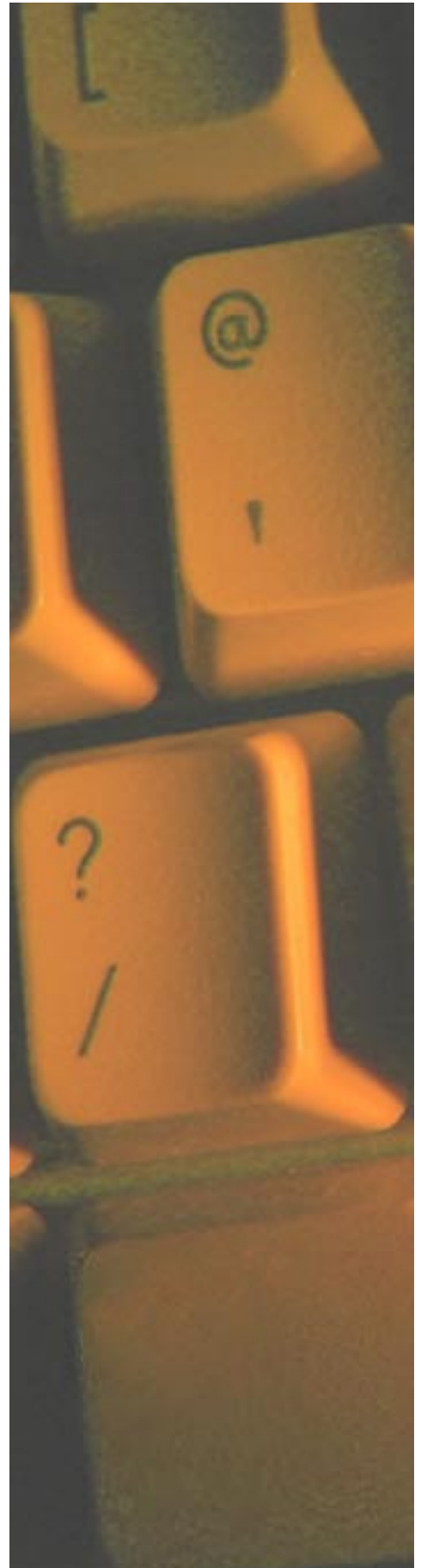
To conclude, Mr. Hayes added "Both these studies tell us that we must stop believing that our commitment to ICT is met when we buy the computer or install the network.... To use [ICT] successfully, we need not abandon the past, but prepare for the future with rational policies, adequate funding, and effective practice [that is] grounded in solid research."



## Discussion – Session 3

The group discussion for Session 3 focused on two main concerns shared by participants:

1. Student participation
  - If students have access to stimulating activities on the Internet and computer at home, then what are the repercussions for Internet- and computer-related activities at school?
  - Will increased access at home make students less interested in using computers and the Internet at school for learning activities?
  - How should teachers address the lack of interest that results when learning activities in school are more structured and focused than Web-surfing in the home?
2. Lack of parental support
  - Some parents have noted the education system's substantial spending on computers and other ICT-related items and would prefer this money be spent on other things.
  - Some parents see computer-related activities in computer labs as simply time away from the classroom (i.e., the lab environment is a waste of students' time).
  - Some parents do not believe that reading and thinking skills can be developed through computer-related activities.
  - If parents do not see the potential benefits of ICT integration, they are more likely to try to influence their school districts to reduce or stop spending on ICT and use the resources for development in other areas.



## Day 2

The second day of the 2002 PCERA Symposium was chaired by Douglas Hodgkinson, Coordinator of Research and Statistics, CMEC.

### Session 4: Equity Issues

#### The digital divide in Canadian schools

**Presenter: E. Dianne Looker, Acadia University**

**Authors: E. Dianne Looker, Victor Thiessen**

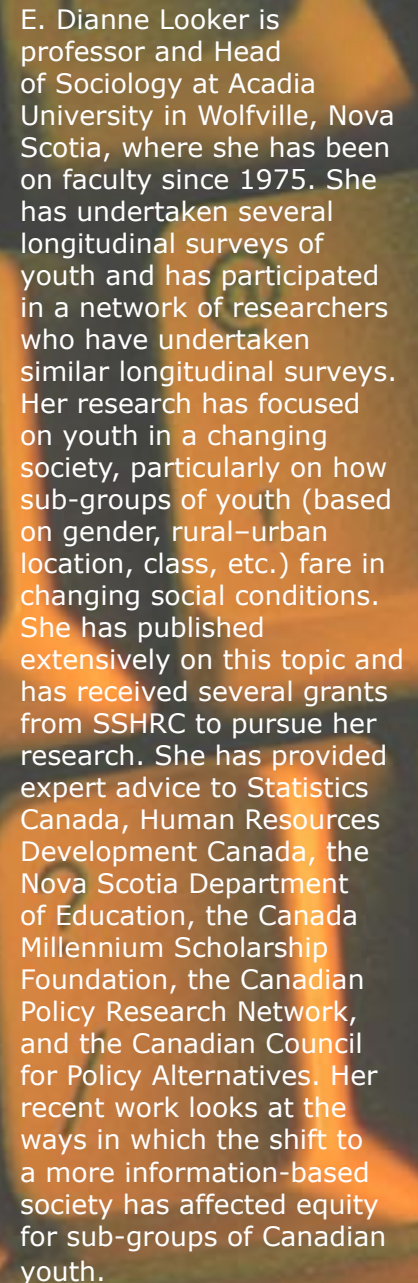
The research undertaken by Dr. Dianne Looker and Dr. Victor Thiessen examined the effects of gender, rural-urban location, and social class on youth access to, use of, and attitudes toward ICT. This analysis used data from the Youth In Transition Survey (YITS), the Programme for International Student Assessment (PISA), the Second Information Technology in Education Survey (SITES), and the General Social Survey (GSS, Cycle 14).

Dr. Looker noted the increasing emphasis on ICT in education and the importance of equity in this area. “It is important to recognize the ways in which innovations in our society and innovations in our schools have implications for existing divisions within our society,” she said. She spoke of the “digital divide” and other equity issues that exist both between users and non-users, and among users.

The specific measures of equity that were examined in the Looker/Thiessen research include:

- gender, geographical location (rural/urban), and social class
- use vs. non-use
- access to hardware, software, and technical support at home and at school
- amount of ICT use
- type of ICT use
- reasons for use (school/study use vs. personal use)
- attitudes toward ICT
- self-reported competence levels

In terms of gender, Looker and Thiessen found no significant difference in ICT usage. There was little difference in the amount of computers in the home, although males did more computer programming and worked with more spreadsheets and graphics than females. Males also performed more data entry tasks and played more computer games. While females used computers more for study purposes, males used them more for personal interest. More males reported they had “excellent computer skills” and were also more likely to find computers interesting and important.



E. Dianne Looker is professor and Head of Sociology at Acadia University in Wolfville, Nova Scotia, where she has been on faculty since 1975. She has undertaken several longitudinal surveys of youth and has participated in a network of researchers who have undertaken similar longitudinal surveys. Her research has focused on youth in a changing society, particularly on how sub-groups of youth (based on gender, rural-urban location, class, etc.) fare in changing social conditions. She has published extensively on this topic and has received several grants from SSHRC to pursue her research. She has provided expert advice to Statistics Canada, Human Resources Development Canada, the Nova Scotia Department of Education, the Canada Millennium Scholarship Foundation, the Canadian Policy Research Network, and the Canadian Council for Policy Alternatives. Her recent work looks at the ways in which the shift to a more information-based society has affected equity for sub-groups of Canadian youth.

When rural and urban youth were compared, there were no differences in usage and few differences in types of ICT use. However, in urban areas, the Internet is used more frequently. Fewer rural youth have computers in the home to use. Rural youth do, however, use computers more at school and at the library. In fact, the SITES data suggested that rural schools have more computers per student than urban schools. Their higher use of computers in the schools means that there were no differences in skill level or attitudes toward ICT between rural and urban youth.

In terms of socio-economic status (SES), youth of low SES use ICT less, have fewer computers in the home, and use computers less at home, but use ICT in public settings for studying rather than for personal interest. They are less likely to say that it is important to work with computers, and they rated their ICT skills lower than students of high SES.

The major conclusions about the effects of gender, rural-urban location, and SES on youth access to, use of, and attitudes toward ICT in this research are as follows:

- There is little difference in the levels of ICT use, although some differences exist in access to the Internet at home.
- Small but important differences exist in youths' attitudes toward ICT, types of use, and levels of expertise.
- Public investment in ICT increases access to ICT.
- Differences in attitudes can affect ICT use.
- Differences in Internet access can exacerbate inequities.

Dr. Looker recommended that policy makers and other education stakeholders move forward with ICT integration while maintaining “cautious optimism.” “We need to re-conceptualize the digital divide.... We need to recognize that it is not just a matter of use versus non-use, or physical access to the Internet or computers. We need to recognize the psychological and cultural barriers to the use of digital technology as well. We need to do that if we're to understand the ways in which ICT can help us bridge the existing social divides instead of exacerbating them,” concluded Looker.

## Students' access to and use of ICT

**Presenter: Bradley Corbett, University of New Brunswick**

**Authors: Bradley Corbett, J. Douglas Willms**

The research presented by Bradley Corbett investigated the extent to which Canadian students have access to computers and the Internet, whether access is related to their gender or socio-economic status, and how students with computers tend to use them. The analysis was based on responses from 30,000 15-year-old Canadian students who participated in the Programme for International Student Assessment (PISA) conducted by the Organisation for Economic Cooperation and Development (OECD). Corbett and Willms examined students' access to ICT in school and at home, and made comparisons between Canadian provinces and other OECD countries.

The Corbett and Willms research paper noted the following key findings:

- 88% of Canadian students have a computer at home (this is comparable to Australia [91%], and greater than the U.S. [83%], Finland [82%], and Japan [67%]).
- 69% of Canadian students have access to the Internet at home (compared to the U.S. [69%], Australia [67%], Finland [54%], and Japan [38%]).

- 81% of Canadian students use a computer at home almost every day.
- Students from low SES families are less likely to have access to computers and the Internet at home.
- Children of single-parent families or families headed by non-parent guardians were much less likely to have a computer at home or Internet access.
- The number of children per family influences ICT access; for each additional sibling, the likelihood of possessing a computer decreases by 5% and the likelihood of Internet access decreases by 7%.
- Students use computers primarily for 1) accessing information on the Internet, 2) communication, 3) word processing, and 4) games.
- Less than one-third of students who use computers report that they use them to help them learn.


Mr. Corbett concluded with a discussion of the “double jeopardy” situation that can arise where students from low SES families living in low SES communities are doubly disadvantaged when it comes to access to ICT. Corbett recommended that “policy makers need to focus on [students] from low SES situations because they do not have the access [to ICT] that other [students] do.”

He recommended that programs be developed at the federal and provincial levels to provide low SES families with computers; that Internet service providers offer more discounts for students; and that more Internet connections be made available in Canadian schools to provide access for students who do not have access at home. Finally, he noted, “Our conclusions argue that universal access at home is within reach and essential if computers are to become a learning tool aimed at improving students’ skills.”

### **Discussant: Britta Gundersen-Bryden, Ministry of Education, British Columbia**

Britta Gundersen-Bryden began her discourse by noting some of the questions that both Looker and Corbett raised and answered in their research:

- **Who** has access to ICT and who does not?
- **What** kinds of technology are available and what uses are made of them?
- **Where** is the technology available (at school, at home, in the community)?
- **When** can the gaps between policy and practice be closed?
- **Why** is it important for policy makers to address equity issues?
- **How** should the “digital divide” and equity challenges be addressed?



Bradley A. Corbett holds a research assistantship with the Canadian Research Institute for Social Policy and is completing his doctoral studies at the University of New Brunswick. He holds a Master of Education degree in Organizational and Administrative Studies and a Bachelor of Arts degree in Health Studies from Brock University in St. Catharines, Ontario. His current research interests are focused on policy development and analysis through the study of risk and protective factors that influence adolescent development.

I think that the issue of digital divide is very important...because [it] is going to be yet another credential. It is just another way that employers will differentiate between candidates”

- Dianne Looker



Gundersen-Bryden noted that policy makers might still be making assumptions about ICT that are no longer correct. For example, some policy makers might believe that there is a significant digital divide along gender lines. According to the Looker paper, girls have closed the access gap thanks to help from schools and parents. “The Corbett paper challenges the assumption that recent immigrants may be less ICT-inclined than those people who have lived in Canada longer,” she added.

Ms. Gundersen-Bryden also reminded participants that the research papers recommend that policy makers think of “equitable access” as access not only to computers and the Internet but also to:

- quality ICT instruction
- quality technical support
- a variety of software programs that can be used both in the classroom and in other settings
- centrally-delivered e-services (i.e., student transcripts, Web-based examinations)
- equal protection from those individuals who use ICT to exploit children

Gundersen-Bryden concluded her discussion by posing various policy questions related to the quality and standards that are required to ensure that the educational benefits of ICT accrue to all learners and society.

- How will federal and provincial governments work together to span the digital divide?
- What role exists for the private sector?
- What role does or should the public education system have in shaping or changing attitudes (i.e., of females) toward technology?
- What role will ICT play in instruction and the assessment of student learning?
- What is the potential for national and international assessments to measure ICT performance and not just self-reported use and attitudes?
- How pervasive will the Internet become?
- How will governments set standards for educational services delivered via the Internet?
- Given the fast-moving pace of the ICT world, will equity of access ever truly be reached? If so, can equity be maintained?

## Discussion: Session 4

The discussion of equity issues was one of the longer discussions that took place during the symposium. Ten major issues were discussed.

### 1. Equity issues and language

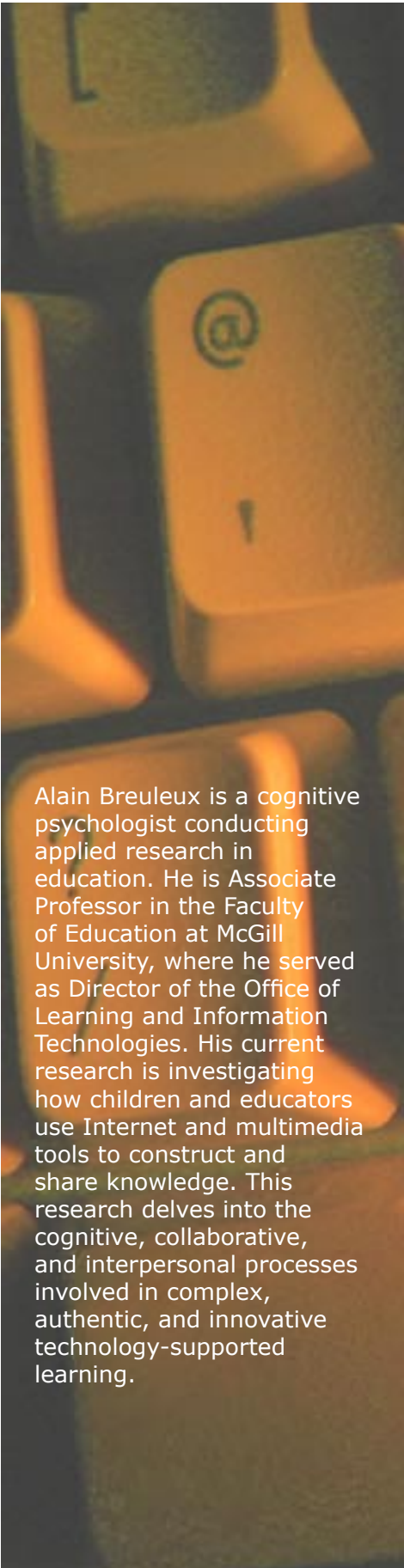
- Curriculum materials in schools must accommodate student language differences. (This will become easier as more language educational Web sites become available in French, Spanish, and Asian languages.)
- Since English has dominated the Internet to date, how does this affect francophone students and French content availability?
- What are the implications of ICT on language programs?

### 2. Broader impact of ICT

- What are the effects of ICT use on the social development of youth (e.g., participation in community activities, physical health, social interaction with peers)? Is this impact positive or negative?
- PISA and YITS measured student participation in sports, clubs, etc., and so did the YITS study. Now the link between participation and ICT should be investigated.



3. Equity research challenges
  - It is difficult to obtain personal information related to ethnic/racial/cultural background and language, because of the sensitivities surrounding these characteristics. It is much easier to note more obvious characteristics (such as gender). The measures that are easier to obtain will be the ones that appear in pan-Canadian data sets.
  - Other kinds of research are needed to complement pan-Canadian data sets and investigate the micro-level issues that are not easily measured.
  - Definitions of “rural” and “urban” are not universal and often vary by study, making comparisons difficult and results sometimes unreliable. What is truly rural or urban? Should this be a self-identified classification? How are results interpreted when the individuals being studied live in a rural area that is relatively close to an urban centre?
4. Access to ICT: Public schools vs. private schools
  - More research is needed to determine whether private schools provide more access to computers and the Internet than public schools.
5. Access to ICT for students with disabilities
  - The number of students with learning and other disabilities has increased in the school system. How can equitable access to computers and the Internet be ensured for these individuals?
  - When used correctly, ICT (e.g., voice recognition software) can help students overcome the difficulties associated with physical and other disabilities. There are various ways in which technology can be employed to close the gap between students with disabilities and students without.
  - There is a need to document how technology has benefited students with disabilities so that policy makers can use this information in decision-making.
  - Both hardware and software for educational purposes should maintain universal design features, and designers should be made more aware of universal design strategies.
6. SES and parental involvement
  - Parental SES is highly correlated to parent involvement, which plays a highly important role in student achievement.
  - In general, children with parents of higher SES have better test scores, have more books in the home, and their parents encourage their kids more to participate in school activities.
7. Factors influencing student achievement
  - Participants questioned whether they were attributing student achievement more to computer availability than other factors that can influence student achievement.
  - SES plays a large role in determining student achievement, but so do other factors. The PISA study found that even when researchers controlled for SES, the number of books at home was still a strong predictor of reading scores.
  - It was argued that the promise of public education is to drive the correlation between predictor variables (background characteristics) and student achievement to zero, at which point SES would not play a major role in determining student achievement.
8. Role of ICT skills
  - Will students who are competent in using ICT be advantaged relative to those who are not computer-competent upon finishing high school?
  - Have or will ICT skills become another credential that employers will use to differentiate between candidates?



Alain Breuleux is a cognitive psychologist conducting applied research in education. He is Associate Professor in the Faculty of Education at McGill University, where he served as Director of the Office of Learning and Information Technologies. His current research is investigating how children and educators use Internet and multimedia tools to construct and share knowledge. This research delves into the cognitive, collaborative, and interpersonal processes involved in complex, authentic, and innovative technology-supported learning.

- Are the computer skills expected of those completing high school minimal or substantial?
- What percentage of Canadian jobs require the use of a computer in some shape or form (e.g., taking orders in a restaurant)?

#### 9. Measuring the digital divide

- Research on ICT should focus less on whether students have computers in their homes and more on whether the students use them, how they use them, why they use them, and how they feel about their ability to use them.
- How useful are self-report studies in measuring the digital divide?
- It was suggested that pan-Canadian data sets might not be the best resource for the micro-level information that policy makers need for decision making related to digital divide issues.

## Session 5: Capacity-Building

### Capacity-building within and across countries: research and development into the effective uses of ICT

**Presenter: Alain Breuleux, McGill University**

**Authors: Alain Breuleux, Mary Lamon, Thérèse Laferrière**

The research presented by Dr. Alain Breuleux sought to answer “what are the important dimensions of capacity-building for ICT integration in education that have been identified, articulated, and experienced in different jurisdictions outside of Canada and that have not [yet] been disseminated in the traditional research publication channels?”

The researchers define capacity-building as a number of processes and outcomes at different levels (individual and organizational — school, school board, university) and the interrelationships between these organizations, that is, connections between faculties of education, research centres, and other organizations involved in providing education and curriculum. Capacity-building, he says, also involves looking at what other countries, nations, and states are doing with ICT in education and how they integrate ICT to make a difference in the lives of their students and teachers. According to Breuleux, the outcomes of ICT integration in education depend on capacity-building, and researchers have repeatedly found that computers are being used at a level where exceptional results have not yet been found.

This research group studied 12 research and development initiatives in 14 countries and organized them according to the themes they observed. These themes included:

- Vision
- Partnerships
- Connectivity and access
- Curriculum requirements
- Teacher professional development
- Assessment of learning

Breuleux noted that policy makers should “combine care, commitment, and courage in order to achieve what we want to achieve with education through ICT [integration].” He continued his presentation with these research and policy questions:

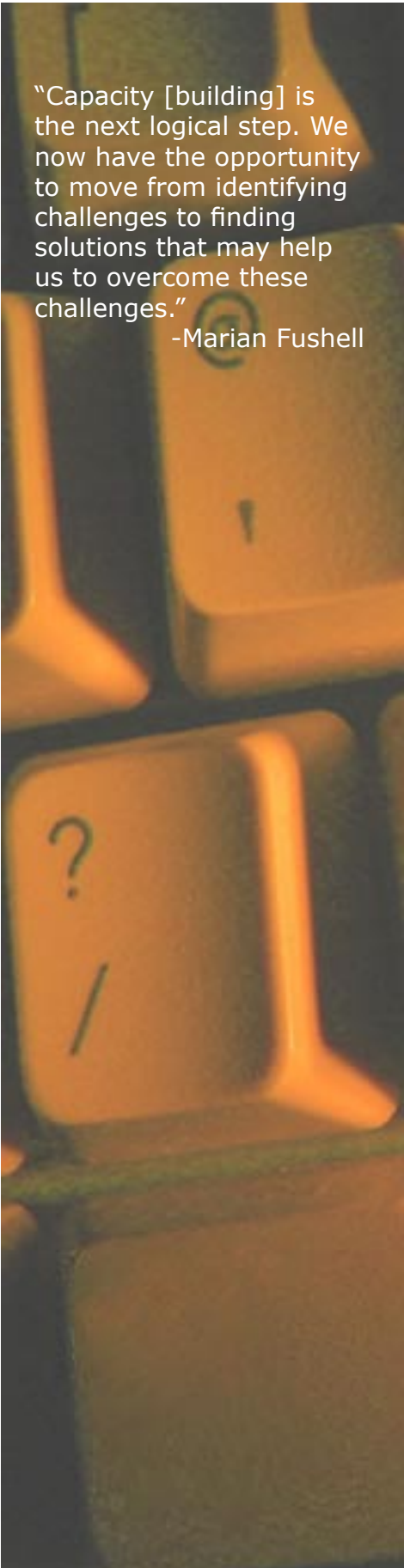
- Can education systems in Canada develop a common research and development initiative that would promote the increased use of ICT in education?
- What can be learned from smaller countries that seem to be more successful in ICT integration? Can larger countries such as Canada achieve similar results?
- Which research and development initiatives would be best suited for Canadian teachers and educators in terms of teacher education and professional development?
- How can Canadian educators implement ICT integration initiatives at a national level in such a way that the innovative qualities and objectives of the initiatives are not lost?
- How can education systems in Canada maintain or initiate research and development initiatives that will specifically take advantage of Canadian programs and products that already serve as models for other countries seeking to take further steps in ICT capacity-building?
- In terms of ICT integration in Canadian classrooms, is the momentum for innovation in this area at risk?
- How do we ensure that Canadian education systems remain flexible and adaptable now and in the future?

“The technical infrastructure called the Internet will stay, and it will evolve. It is recognized to be a valuable source of information and communication, a place for transactions. Countries are acting proactively but are still far away from seeing network-supported innovative practices in teaching and learning being sustainable or adopted on a large scale,” he concluded. “... We must engage actively in vigorous debates and policy discussions [on ICT in education] in order to keep the momentum going.”

### **Discussant: Marian Fushell, Department of Education, Newfoundland and Labrador**

Marian Fushell began her discussion of the Breuleux research by noting that his paper asked participants to do something that the other papers did not. “What Alain’s paper has provided is not just what his research has found, but...he is asking us to shift our thinking from defining problems to finding solutions,” she noted. His research, she remarked, focuses on initiatives in other countries that are meeting some of the challenges associated with teacher professional development, connectivity and access, leadership, curriculum requirements, assessment of learning, and partnerships.

“When we look at capacity-building in other countries, it is with the view of how such initiatives might play out in our own jurisdictions. However, for capacity-building to be a reality, policy and practice issues associated with each of the themes must be considered,” said Fushell. The themes she referred to were three that she had identified from the research. These themes are listed below along with several comments that Fushell made at the event on each topic.



"Capacity [building] is the next logical step. We now have the opportunity to move from identifying challenges to finding solutions that may help us to overcome these challenges."

-Marian Fushell

### 1. Teacher professional development (PD)

- All jurisdictions have responsibility for, and play an active role in, teacher PD and there is a need for ICT training.
- Some teachers require only support as they provide learning opportunities for their students; others require more intensive intervention.
- We need to develop a model for delivering PD in ICT. For in-service PD, how should the model be designed so that it meets the needs of all teachers? Should PD involve a workshop, a 3-4 day training seminar, a paid semester leave, or a mentorship program? Should PD in ICT be independent of or incorporated into already existing initiatives for PD (i.e., literacy or numeracy)? How does PD for ICT relate to teacher certification?
- For pre-service training, to what extent are ICT integrated into course offerings? Are students taught how to develop lesson plans that integrate ICT skills or are they introduced to project-based learning? Will governments develop policies that state what level of expertise in ICT is a condition for employment as a teacher?

### 2. Curriculum

- Both ICT skills themselves and the integration of ICT skills into course work need to be considered part of student curriculum.
- School districts have the responsibility to provide necessary support for teachers to deliver curriculum.
- As enrolment continues to decline in small rural communities in Canada, alternative methods of curriculum delivery and instruction must be considered.
- Will tight budgets influence the nature of on-line curriculum?

### 3. Connectivity and access

- What is the position of policy makers on the provision of low-cost broadband for all communities in Canada?
- How will local, provincial, and federal levels of government work together to improve connectivity and access in education?
- How are governments and the business community working together to address connectivity and access issues?
- How can students in remote communities be provided with adequate Internet access?

"We now have the opportunity to move from identifying challenges to finding solutions that may help us to overcome these challenges. As we consider solutions, we must also consider ICT use as part of the bigger agenda in education and recognize that it must be woven together into the full mosaic that exists — accountability, literacy, numeracy, and wellness for our students," she concluded.

## Session 5: Discussion

The discussion for Session 5 focused primarily on the role of education, the role of ICT, and the role of teachers and learners in relation to ICT integration.

### 1. Approaches to ICT integration:

- It was suggested that education stakeholders need to put everything that is known about ICT integration together and decide what future steps to take based on this information (examine the research available, develop ICT integration plans, invest in ICT), rather than take the “autopsy” approach that is now the norm (invest in ICT, see what happened, determine what worked and what did not).
- The development of a vision is crucial for successful ICT integration in education.

### 2. Involvement of teachers and learners in the development of ICT integration plans:

- To date, there has been little discussion about the direct involvement of teachers and students in local experimentation for the sake of improving teaching practices and learning.
- Students and teachers should be asked to examine their own work and identify what they consider to be effective in terms of the use of ICT in education.
- How can bottom-up and top-down initiatives be coupled together to quicken the rate at which the technologies are being integrated into schools and learning institutions across Canada?
- In parts of the world such as the United Kingdom, teachers meet regularly with other teachers in a facilitated forum to share information about their ICT practices and student learning on a regular basis. They have found that teachers are better able to take control of their work by sharing and discussing their practices with other teachers in similar situations.

### 3. Role of ICT:

- It was debated whether ICT plays a role in education. Many felt that society has already decided that it does play a role and will continue to play a role.
- Also debated was whether ICT are the means to the end goal of education, or whether education is a means to the end goal of ICT integration in general (i.e., ICT integration in society).
- It was argued whether ICT is the best tool for achieving the goal of education and learning for all.
- Some noted that society does not yet fully understand the extraordinary impact the technologies are having on learning, working, etc. in Canada, and that this needs further investigation.
- Clear vision and leadership is needed to aid Canadians in using ICT for the benefit and best interests of all citizens.



# Group Thematic Discussions

After the last session of the symposium, participants took part in small group discussions that focused on the five major themes of the event. Each group was asked to discuss the key policy issues surrounding each theme and the facilitator for each group reported back to all participants on their discussions. In particular, the groups were asked to examine differences in their outlook and experiences, and to comment on the implications that ICT integration has for administration, assessment, and curriculum.

## Group 1: Learning Enhancement

### How can ICT best be used to support learning at all levels?

**Facilitator: Margaret Haughey, University of Alberta**

In the learning enhancement discussion group, much of the dialogue focused on the importance of moving from teaching *about* technology, to teaching *with* technology, and finally to teaching *through* technology. They noted that technology has the potential to change space and time, but the greatest challenge associated with ICT is their pedagogical use. The integration of ICT is not just about the implementation of ICT; it is also about the enhancement of learning. They also noted that some of the present components of Canadian education systems (such as current assessment strategies) delay and restrict the integration of ICT in education.

This group also felt that it is important to “make learning delightful” for students. They emphasized that the loss of motivation felt by students in secondary schools, especially by boys, must be addressed. They also felt strongly that teachers and learners should retain the present diversity of teaching and learning styles, and not have to sacrifice these for ICT integration.

In terms of professional development and pre-service training for teachers, the following questions were raised:

- What will we teach teachers?
- Who will teach them?
- How will we teach them?
- If students are often expert users, how should teachers be prepared to address this issue in the classroom?

The group also discussed resource-based curriculum, appropriate use of ICT, and the importance of instructors’ understanding and ability to model good ICT use. Dr. Haughey told participants that her group believed that teachers need strategies for linking ICT solutions with problems within discipline areas.

To conclude, the group identified the need for more research in the following areas:

- Integrated research models (research, development, and implementation)
- Causes and solutions for low student motivation
- The development of critical thinking and evaluative skills
- Teacher/educator training and professional development
- Faculty development issues

## Group 2: Teaching and Technology

### How can new information technologies support the way teachers teach?

**Facilitator: Patrice de Broucker, Statistics Canada**

This group focused much of their discussion on the changing role of the teacher in today's classroom. They asked "What would it be like to be a teacher effectively using ICT in teaching practice today?" If we cannot answer this question, they argued, then how would we know where to go from here? How do we teach teachers and educators how to use the new ICT tools available to them? These questions are hard to answer at this stage, especially since there is no "template" for ICT integration.

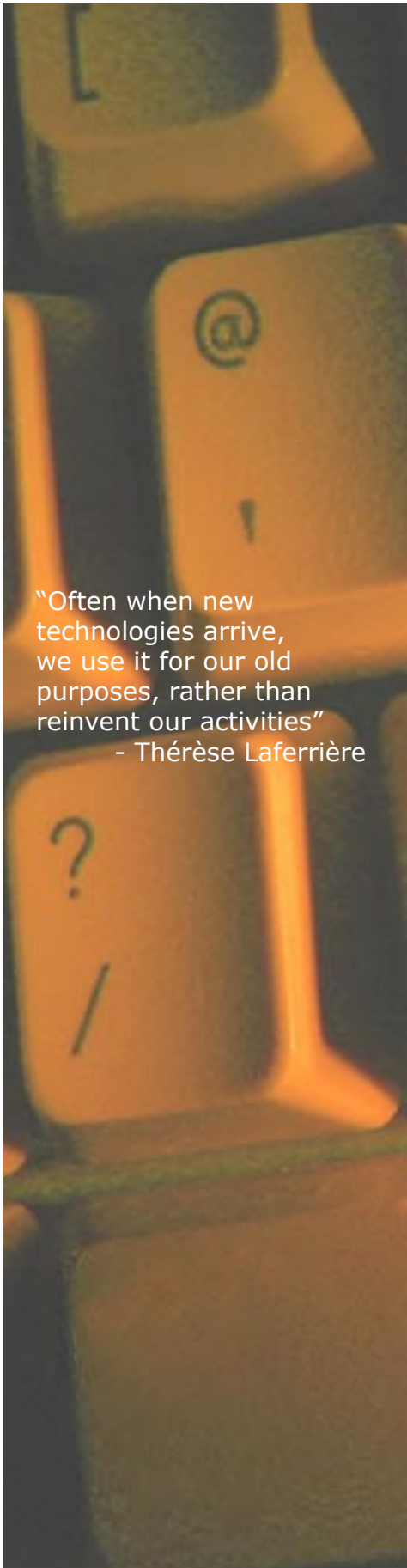
Mr. de Broucker told participants that his group spoke about how Manitoba defines technology as a foundation skill and integrates ICT into curriculum. Teachers in this province have the resources on-line to support them in this integration and they have identified learning outcomes for every teaching strategy they have. ICT training is also provided for teachers.

This small group examined the issue of motivation, in particular, they sought answers to "how do teachers get exposed to beneficial use of technology?", "how do we motivate them to use ICT themselves?", and most importantly, "how do we demonstrate the usefulness of ICT to teachers?"

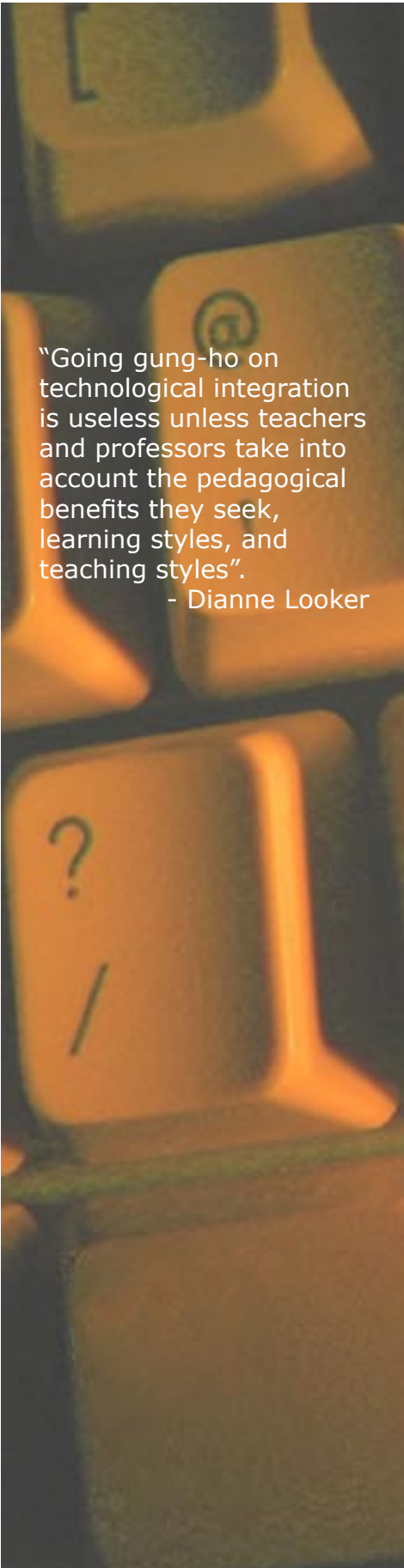
Some of this group's discussion was also centred on pre-service training for teachers. They noted that in pre-service training, when education students use ICT, they are in a protected environment with technical and instructional support. However, when these new teachers get to the classroom, they must address the behaviour management of students, computer problems, lack of computers, space and time constraints, and so on. The reality of the classroom is very different from what students are prepared for in their pre-service training.

It is also important, they noted, for education students to have basic ICT skills before they begin their pre-service training so that when they begin their units on ICT integration, they will have a knowledge base to build on.

Finally, this group also discussed the changing role of principals and school administrators in terms of ICT integration. These individuals are now expected to champion the integration of ICT in their schools. This can be a difficult task for those who are unsure of the potential benefits, challenges, and issues surrounding ICT integration.



"Often when new technologies arrive, we use it for our old purposes, rather than reinvent our activities"  
- Thérèse Laferrière



## Group 3: Quality and Effectiveness

### How can we best measure the effectiveness of technology-mediated learning?

**Facilitators: Charles Ungerleider, University of British Columbia, and Jerry Mussio, Statistics Canada**

This small group prepared various recommendations to address issues related to teaching and learning, indicators and assessment, and key research questions that remain for investigation.

#### 1. Teaching and Learning:

- A clearer definition of what information and communications technologies are and what they can and should be used for in education needs to be developed.
- There is also a need to define our education objectives and then broadly clarify where the technologies fit in.
- Information and communications technologies do not change *what* is learned, but they do change *how* something is learned.
- Different teachers' experiences with ICT from across Canada should be used to generate hypotheses about ICT and learning. These hypotheses could then be tested so that a quantitative knowledge base could be built.
- Student experiences can also be used to inform policy decisions regarding the use of ICT in schools.

#### 2. Indicators and Assessment:

- A wealth of data exists in Canada to allow education stakeholders to better understand ICT and the changes that come as a result of their use (PISA, YITS, National Graduate Survey). Opportunities to learn more about the impact of ICT on education in Canada should be explored.
- Large-scale assessments (including PISA, SITES, and SAIP) provide users with opportunities to measure ICT literacy.
- Classroom assessment strategies should be provided for teachers to facilitate the monitoring of student ICT progress.

#### 3. Key Research Questions:

- What be done now with current resources in schools?
- How can ICT make teaching more effective?
- Is investment in ICT the best way to improve learning?
- How can the provinces and territories work together to improve ICT learning in schools?
- How can changes in the workplace, which are heavily influenced by ICT, inform the integration of ICT in schools?
- What is the impact of ICT integration in the home and how does this relate to ICT integration in schools?

"Going gung-ho on technological integration is useless unless teachers and professors take into account the pedagogical benefits they seek, learning styles, and teaching styles".

- Dianne Looker

## Group 4: Equity

### What are the equity issues in relation to ICT and their impact on teaching and learning?

**Facilitator: E. Dianne Looker, Acadia University**

This small group focused their discussion on finding answers to two major policy-related questions: a) “How do we ensure equitable access to ICT and/or the benefits that ICT can bring?” and b) “What further research is needed?”

To ensure equitable access to ICT, the group suggested that federal and provincial initiatives be developed that tie contracts for curricular material, software, etc., to compliance with equity guidelines. They also suggested that equity goals should be articulated in education at the provincial/territorial level as well as at the federal level.

To ensure equitable access to ICT, the group also identified three other general needs: the need to recognize that cultural barriers can be exacerbated by ICT, the need for stakeholder groups to become more involved in equity issues, and the need to recognize the importance of providing focused initiatives for subgroups (minority groups, individuals with disabilities, etc.), however small or dispersed.

This group also discussed the importance of coordinating federal and provincial/territorial consultations on equity issues, especially with respect to Aboriginal groups who fall under federal jurisdiction and so are often excluded from provincial/territorial consultations.

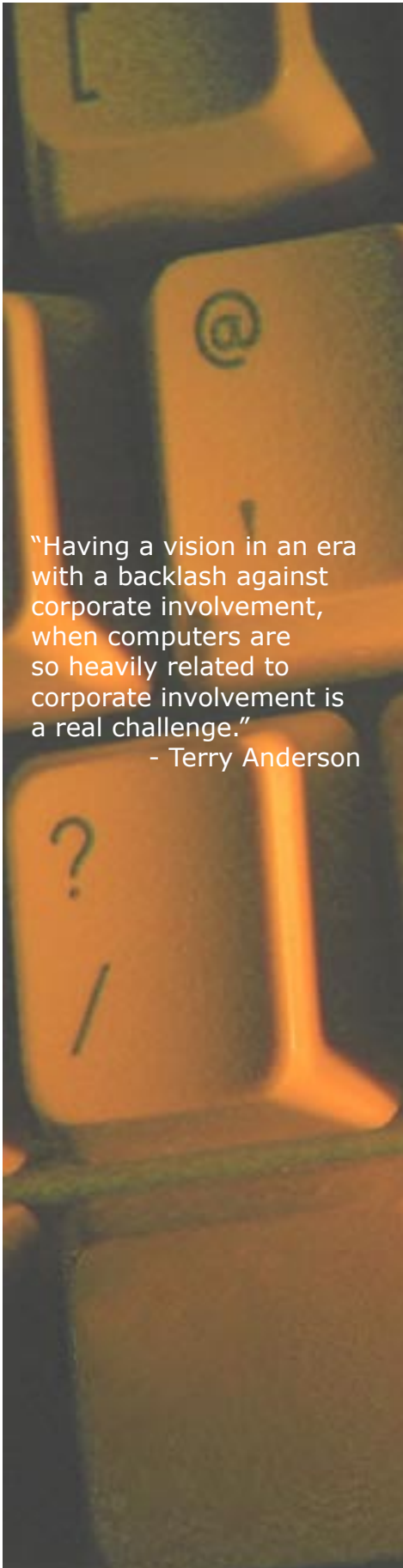
As for further research, the group indicated that the link between access to ICT in the home environment and schooling should be further investigated. They also questioned what role public bodies should play in terms of this link.

Other areas the group felt warranted further research included:

- age inequities in ICT
- The role of private tutoring and privately marketed curriculum materials
- The diversity of disabilities and the ways that different types of disabilities affect the use of ICT
- How language and culture are affected by increased Internet access in Canada
- The negative effects associated with ICT use
- Research on Aboriginal groups that have been excluded from large-scale surveys
- Who does not have access to the Internet or computers at home and why

This group concluded that policy makers need to recognize the usefulness and value of having a variety of research to inform policy. This includes action research, qualitative research, large-scale surveys, and experimental research.





“Having a vision in an era with a backlash against corporate involvement, when computers are so heavily related to corporate involvement is a real challenge.”

- Terry Anderson

## Group 5: On-line Learning

### How effective are the courses that are delivered on-line/technologically?

**Facilitator: Sandy Bellan, Alberta Learning**

This group explored three major areas: 1) What are the opportunities and challenges surrounding on-line learning? 2) Are there differences between on-line learning issues in postsecondary and K-12? and 3) What are the implications of 1) and 2) for policy and research?

Some general issues that were raised by the group surrounded the question of when on-line learning should be introduced to children (i.e., what age groups/grade levels) and what the effects of doing so are (i.e., impact on socialization, potential isolating impact of technology). There is a risk that children may miss out on the socialization opportunities that are associated with traditional schooling if they use computers more and interact with each other less.

The group also discussed cost issues associated with ICT integration. They noted that there seems to be a general assumption that delivering on-line learning is cheaper than traditional methods; this may not necessarily be the case.

Other issues that arose included:

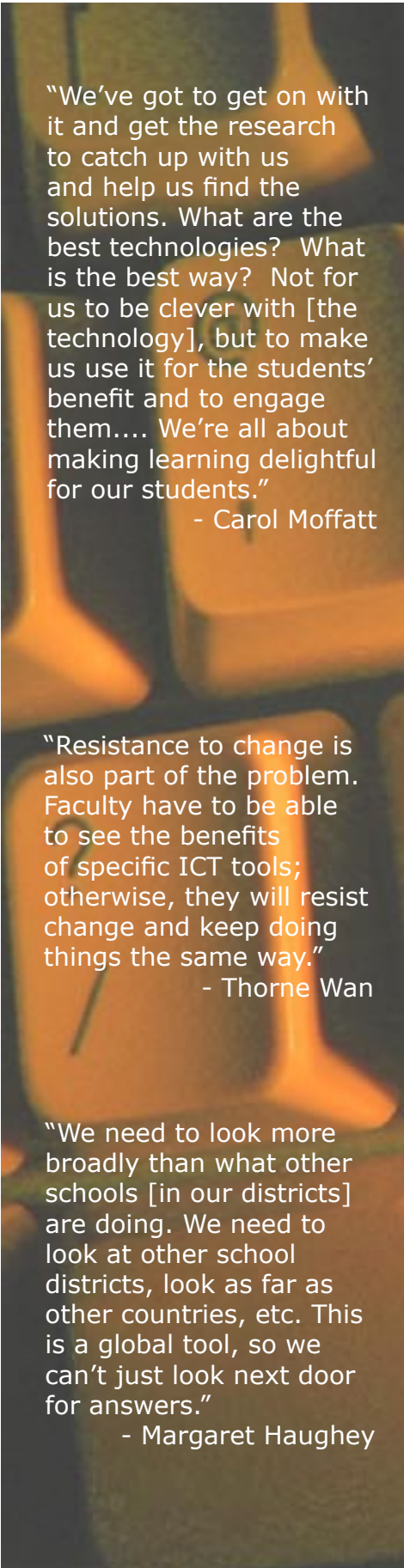
- What exactly is on-line learning? – Definitions range from attending virtual schools to simply using e-mail in a course.
- How can content quality be assured? – By using on-line learning strategies, there is an opportunity to reach students who cannot attend or be reached in a traditional classroom setting, but the quality of the educational content must be the same as that in traditional settings.
- How should traditional assessment methods change to measure achievement in an on-line or ICT-integrated learning environment?
- How should copyright issues be addressed? – Copyright issues concerning content to be used by educators and learners in the classroom must be further explored.
- What are the implications for the parental role? – There may be a need for parents to become more involved in their children’s learning and more supportive when teachers are not available in on-line learning environments in the traditional face-to-face sense.
- What are the implications for policy and research? – Answers to “What is driving on-line learning?” “Who is the on-line client?” “What is the effect of on-line learning on completion rates?” and “How effective are on-line courses?” are still needed.



## Group Discussion on Themes

After the facilitators reported back to the group, a plenary discussion took place. During this discussion, the following major topics were debated:

1. ICT and socialization
  - Since the Web is increasingly being used for collaborative learning, the theory that on-line learning decreases opportunities for socialization was debated.
  - ICT can provide students and other users with access to the community and other resources and information. However, the lack of face-to-face interaction between students and between teachers and students is still perceived as being negative.
2. The evaluation of on-line learning materials and educational Internet resources
  - How should educators evaluate Internet material to be used in their courses?
  - Because “media consumption” courses are not available for teachers, how should they critically review available on-line resources to determine suitability and appropriateness for classroom use?
  - Determining the educational value and suitability of on-line resources and other media is significantly different than evaluating literature and other printed learning materials.
3. Interface design issues
  - How do human factors affect interface design?
  - How do pull-down menus, buttons, the use of color, and the graphic design of Web-based resources affect how students learn?
  - Some participants argued that interface design is a micro-level dimension of ICT that is worthy of further investigation.
4. Interpretation of large-scale data
  - Students are often asked whether they have a computer at home or at school; however, they are rarely asked how old this equipment and their software are. Having access to a computer is not an indicator of what kind of ICT-related tools students actually use. Their computer or software may be out of date, and their Internet connection may be slow and unable to handle visually or aurally enhanced Web content.
  - Another data source that may be subject to misinterpretation is “frequency of use” of ICT. Students are often asked how many times they use a computer or access the Internet during one day. Their answers reflect the frequency of use, but not the intensity or purpose. For example, a student who reports using his computer and the Internet once a day does not specify whether the purpose is used to write book reports, check e-mail, or play an Internet-based video game.
5. Protection of students
  - How can students be protected from Internet pornography, Internet stalkers, and other risks?
  - How can student exposure to Internet-based marketing and other non-educational messages be limited?
  - Not all educational content is posted on the Internet for the best interests of children and students.
6. Importance of bridging the topic of ICT and learning to other education research themes
  - The topic of ICT and learning should not be considered an entity unto itself. It needs to be examined in terms of other educational themes and topics such as teacher/educator professional development, learning outcomes, student transitions, citizenship, and social cohesion.



"We've got to get on with it and get the research to catch up with us and help us find the solutions. What are the best technologies? What is the best way? Not for us to be clever with [the technology], but to make us use it for the students' benefit and to engage them.... We're all about making learning delightful for our students."

- Carol Moffatt

"Resistance to change is also part of the problem. Faculty have to be able to see the benefits of specific ICT tools; otherwise, they will resist change and keep doing things the same way."

- Thorne Wan

"We need to look more broadly than what other schools [in our districts] are doing. We need to look at other school districts, look as far as other countries, etc. This is a global tool, so we can't just look next door for answers."

- Margaret Haughey

## Summary and Conclusions

Despite the many research and policy questions that remained after the 2002 symposium came to an end, many conclusions were drawn by the participants who attended. A key conclusion from this event was that researchers, policy makers, teachers, and educators must make a commitment to perfect the use of technology in education. ICT should not restrict or constrain teaching or learning styles, but rather ICT should be used to improve and benefit both. Now more than ever, there is a need for all parties to collaborate on research projects and policy development so that the end goal of improving learning and access to education for all students is achieved.

Some participants also concluded that each ministry and department of education, school district, and educational institution needs to develop an ICT integration plan for teachers/educators and administrators. These plans should set out and reinforce the ministry's, department's, district's, and institution's vision for ICT integration. These plans should be linked in order to ensure cohesiveness is maintained and that common goals are met.

Another conclusion drawn at the event was that more resources are needed for teachers and educators in the form of pre- and in-service training for ICT integration in the classroom, recertification programs, and on-site technical support.

To achieve successful ICT integration in schools, participants agreed that administrators at the K–12 and postsecondary levels need to champion ICT integration initiatives and encourage their adoption by teachers and educators. Furthermore, both "top-down" and "bottom-up" ICT integration strategies are recommended at the school, district, and provincial levels. ICT integration strategies should also be designed to address the ever-constant gap that exists between what teachers/educators are trained for and the realities of the classroom.

Participants also concluded that better definitions are needed regarding the role of ICT in the education system; these would include clearer definitions of ICT themselves as well as terms such as "on-line learning," "virtual classroom," and so on. Once these definitions have been developed, they could be used to create better indicators and assessment tools.

The fifth major conclusion from this event was that a need exists for multiple research methods to investigate the impact of ICT on education. Furthermore, it is not enough, some suggested, to do pan-Canadian studies that measure only certain sectors of the population.

Micro-level surveys and other research on minority groups and those who have been excluded from previous studies are required. Research methods that overcome language and other cultural barriers are also needed.

Other areas that require more investigation include cost-benefit analyses of ICT integration and the maintenance of quality in instruction and content in computer-assisted learning environments.

Finally, some of the major policy-related questions that were raised at this event that may be used to guide future research include (among others noted throughout this report):

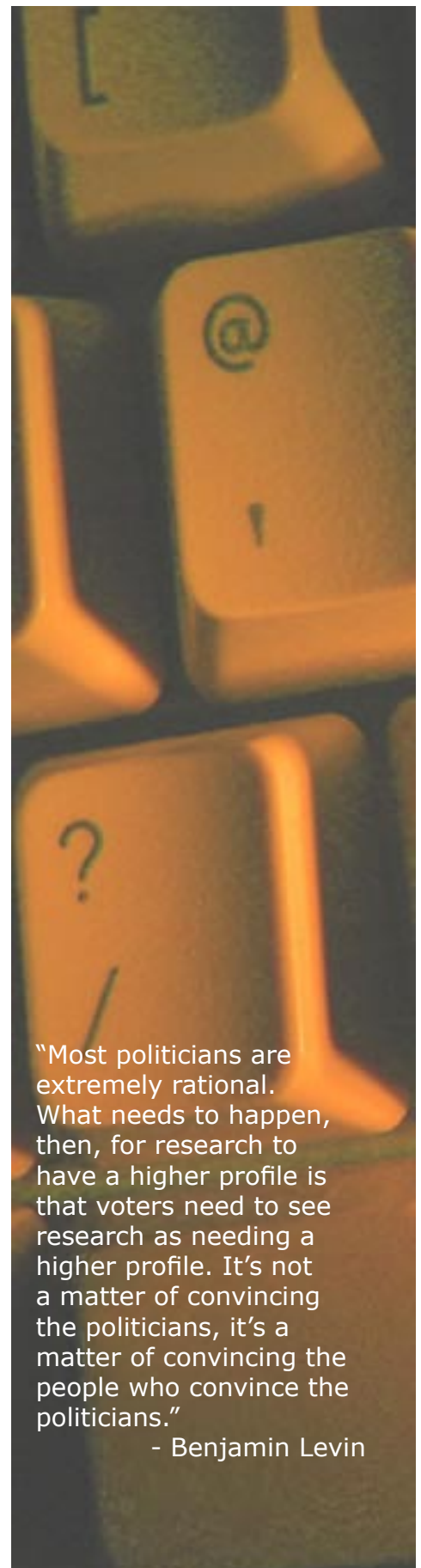
- What is driving the integration of ICT in education in Canada?
- What is the final goal or objective of ICT integration?
- What are the regular and opportunity costs of ICT integration?
- How will we train current and future teachers/educators to educate their students with and through ICT?
- Which types of students should use ICT for learning (At what age, grade level, location, class size? Do they need previous experience with computers/Internet? Is ethnic or cultural background relevant?)?
- How can equitable access to computers and the Internet be made available for all students?
- Who is responsible for leading ICT integration (ministries/ departments of education, administrators, teachers/educators)?
- What future steps need to be taken?

## Closing Remarks

Douglas Hodgkinson concluded the 2002 PCERA Symposium by thanking the researchers, discussants, small-group facilitators, and other speakers at the event. He also thanked participants for their interest, participation, and contribution to discussions, particularly the international delegates who stayed on after the CMEC–OECD–Canada Seminar to offer an international perspective on ICT and learning.

He noted that participants would be leaving with a broader understanding of the issues surrounding the integration of ICT in education, as well as an understanding of how these issues will influence policy and practice in the field. “Our challenge, as always, remains to take our new knowledge and put it into practice,” he noted.

Mr. Hodgkinson drew the symposium to a close by expressing his wishes to see participants at future PCERA events.



“Most politicians are extremely rational. What needs to happen, then, for research to have a higher profile is that voters need to see research as needing a higher profile. It’s not a matter of convincing the politicians, it’s a matter of convincing the people who convince the politicians.”

- Benjamin Levin

# Participants

Terry Anderson	Athabasca University	Canada
Thorvald Astrup	Ministry of Education and Research	Norway
Antonio Avila	Ministry of Education	Mexico
Georges Barthel	National Ministry of Education	Luxembourg
Huguette Beaudoin	Université Laurentienne	Canada
Sandy Bellan	Alberta Learning	Canada
Christian Blanchette	Université d'Ottawa	Canada
Robert Bracewell	McGill University	Canada
Alain Breuleux	McGill University	Canada
Monique Brodeur	Université du Québec à Montréal	Canada
Patrick Bussière	Human Resources Development Canada	Canada
Katy Campbell	University of Alberta	Canada
Ruby Chow	Council of Ministers of Education, Canada	Canada
Bradley A. Corbett	University of New Brunswick	Canada
Yvon Côté	Quebec Ministry of Education	Canada
Carl Cuneo	McMaster University	Canada
Patrice de Broucker	Statistics Canada	Canada
Shannon Delbridge	Department of Education, Nova Scotia	Canada
Fiona Deller	Council of Ministers of Education, Canada	Canada
Denise Doré	Ministry of Education, Ontario	Canada
Doug Drew	Statistics Canada	Canada
Jacques Drouin	Industry Canada	Canada
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Regina Eichen	Schulen Ans Netz E.V.	Germany
Heidi Ertl	Statistics Canada	Canada
Gustavo Flores	Latin American Institute of Education Communication	Mexico
Bernie Froese-Germain	Canadian Teachers' Federation	Canada
Wendy Fukushima	Council of Ministers of Education, Canada	Canada
Marian Fushell	Department of Education, Newfoundland and Labrador	Canada
Tomasz Gluszynski	Human Resources Development Canada	Canada
Britta Gundersen-Bryden	Ministry of Education, British Columbia	Canada
Kenneth Gunn	Ministry of Education, Prince Edward Island	Canada

Laurie Harrison	University of Toronto	Canada
Margaret Haughey	University of Alberta	Canada
Mike Hayes	Saanich Teachers' Association	Canada
Jean Hénai	Quebec Ministry of Education	Canada
Ann Marie Hill	Queen's University	Canada
Guy Hô Văn Hap	Quebec Ministry of Education	Canada
Douglas Hodgkinson	Council of Ministers of Education, Canada	Canada
Ignacio Jara	Ministry of Education	Chile
Thierry Karsenti	Université de Montréal	Canada
Robert Kennedy	Apple Canada	Canada
Robert Kozma	Center for Technology in Learning, SRI International	USA
Thérèse Laferrière	Université Laval	Canada
Nicole Lefebvre	Quebec Ministry of Education	Canada
Frédéric Legault	Université du Québec à Montréal	Canada
Jo Ann Lévesque	Social Sciences and Humanities Research Council of Canada	Canada
Ben Levin	Department of Education, Training and Youth, Manitoba	Canada
E. Dianne Looker	Acadia University	Canada
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Andrew Manning	Mount Saint Vincent University	Canada
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Kathleen Matheos	University of Saskatchewan	Canada
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Penny Milton	Canadian Education Association	Canada
Carol Moffatt	Ministry of Education	New Zealand
Susan Mongrain	Industry Canada	Canada
John Morgan	Toronto Catholic District School Board	Canada
Socrates Muñiz	Arturo Rosenblueth Centre	Mexico
Nery Muñoz	Ministry of Education	Mexico
Jerry Mussio	Statistics Canada	Canada
Gabor Nagy	Ministry of Education	Hungary
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Dorte Olesen	UNI-C	Denmark
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Laura Sheehan	Ontario College of Teachers	Canada
Wade Sheppard	Department of Education, Newfoundland and Labrador	Canada
Mike Sheridan	Statistics Canada	Canada
Peter Sovran	Ministry of Education, Ontario	Canada
Amanda Spencer	Council of Ministers of Education, Canada	Canada
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Chantal Vaillancourt	Statistics Canada	Canada
Maryanne Webber	Statistics Canada	Canada
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