



SUMMIT ON TECHNOLOGY AND EDUCATION 2001



Report



Canadian Education Association

With

Cisco Systems Canada
Sun Microsystems Canada
Adobe Canada



And



Panduit Canada
Pearson Education Canada
Fluke Electronics LLP



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EXECUTIVE SUMMARY

The Technology Summit on Education - a partnership between the Canadian Education Association, Cisco Systems Canada Co., Sun Microsystems of Canada Inc., Adobe Systems Canada, Panduit Canada and Pearson Education Canada with the assistance of Fluke Electronics Canada LP - met in eight cities across the country at the end of 2001. The key messages were:

- Canada needs to raise academic achievement levels especially those of students from lower socio-economic backgrounds;
- To do so is part of the necessary response to the growing insufficiency of technical and managerial skills in the Canadian labour pool;
- The use of technology in educational settings continues to be a high priority but unless it is used to improve outcomes for students, public expenditures on technology will come under increasing scrutiny;
- Partnerships between the public and private sectors offer an important means of addressing challenges faced in using technology for learning;
- Partnerships must be genuine collaborations in problem solving – i.e. they are a social investment by partners that advance educational goals.

The participants in the Technology Summit generally agreed with these propositions but they face significant challenges in realizing the potential that the use of technology in education appears to have. The most significant of these is the need to enhance teacher competence and confidence in using technology as an instructional tool. The availability of the hardware and software, reliability of performance and access to technical support remain challenges at all levels of the education system. We draw the following conclusions from the dialogue.

- Professional development is the key to effective use of technology. The form of professional development initiatives is critical. Teachers at all levels of the education system need opportunities to examine basic beliefs about teaching and learning and their forms of practice. They need time for learning and for practice. If technology is used to do what we have always done, we can expect results similar to those that we already have.
- Teachers cannot be expected to be "system administrators, computer technicians and programmers". Hardware and software installations need to be affordable, reliable and robust in classroom settings. The constant demand for upgrading of installations should be moderated by better definition of what is needed to achieve specific objectives and by sharing knowledge about what can be achieved with the technologies already in place.
- Interoperability is a key issue in the educational use of technology. Schools, colleges and universities need to be able to work with a

variety of platforms according to the educational purpose at hand. Key players in the industry have generally been unresponsive to this need. While single platforms may be highly appropriate for the business processes of educational institutions, they do not necessarily serve educational ends.

- Issues of intellectual property and copyright in web-based content must be resolved within a framework that reflects the clear differences between the public sector and private sector and the importance of access to information and resources by learners – both teachers and students.
- Issues of gender remain prevalent in the use of technology. This is especially true within specialist programs that teach about technology.
- Partnerships maybe an important means of responding to these challenges. Institutions may need to better understand both what they 'bring to the table' and what an effective partnership requires. Partnerships can be explored with other public and not for profit organizations as well as with private firms.

1.0 THE SUMMIT ON TECHNOLOGY AND EDUCATION

The Canadian Education Association is a national, bilingual charitable organization that advances public commitment to education by engaging diverse perspectives in finding common ground on issues that affect the learning of children, young people and adults. One of these issues is the effective use of technology in learning. The Canadian Education Association in partnership with Cisco Systems Canada Co., Sun Microsystems Canada Inc., Adobe Systems Canada, Pearson Education Canada and Panduit Canada, held a Summit on Technology and Education in eight Canadian cities in seven provinces between November 13 and December 4, 2001.

The purpose of the Summit was to allow educators and representatives from the private sector to explore challenges and opportunities for partnerships in using technology as a tool in education.

This report summarizes the findings of the Summit. It includes perspectives offered by education researchers, participants and private sector partners.

We acknowledge with appreciation the provision of facilities and logistical support by local partners – Nova Scotia Community College, McGill University, Red River College, Saskatchewan Institute of Applied Science and Technology, Southern Alberta Institute of Technology, Northern Alberta Institute of Technology, Vancouver School Board and Centennial College. Fred Crouse, Mount St Vincent University; Alain Breuleux, McGill University; Thérèse Laferrière, Université Laval; Vi Maaers and David Freisen, University of Regina; Katy Campbell, University of Alberta; Bill Hunter, University of Calgary; Rob Tierney, University of British Columbia; and Jennifer Jenson and Chloë Brushwood Rose, York University generously shared their research and experience in integrating technology in learning.

2.0 THE EDUCATIONAL CHALLENGE

For the education sector the consequences of globalization are dramatic. System and student achievements are increasingly measured against international standards. The rapidly changing labour market demands new and higher levels of education and skills.

In Canada, the commitment to equal educational opportunity for all is being replaced by an expectation of successful educational achievement for all. In the recently reported results of the Program for International Student Assessment (PISA), Canada ranked among the top six of 30 countries in achievement by 15 year olds in reading, science and mathematics. The Council of Ministers of Education (CMEC) reports that the gap in performance between the highest-scoring and lowest-scoring students in Canada was narrow compared to most other participating countries. The performance gap was also narrow between students from higher socio-economic levels and those from lower socio-economic levels.¹

Efforts to raise the level of overall achievement and to narrow these gaps are essential to social as well as economic development. Doug Willms, a winner of the CEA Whitworth Award for Educational Research, writes that, "Literacy and economy are interdependent given that a country's economic performance relies heavily upon the ability of its labour market to adapt quickly to innovation and change in an emerging global economy".² His analysis of the International Adult Literacy Survey reveals that a substantial number of adults, 40%, scored at literacy levels 1 and 2, generally regarded as inadequate to the modern economy. Thus continuing to raise school achievement is a significant strategy to respond to labour market shortages.

In its survey in 2000, the Canadian Federation of Independent Business (CFIB) reported that 300,000 jobs went unfilled because of skill shortages.³ As well, the Conference Board of Canada found that 83% of those surveyed reported experiencing shortages of skilled workers, especially highly sought after technical and middle managerial skills.⁴ Skill shortages are widespread throughout the economy, especially in skilled trade areas and are expected to get worse in the future as demographics including the retirement of the baby boom generation come into play.

¹ Council of Ministers of Education. PISA 2000: Measuring Up: The performance of Canada's youth in reading, mathematics and science — First Results for Canadians aged 15
<http://www.cmec.ca/pisa/2000/indexe.stm>

² Willms, J. Douglas and Sloat, Elizabeth. Literacy for Life. 1998.
<http://www.unb.ca/crisp/pbrief4.PDF>

³ Canadian Federation of Independent Business. Help Wanted. February 2001.
http://www.cfib.ca/research/reports/sql_e.pdf

⁴ Conference Board of Canada. Skill Shortages Threaten Canada's Competitiveness. 2000.
http://www.conferenceboard.ca/press/2000/scarceskills_old.htm

The new longitudinal Youth in Transition Survey (YITS) of 18-20 year olds illustrates the complexity of pathways for young people. The school dropout rate has declined to 12% of 20 year olds without high school graduation. Just over half of all those surveyed were in post-secondary education (PSE), 46.9% were continuing their studies and 3.7% had graduated from PSE. Twenty-five percent had graduated from high school but not gone on to college or university and 6.1% had left PSE before graduation. Although financial barriers to PSE were cited by two-thirds of respondents, lack of skills remains important. Drop-outs are more likely than others to rate their skills as poor or fair and they were less likely to have been exposed to career and job skills courses.⁵

The focus is now on the use of technology to improve learning and to respond to the needs and interests of all students.

The pilot project demonstrates that having more computers not only improves students' technological knowledge and skills, but is also creating a paradigm shift in teaching and learning.

(Vi Maaers, David Friesen, BrainBinder Project, Saskatchewan)

⁵ Human Resources Development Canada. Youth in Transition Survey: Highlights.
http://www.hrdc-drhc.gc.ca/arb/publications/books/highlight_yits-en.pdf

3.0 THE TECHNOLOGY CHALLENGE

The defining technologies of this global era – computerization, miniaturization, digitization, satellite and wireless, fiber optics and the Internet – have seen rapid take up in workplaces, schools, colleges, universities and homes. Large investments in information and communications technologies (ICTs) in education have been made over the last decade. In a recent survey 56% of schools and 37% of school boards rated investment in technology as a high priority. It found also that of the average 77 computers per school, 60 were connected to the Internet.⁶

No previous technology has entered the education domain as extensively and quickly as ICTs. The World Wide Web appeared in 1990 and by 1993 had attracted 10 million Internet users. With the launch of Netscape, the number jumped to 50 million by 1995 and estimates of over 500 million users worldwide are made for 2001.⁷ Annapolis Valley Regional School Board was the first school district in North America to have every school directly connected to the Internet.⁸ Industry Canada through the SchoolNet partnership with the provinces ensured that every school was connected by 1999. By 2000 SchoolNet had achieved its goal for classroom level Internet connection. Late in 2001 the CMEC called on the federal government to include further financial investment in connectivity in order to enhance the education sector's innovative capacity in e-learning. Issues of limited multimedia access particularly for rural and remote communities are regarded as urgent.

As well as external connectivity, school systems and post-secondary education institutions face high costs in technology and human resources to provide and maintain internal local or wide area networks.

Hardware (and software) acquisition and implementation has consumed large financial investments including reinvestments as new generations of equipment are released. But social and educational factors are at the heart of the use of technology to enhance learning.

We have less than 4 years experience with a profound and radical change that is affecting the very way in which we teach... We still use classroom practices that had their origins in the early 1900's.
(Fred Crouse, Halifax)

We know what to do – we just wish the teachers would let us do it. I learned by eavesdropping. I taught the technology consultant.
(Students, BrainBinder Project, SK)

⁶ Cisco Systems. Presentation to Technology Summit. <http://www.acea.ca/english/Cisco.pdf>

⁷ Ibid

⁸ Crouse, Fred at <http://faculty.msvu.ca/fcrouse/summit/slide3.html>

4.0 WHAT WE HEARD

The findings set out below have been collated across all locations. There were no significant differences in concern across the country. Approximately 350 educators and staff working in information and communications technologies accepted the invitation to attend the Summit. Their reasons for doing so reflected a desire to understand where technology development is going; to look at innovative practices in learning and in products and services; and to network with peers from other organizations. The Summit program was generally well received with many suggestions made for continuing this kind of initiative in the future.

TEACHING AND LEARNING

The relatively rapid introduction of information and communication technologies (ICT) including access to the World Wide Web in schools, colleges and universities presents perhaps the largest challenge for retraining and professional development that the sector has ever seen. ICT requires that teachers themselves master not only the use of the technologies in their classrooms but address deeply embedded professional beliefs about their roles. The most effective use of technology requires new instructional models. Technology enables the application of new knowledge from brain research and cognitive science about how people learn. These include project-based learning, thematic/multidisciplinary instruction, and personalized instruction. The role of the teacher is shifting from one of the provider of information and opportunities to practice skills to one that supports and facilitates the engagement of students in meaningful activities, with hands-on experience of real life tasks and problems; providing complex and relevant problems to work on with others, and including experts inside and outside of the classrooms.

Advanced skills required by students today include effective communication of ideas, concepts and knowledge using a variety of media; technological literacy; information management (accessing, exchanging, compiling, analyzing, concluding); and capacity to collaborate and cooperate. Networked classrooms and broadband connections to the Internet, that connect students in learning communities and support the use of multimedia, enhance the new teacher skills. Providing sufficient bandwidth presents a further challenge to the public and private sectors that have much to gain from higher achievement by students in Canada.

To get higher payoffs from the implementation of technology in schools, colleges and universities, we need to invest in teacher development in these newer instructional approaches as well as in the use of technology.

TEACHER READINESS

By far the overriding concern of Summit participants is the need for effective professional development and training. This requires an understanding that teacher practice is rarely modified by short-term workshops, the classic

mode for teacher professional development. They need instruction and support to practice new approaches. They need the possibility of learning by doing – of being able to experiment and explore new approaches and to develop new resources. Providing mechanisms for teachers to learn from each other, to share access to resources developed by peers are seen to be valuable tools for developing the capacity of teachers to use ICT in their programs. Pre-service education for those preparing to teach in the K-12 system must include the instructional use of technologies. The challenge of equipping instructors and professors to teach with technology is equally difficult because of the higher level of autonomy in how they teach and the fact that traditional models of professional development in the post-secondary sector focus on subject knowledge rather than pedagogical expertise.

GUIDING VISIONS

Summit participants across the country identified the need for the development of clear visions for the use of technology in learning at provincial, school district, college and university levels. They suggested that such visions be developed with the inclusion of key stakeholder groups and supported by institutional leadership and policies in order that staff, students and community can better understand the directions being taken. Participants believed that clear direction about the intended uses and expected impacts of technology in classrooms is essential, and will contribute to lessening the resistance to its use.

THE TECHNOLOGIES

The current state of technology itself presents particular challenges. The high costs of the initial acquisition of networks, hardware and software represent only a fraction of what is required to maximize the impact of new technologies. These are new costs. There are not savings in classroom expenditures to be achieved by technology, rather further expenditures on adequate technical and administrative support as well as investments in professional development must be calculated and provided for. Rural and remote communities are still inadequately connected to the Internet for high speed and broadband access, and their technology infrastructure is often not as sophisticated as in urban settings.

Some educators desire to use cross-platform network installations; interoperability remains a problem and competition amongst suppliers limits their interest in solving these problems. Reliability and quality of technology (hardware and software) is not always adequate to the rigours of the classroom.

ADDRESSING THE CHALLENGES

Participants offered many suggestions and reported on efforts to address these challenges. They urge that the issues must be framed as educational ones, i.e. what are the needs of learners and how does technology assist in meeting them? Rather than what should we do with the technology? We need

to change the approach from technology as an "add-on" to what teachers already do to real integration with the curriculum. This requires a lot of rethinking about how schools and colleges organize the learning program and requires discussion with parents in K-12 settings so that they have an opportunity to support directions planned for their children.

A number of references were made to the need for education organizations to assess achievements to date and build on that base rather than constantly pursuing technological upgrades. Reconsideration of how time is scheduled for teacher/faculty learning is required. Traditional methods and models of professional development are inadequate to the task. Investment in opportunities for teachers to learn and practice new skills is a high priority.

There is a significant need for further research on technology and learning, including the impact of teacher practice, the identification of its implications for choice of technologies, and to make research accessible and meaningful to practitioners.

PARTNERSHIPS

Most participants recognized that partnerships between sectors might be the only viable option for enhancing the use of technology in learning. Partnerships that include the private sector, other educational organizations and the not for profit sector should be explored. Partnerships between multi-parties could be beneficial by including several education organizations, government and the private sectors.

Good content is more important than the technology. (Vancouver)

Teachers need computers. In what other workplaces is this tool not provided to the employees that need it? (Calgary)

Build a continuum for students. They enter higher education and find less use of technology than in their schools. (Toronto)

Professional development is the greatest challenge – finding the time to learn and to practice new skills. (Montreal)

A real vision for our school district would challenge the resistance of teachers.(Regina)

We have a serious lack of IT staff to keep things running.(Winnipeg)

The focus must be on the pedagogy and on what we know about teaching and learning. (Toronto)

5.0 WHAT DIFFERENCE CAN NETWORKED CLASSROOMS MAKE?

(The presentations made by Fred Crouse in Halifax, Alain Breuleux in Montreal, Vi Maers and David Friesen in Regina, Katy Campbell in Edmonton, Bill Hunter in Calgary and Jennifer Jenson and Chloë Brushwood Rose in Toronto can be found at <http://www.acea.ca/english/events.phtml>)

Research indicates that technologies and certain kinds of software applications allow teachers to facilitate knowledge building in support of the development of problem solving, critical thinking and analytical skills in students of all ages. Support to teachers in the skills of inquiry based-learning and constructivist pedagogy may be the key to ensuring that investments in ICT result in better learning for all students.

Fred Crouse in Halifax began his discussion of networked classrooms with observations about the change in student attitude and behaviour that results from the widespread access to the Internet. He reported that "most students entering our colleges and universities today are younger than the microcomputer, are more comfortable working on a keyboard than writing a spiral notebook, and are happier reading from a computer screen than from paper in hand. For them, constant connectivity – being in touch with friends and family at any time and from any place – is of utmost importance. The many new attributes of student behavior will have a profound impact on our educational institutions. Crouse presented ten attributes reflecting values and behaviors that make up "the information age mindset."⁹ They are:

- * Computers aren't technology.
- * The Internet is better than TV.
- * Reality is no longer real.
- * Doing is more important than knowing.
- * Nintendo (trial-and-error; experimentation) is preferable to logic.
- * Multitasking is a way of life.
- * Typing is preferable to handwriting.
- * Staying connected is essential.
- * There is zero tolerance for delays.
- * The lines between consumer and creator are blurring.

(From the American Council on Education, Centre for Policy Analysis, [Distributed Education and its Challenges](#))

What are networked classrooms? They are classrooms connected to the Internet. Preferably, access is constant through high-speed local intranets and the Internet, students have access to full multimedia workstations and the tools and peripherals for the creation of graphics, video, audio and interactive environments. Ideally, personal workplaces are accessible from

⁹ Crouse, Fred at <http://faculty.msvu.ca/fcrouse/summit/slide1.html>

various locations and collaborative workspaces enable groups of students to meet to share resources, share information, collaborate and communicate with each other. They and their teachers have access to the seemingly limitless online resources and strategies for finding the educationally sound and valuable resources.

These features of the networked classroom are not yet the reality for many students and teachers, particularly in remote and rural areas. And where they do exist, the question becomes how are students and teachers using the technology and what are the differences that it makes. However, there is growing evidence that it is under these conditions that important changes in student learning may occur.

It is the network that brings more people into the learning endeavour, different perspectives, different voices both from inside and from outside the traditional boundaries of a classroom. The idea of the school as the place of learning suddenly seems entirely too limited. The theory of the social construction of knowledge – that is that learning emerges from social interactions that build understanding and meaning for the participants – has gained significant currency as technology allows students and teachers to build knowledge together with people including experts outside of the school and even country. Access to so many new resources through the Internet allows learners to work on real or authentic projects and problems.

Alain Breuleux offers the important caveat that a focus on the technology can “mask the more complex reality that it is educator’s decisions and actions with ICT that result in change and that constitute most of the impact”.¹⁰ The speed of change in our social world and in technology has been such that practice precedes policy and what we know is discovered through the reflective acts of practitioners and researchers. Breuleux writes that “communities of interpretation are essentially connecting the present with the future, the actual with the possible, and that they accomplish this by connecting the views of teachers, researchers, developers and other interested members of the educational community”.¹¹

The BrainBinder pilot project that involved four school districts in Saskatchewan provides one opportunity to contemplate the complexity of integrating technology and curriculum for the benefit of learning. (See Section 6.0 for more information on this project.) In the project evaluation final report, Vi Maaers and David Friesen conclude:

“The dramatically increased access to computers, particularly in classrooms, is creating a paradigm shift in teaching and learning. Most teachers indicated they had not used computers in the classroom in the previous two years on a regular basis.

¹⁰ Breuleux, Alain. Technology and the Renewal of teaching and Learning. Education Canada. Canadian Education Association. Vol. 41 No. 3. 2001 (12)

¹¹ Ibid. (15)

The pilot project demonstrates that having more computers not only improves students' technological knowledge and skills but is also creating a paradigm shift in teaching and learning. Increased computer access to educational Internet sites and learning applications enables students to pursue their unique learning goals through resource-based learning. However, paradigm shifts take a considerable amount of time and are not without severe growing pains." BrainBinder Final Report¹²

Friesen and Maaers agree with Alain Breuleux – networked classrooms do not make the difference, teachers do. All teachers with the appropriate support and opportunity to learn to use it can use the technology. The type of use that teachers make of the technology in their classrooms depends on their affiliation with teaching beliefs and practices. Although there is an emerging consensus that constructivist approaches bring the greatest benefits to learners in networked classrooms, these are not the traditional teaching styles in K-12 or post secondary education. Networked classrooms support the emergence of learning communities that reach out beyond the school to engage others. Brueleux identifies several important principles for networked learning communities: the perspective on knowledge moves from individual to collective; the perspective on learning is an active process of building knowledge and understandings with others; the perspective on technology sees it as transformational moving from reproduction or presentation of ideas to the creation of them.¹³ Bill Hunter reinforced these observations through illustrations of student and teacher work reported in case studies prepared for the Organization for Cooperation and Development. In one school a teacher described the impact of a special project, "I came in with misconceptions about technology use. I came prepared to learn a lot about technology, but I came away with an even greater understanding of teaching and learning, and how technology is used as a tool, (it's) not the flashy stuff that we need to be doing."¹⁴

Hunter has also looked at these ideas of networked learning communities in virtual classrooms or on-line learning. He quotes secondary school teachers, "I am not here because I embrace technology; I'm here because it creates innovation, it's a catalyst for re-thinking and re-design, and it brings the debate back to the table" and "Technology should not be the defining trait of best practice. But I have found that it has been my experience that it has allowed us to examine practice again and raise the bar everywhere".¹⁵

Perhaps these teachers have identified one of the most important contributions that technology makes to changing outcomes for students – it provokes a critical examination of professional practice. If we intend to use technology as a catalyst for renewed teaching practice, we must give serious

¹² Maaers, V. and Friesen, D. What Difference Do Networked Classrooms Make?
<http://www.acea.ca/english/events.phtml>

¹³ Brueleux, A. at <http://www.acea.ca/english/events.phtml>

¹⁴ Hunter, Bill at <http://www.acea.ca/english/events.phtml>

¹⁵ Ibid

attention to the needs of teachers, professors and instructors for opportunities to learn and to practice.

In their current research project *Schools for the Knowledge-based Society*,¹⁶ Jennifer Jenson and Chloë Brushwood Rose have identified professional development as a critical issue for teachers. The case studies of schools across Canada indicates that best or promising practices for teacher development are scalable and sustainable, involve incentives, on site work, a facilitating environment, opportunity for 'play' and discovery. They are activity-based, flexible and include ongoing support. They found too that there are significant barriers to policy implementation whether governments, school districts or the school creates that policy.

One of the significant disconnections is between curriculum and technology. Many districts have cut back on curriculum support personnel because of fiscal constraints leaving support for teachers with access to largely specialized technical staff. As one of them in the study said, "I don't know anything about curriculum and I have no interest in learning about curriculum design". Although not an unreasonable position, teachers need support from both technical and curriculum experts if we expect teaching practice to change with the use of technology. This loss of curriculum support has happened at the same time that policy objectives have shifted from a technology skills-based approach to integration of technology across the curriculum.

The Faculty of Education, University of British Columbia has introduced a new approach to support the development of pre-service teachers in the use of technology in the classroom and to assist in the development of practicing teachers who work in the practicum periods. Rob Tierney, Dean of the Faculty of Education, presented the program at the Vancouver Summit. The teachers in training are provided with Macintosh IBooks laptops with wireless Internet access across the campus. They use technology in the development of classroom units and can then share their growing competence with their partners in the regular classroom setting. Several school districts are participating in the pilot.

Integrating technology into post-secondary education (PSE) in colleges and universities presents challenges both similar and different than in the K-12 system. Trends in higher education were presented by Katy Campbell in Edmonton.¹⁷ One approach is that of the Academic Technologies for Learning (ATL) group at the University of Alberta. Its mandate is to support a cultural shift through faculty and institutional transformation, and to support faculty action research concerning technological innovation in the disciplines. Key issues include the changed access to learning opportunities and resources available to students, the emergence of new learning communities, the

¹⁶ Visit <http://delta.cprost.sfu.ca:8080/skbe/>

¹⁷ Cambell, Katy at <http://www.acea.ca/english/events.phtml>

impact of the changing nature of work, formation of new partnerships and the creation of collaborative course teams. Technology is a driver of change.

Like in the K-12 sector, the adoption of technologies in teaching is pursued by the 'early adopters' while others are less sure of its significance and some are distinctly hostile to its use. In a survey conducted by ATL a large contingent of respondents agreed that further research in the area of innovative teaching practice is needed.¹⁸

Profound change faces Canada's post-secondary institutions. The Advisory Committee on On-line Learning in its report *the e-learning e-volution in colleges and universities* sets directions "about how we can preserve and build upon the best of the past while seizing the opportunities and overcoming the challenges of the future. The prism through which we view this change is online learning — the use of digital networks to deliver post-secondary education and training — because this new mode of delivery will prove strategic to Canadians as both individuals and a society."¹⁹

Research in education with technology is ongoing. It makes an important contribution to what we know and how we need to act to advance the best uses of technology for learning. However Larry Cuban, Professor of Education at Stanford University offers much for further reflection. He writes,

The billions of dollars already spent on wiring, hardware and software have established the material conditions for frequent and imaginative uses of technology. Many students and teachers have acquired skills and engaged in serious use of these technologies. Nonetheless, overall, the quantities of money and time have yet to yield even modest returns or to approach what has been promised in academic achievement, creative classroom integration of technologies, and the transformations in teaching and learning. Nor can proponents of the slow revolution be confident that those outcomes will materialize without considerable changes in school organization, and the distribution of decision-making authority among teachers, administrators and policy-makers.²⁰

As yet we have little evidence of the kind of changes that Cuban advocates as essential.

¹⁸ Academic Technologies for Learning. Teaching and Learning Survey 2000. <http://www.atl.ualberta.ca/services/evaluation/Files/TLS2000Exec.htm>

¹⁹ Industry Canada. the e-learning e-volution in colleges and universities. 2001. http://www.schoolnet.ca/mlg/sites/acol-ccael/en/report/exec_summary.html

²⁰ Cuban, Larry. *Oversold and Underused: Computers in the Classroom*. Harvard University Press. Cambridge. 2001 (180). Available at www.edtechnot.com/notcuban.html

6.0 PARTNERS' VISIONS FOR TECHNOLOGY AND LEARNING

(The Technology Summit Presentations made by Anne Miller, Joanne Wong and Lorna Carlson for Cisco Systems Canada, by Ruta Cummings and Colin Smith for Adobe Systems and Ted Jawniak for Sun Microsystems Canada can be found at <http://www.acea.ca/english/events.phtml>.)

The private sector partners in the Technology Summit are industry leaders in their fields. They are innovators that strive to be 'best in class' and to establish industry standards in their specific fields. Their success is in part dependent on understanding and responding to client needs. Cisco Systems, Sun Microsystems, Adobe, Panduit, Fluke and Pearson Education are some of the partners in the Cisco Networking Academy. They came together with CEA or order to share their visions for learning and education and to engage in dialogue with educators about the challenges we face and the opportunities to address them together.

Sun Microsystems and Cisco Systems have adopted the concept of an 'education ecosystem' to capture the connections and interdependencies between and among educational institutions, civil society organizations and private firms as they work together to support learning with technology.

CISCO SYTEMS CANADA LTD

Cisco Systems, founded in 1984 by a group of computer scientists from Stanford University, is the worldwide leader in networking for the Internet. Its Internet Protocol-based (IP) networking solutions are the foundation of the Internet and in use by most corporate, education, and government networks around the world. Cisco provides the broadest line of solutions for transporting data, voice and video within buildings, across campuses, or around the world.

Since the company's inception, Cisco engineers have been prominent in advancing the development of IP – the basic language to communicate over the Internet and in private networks. Cisco relies on innovation in the process of developing advanced technologies that include: advanced routing and switching, voice and video over IP, optical networking, wireless, storage networking, security, broadband, and content networking.

Networking has become ubiquitous in the public, private and voluntary sectors bringing with it a demand for skilled technicians to install and maintain computer networks. In response, the Cisco Networking Academy Program teaches students Internet technology skills. It prepares students for college, good jobs – and the 21st Century. It provides technology support and resources for schools and helps address IT worker shortage.

The Cisco Networking Academy exemplifies the possibilities of successful public/private/not for profit partnerships. It provides a teacher led, hands–

on, web-based curriculum taught mainly in schools, colleges and universities. The curriculum developed by education and networking experts, is correlated to prescribed curricula and has been recognized for credit in a number of Canadian jurisdictions. Few, if any, other programs offer such intensive instructor training, sophisticated on-line assessment and the opportunity for industry certification. This has been made possible by an investment by Cisco of over \$100 million dollars. More than 254,000 students are currently enrolled over in 8,725 Academies in 138 countries in nine different languages.

For more information visit <http://www.cisco.com>

*I used to be the geek that messed up the network in our school. Now I make sure it works properly for all of us.
(Student, Montreal)*

*The online assessment tools let me see instantly how my students are doing. If they average 60% at the end of a module but other classes achieve 80%, I know I need to rethink how I teach it.
(Teacher, Alberta)*

SUN MICROSYSTEMS OF CANADA LTD

Sun Microsystems is committed to a vision of connecting anyone, anywhere, anytime on any device. This is particularly relevant to education systems and institutions where students and teachers expect to be able to connect to their work from home and libraries as well as from the institution. It sees a paradigm shift as services move to the web providing centrally and distributed registries of software components, distributed deployment and access from multiple devices.

Since its founding, Sun™ has been synonymous with open systems standards. From its original NFS (Network File System) protocol in the 1980s, to Java™ HTML and the Internet standards of the 1990s, to Sun's Open Net Environment (ONE), which encompasses today's emerging standards for smart web services, Sun has been at the forefront of the open systems movement. Sun continues to be the largest single contributor to the open source movement, based both on lines of code contributed and on number of standards adopted. It is adamant in its position that open standards support innovation in applications' development, flexibility and maintenance of choice for purchasers of technology and avoids institutions becoming locked into proprietary investments over the long term.

Participants in the Technology Summit were particularly interested in Sun's collaboration with Sasktel through the web-based BrainBinder curriculum initiative in Saskatchewan. All schools – classrooms, libraries, teacher desks and the administrative office - in four school districts in North Battlefield and Moose Jaw are equipped with Sun Ray appliances that have replaced outdated personal computers and the freely available StarOffice software. All

applications run on a central server and draw their computing services from the Sun Ray server software. The relatively low cost of the appliances and reduction in maintenance and repair costs have enabled one of these school boards to reduce their student to computer ratio from 7:1 to 2.5:1.

For more information visit:

http://www.sun.com/edu/success/MooseJaw_SS_0620.pdf

We kept a small number of Macs and PCs for special purposes in secondary schools. Now 80% of my time (is) spent trouble-shooting the PCs. Once the Sun Rays were installed, support takes very little time.

(IT Coordinator, Saskatchewan)

ADOBE SYSTEMS INCORPORATED

Founded in 1982, Adobe Systems Incorporated builds award-winning software solutions for Network Publishing, including Web, print, video, wireless, and broadband applications. Its graphic design, imaging, dynamic media, and authoring tools enable customers to create, publish, and deliver visually rich content for various types of media. Adobe is the second largest PC software company in the U.S., with annual revenues exceeding \$1.2 billion. Its vision, like that of Sun Microsystems reflects the centrality of the Internet in today's business and educational environment - publish anything, anywhere, on any device.

That's the vision behind Network Publishing, which Adobe defines as the next publishing revolution. Leveraging the Internet, Network Publishing represents an era of reliable delivery of visually rich, personalized content wherever the user wants, whether it's a printer, Web page, cell phone, handheld device, or personal computer. By driving the delivery of compelling content regardless of platform or device, Adobe continues to set standards in Web, print, and video publishing.

The participants in the Technology Summit were introduced to the Adobe e-Book Reader, the software application for reading already available titles published on the Internet. Like Acrobat Reader, the new e-Book Reader can be downloaded without cost from the web. Adobe demonstrated a prototype electronic textbook created with McGraw-Hill to illustrate the potential of e-books in the education environment for academic text creators. Some of the advantages of this new format include the ease of keeping texts up to date, direct links to further Internet resources, the inclusion of video clips and text to speech features providing access by visually impaired users.

For more information visit: <http://www.adobe.com>

7.0 CONCLUSIONS

CEA and its partners undertook the Technology Summit to both share information and to learn from practitioners. The participant group was extremely diverse with representatives of the K-12, college and university communities and included teachers and instructors, information technology officers, government officials and administrators. The dialogue identified issues and directions that should have meaning for technology users and technology suppliers in the education sector.

- Professional development is the key to effective use of technology. The form of professional development initiatives is critical. Teachers at all levels of the education system need opportunities to examine basic beliefs about teaching and learning and their forms of practice. They need time for learning and for practice. If technology is used to do what we have always done, we can expect results similar to those that we already have.
- Teachers cannot be expected to be "system administrators, computer technicians and programmers". Hardware and software installations need to be affordable, reliable and robust in classroom settings. The constant demand for upgrading of installations should be moderated by better definition of what is needed to achieve specific objectives and by sharing knowledge about what can be achieved with the technologies already in place.
- Interoperability is a key issue in the educational use of technology. Schools, colleges and universities need to be able to work with a variety of platforms according to the educational purpose at hand. Key players in the industry have generally been unresponsive to this need. While single platforms may be highly appropriate for the business processes of educational institutions, they do not necessarily serve educational ends.
- Issues of intellectual property and copyright in web-based content must be resolved within a framework that reflects the clear differences between the public sector and private sector and the importance of access to information and resources by learners – both teachers and students.
- Issues of gender remain prevalent in the use of technology. This is especially true within specialist programs that teach about technology.
- Partnerships maybe an important means of responding to these challenges. Institutions may need to better understand both what they 'bring to the table' and what an effective partnership requires.

Partnerships can be explored with other public and not for profit organizations as well as with private firms.

The Canadian Education Association will continue to pursue initiatives through partnerships that support the growing understanding of the contribution that teachers can make to education through the use of technology.