

## ICT in High Schools

by

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### Context for the study

Placing technology in schools and mandating an ICT program of studies is not enough to enable teachers and students to acquire the skills and proficiencies to use them effectively (Breuleux, 2001). Current research points to knowledge-building collaborations to provide further insight into effective ICT use in high schools. It is Breuleux's contention that ICT can, indeed, support more powerful and complete knowledge-building experiences for learners "if we integrate well-designed technologies in the context of meaningful, mindful inquiry projects, non-presentational pedagogies, access to resources and tools, and adequate support for technological maintenance and pedagogical renewal" (Breuleux, 2001, p. 3).

At present, most of the institutional structures of high schools meet the demands of an industrial age. Timetables fragment students' days into identical blocks; students make the transition from one discrete subject to another without serious attempts to integrate subject disciplines into multidimensional studies; teaching effectiveness is strongly tied to students' performance on standardized tests; and teachers work in isolation from one another. The result is that students do not often find that schoolwork gives them the opportunity to engage in robust, interesting, and personally meaningful inquiries. Students generally report dissatisfaction with transmissionist approaches to learning. (Baines & Stanley, 2003; Bowlby & McMullen, 2002; Cushman, 2003; Intrator, 2003). Conversely, learning that uses technology to involve students in real-life circumstances, concerns, and interests, and that respects students as true partners in formulating topics, processes, and assessment practices have been seen to be engaging and worthwhile (Baines & Stanley, 2003; Sizer, 1984, 1992, 1996).

The initiative described in this report specifically addresses issues of how technology can be used to create more engaging learning experiences for high school students, and how teachers can be supported to make changes to their teaching practice that permit the design and implementation of technology-enhanced experiences for learning. In particular, the initiative explores what happens when teachers move to more inquiry based teaching that includes the use of technology in innovative and intriguing ways.

## Participants

The Galileo Educational Network worked collaboratively with a number of groups and individuals to facilitate professional development initiatives for high school teachers interested in inquiry practices and ICT integration. Projects developed through this professional development support are indicated below:

- National Sport School, Calgary Board of Education
  - Democracy & Iraq <http://www.galileo.org/secondary/iraq/index.html>  
– Social Studies 10
  - E-zines – Social Studies 9
  - Model Parliament between students in Calgary and Toronto – Social Studies 10
  - Canadian Sovereignty  
<http://www.galileo.org/secondary/sovereignty/index.html>  
– Social Studies 10
- EP Scarlett High School, Calgary Board of Education
  - Macbeth: What Matters about Shakespeare?  
<http://www.galileo.org/secondary/macbeth/index.html>  
- English 20
- Highwood High School, Foothills School Division with HJ Cody High, Chinook's Edge
  - Nature of Man Debate - English 20 online discussion between students from two different rural communities within Alberta (High River and Sylvan Lake)
  - Lord of the Flies novel study and film festival  
<http://www.galileo.org/projects/flies/index.htm>  
– English 20-1, 20-2 and Drama classes
  - Mirror/Door E-zine  
<http://partner.galileo.org/schools/highwood/default.asp>  
English 30-1
  - Healthzine <http://partner.galileo.org/highwoodhealth/>
- HJ Cody High School, Chinook's Edge
  - River Run ([www.ourroots.ca](http://www.ourroots.ca))  
Humanities 10 - novel study
- Edge School for Athletes (Private School in Calgary AB)
  - Mathematics Grade 9 & Grade 11
- J. Percy Page, Edmonton Public Schools (and ABEL)
  - Democracy & Iraq – Social Studies 30  
<http://www.galileo.org/secondary/iraq/index.html>

- Let Me Count the Ways P2S - Mathematics 30  
<http://www.galileo.org/projects/abel/math/>
- Sundre High School, Chinook's Edge School Division
  - Mathematics Pure & Applied Grades 10, 11 & 12  
<http://partner.galileo.org/mathfairs/sundre/>
  - Has the UN outlived its usefulness? - Social Studies 30
- Drumheller High, Golden Hills School Division
  - Chemical Warfare – Chemistry 20  
<http://www.galileo.org/schools/drumheller/chemwarfare/index.html>
- Strathmore High School, Golden Hills School Division
  - Financial Makeover  
<http://partner.galileo.org/schools/strathmore/math/grade11/finance/index.html>

**High School PD initiative web site <http://www.galileo.org/secondary/index.html>**

Galileo worked with the above listed school divisions, high schools and teachers as they moved towards more technology-infused inquiry-based teaching and learning environments. The teachers used *io* (Inquiry Online), a web-based instructional design environment where teachers are mentored by experts as they create technology infused inquiry studies for their students. Generally, teachers reported they found using *io* very different from how they typically planned for teaching and learning. This is consistent with a recent Statistics Canada report that concluded most high school instruction is heavily reliant on textbooks and course coverage with little opportunity for serious engagement or deep inquiry (Bowlby & McMullen, 2002).

The professional development offered by Galileo to the teachers in the schools listed above provided a combination of face-to-face and online support through *io*. In three instances ICT infused inquiries were documented using audio and video technologies to highlight key themes and issues related to effective ICT use in high schools. These studies have been produced in DVD format but are also available on the web at <http://www.galileo.org/secondary/index.html>. The other high school illustrations that appear on this web site include two e-zines and one example drawn from a Math 30 class.

### **Focus Group Findings**

Twenty-two teachers participated in focus group interviews to discuss their experiences of ICT integration in high school.

Generally teachers felt overwhelmed when asked to design learning opportunities for their students that they themselves had never experienced. Investing time in instructional planning through *io* helped teachers design learning and create assessment

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processes that enabled students to demonstrate deep understanding of key concepts and acquire important ICT proficiencies. The professional development support offered by the Galileo Educational Network challenged teachers to think deeply about what mattered for students to know and be able to do. Teachers were encouraged to keep the big picture in mind and design learning that would be truly meaningful for students living in a knowledge society.

Although the teachers were interested in using digital technologies with their students, they felt handicapped by their own inexperience and inability to effectively integrate ICT into their practice. In most instances they required sustained support and encouragement in order to design and implement technology infused inquiries for students. In addition teachers reported that these types of professional development and learning opportunities rarely occurred in the high schools that they were familiar with.

### **Themes emerging from the interviews with teachers regarding ICT in high schools**

Learning how to teach effectively with technology both enables and requires some fundamental changes to schooling. When teachers were asked about their experiences related to technology use in high schools the following common themes emerged:

- Teachers observed that creating technology enhanced inquiries for students was much more challenging than they initially anticipated and it required sustained support on a number of different levels.
- Teachers made the following observations about student learning in relation to the ICT infused inquiries that they had undertaken
  - Depth of student understanding increased
  - Students demonstrated more ownership of and investment in their learning
  - Students produced a higher quality of work and greater levels of scholarship than previous groups of students
  - Students were able to see greater connections between their school work and work in the real world outside of school
  - Students seemed more interested in learning

### **Use of online professional development components (io)**

Generally, teachers reported they found using io very different from how they typically planned for teaching and learning. It was not always easy for them to learn in these new ways, although they indicated satisfaction with the outcomes for students.

They found that Galileo professional development and design processes enabled students to think and work in a more sophisticated manner than conventional school assignments required. Students were often engaged in complex work that demanded greater intellectual investment and technological skill than standard school assignments. Tasks were consciously designed to enable students to confront real-world issues and use digital tools in the same ways in which they are employed in the real world. As a *ICT in High Schools* was created through the support of Alberta Learning

result the reach of students was often extended outside of the classroom and into the world beyond.

Teachers confronted the reality that ICT enables students to acquire new literacies and think differently as they explore the uses of these new technologies. Galileo supported teachers and students as they began to use technology to conduct research, share information, make decisions, solve problems, create knowledge and communicate with audiences both inside and outside of the classroom.

In a number of the studies that teachers designed in collaboration with Galileo, the tasks, online resources, and scoring rubrics were made available online through the publishing feature of *io* (see <http://about.myio.org/whatisio1.asp>). In addition the web served as a forum for displaying student work and helping to create powerful images of learning and ICT integration. It is rare for parents to be afforded such a close view of the learning and expectations of high schools.

Besides making the expectations and learning of students more transparent digital technologies enabled new forms of literacy to emerge. According to Eisner (1998), a primary responsibility of schools is to cultivate multiple forms of literacy that extend beyond conventional notions of reading and writing. Eisner challenges educators to embrace a broader conception of literacy to allow for all the ways that experience can be represented including, propositional, literary, poetic, visual, auditory and choreographic. In fact he warns us that the cognitive potential of students is *dependent* upon the variety of ways that the mind is employed. Different forms of representation evoke, develop and refine the modes of thinking that contribute to the cultivation of the mind. When students are restricted to the print mediums that are so predominant in high schools, their cognitive growth is essentially being restricted (p. 16).

The ICT infused inquiries that are presented as part of this report were designed to provide students with the opportunity to acquire knowledge and proficiencies that extend well beyond print media. Video conferencing and film technologies were used to capture and represent students' understanding of complex issues in a way written descriptions could not adequately convey. New options for representing meaning become available when students were provided with opportunities to experiment with camera angles, colour, special effects, music, and voice narrations. Transitions began to make sense when young people witnessed for themselves the impact that fades, cross dissolves, iris openings and other visual cues produce on the audiences who come to view their work.

Visual literacy is elevated to new heights when students are invited to explore the power of images and music to produce their own stories with an emotional edge. Language Arts abstractions such as editing, audience, purpose and visual literacy suddenly crystallize in new ways for students. Individuals who ventured into the world of e-zines and web technologies developed a sharpened awareness of audience and purpose. New forms of literacy began to surface when learners began to work in web based and hyper linked environments. Students confronted copyright issues and acquired a clearer understanding of the implications of intellectual property rights as they began to publish their own work on the web. These are the new literacies that are becoming increasingly vital in a knowledge society.

### **Supports that enable teachers to create technology infused inquiry-based learning environments for students.**

Participants reported several factors that permitted them to develop and implement more inquiry-based studies that integrated technology in new ways:

1. Professional development that is ongoing and job embedded
2. Opportunities to work collaboratively with researchers to jointly collect and examine evidence of student learning.
3. A school culture that values and supports innovation and creativity
4. Colleagues onsite who can facilitate inquiry and effective use of ICT
5. Time to design inquiry-based technology infused learning experiences for students
6. Opportunities to collaborate with colleagues and mentors to design robust multidisciplinary tasks and assessment
7. Strong administrative leadership that
  - supports innovation and risk taking
  - understand the importance of this work and are able to help parents understand it as well
  - encourages teachers to keep trying and not give up
  - expects mistakes to happen but views them as learning opportunities
  - is prepared to create opportunities for teachers to work collaboratively with colleagues from both within and outside of the school
  - seeks to maximize the flexibility of teachers and students through creative scheduling and timetabling
8. opportunities to move outside the classroom into the real world
9. celebrations showcasing student work
10. access to technology that is current and able to support the work that students and teachers want to do
11. open technology and architecture that allows for applications to stay current and web resources accessible
12. the kind of access and flexibility that wireless laptops would make possible so that time and place cease being obstacles

### **Inhibitors to ICT infused inquiry-based work**

In discussing what makes it difficult to work in innovative ways, participants identified the following factors:

- the conservative nature of most teachers and the teaching profession in general
- large, impersonal, and inflexible high school structures
- conventional attitudes and expectations about what the classroom should look like
- it is easier to do “telling” than serious inquiry work
- there are few pressures to, or rewards for, challenging the status quo
- general attitude of “if we continue to ignore it the technology will go away”
- teachers do not see themselves as lifelong learners and the profession in general has not adopted a learning culture

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- locked down networks – slow networks and centralized/restricted security systems
- internet filters and email blocks
- huge bureaucratic systems that are inflexible and unresponsive to the needs of the classroom. Such systems restrict the ability of teachers to download software updates, publish on the net or visit pre-selected sites on the internet that school filters block
- Centralized control of IT reduces school and classroom flexibility significantly. Using technology just becomes too cumbersome and frustrating so teachers and students avoid it
- obsolete equipment unable to perform the tasks that learners require
- Lack of common folders where students can work collaboratively and share files
- lack of time
- PD that is not situated in or relevant to the work of the classroom teacher
- administrators and parents who do not understand that changed practices are needed
- achievement tests and diploma exams that are incapable of assessing the multiple forms of literacy and proficiencies that students may acquire
- the amount of content that must be “covered” in a semester encourages a superficial treatment rather than deep understanding of important ideas and issues
- High school traditions that are heavily reliant on textbooks and their resulting expenditures
- assessment that relies almost exclusively on quizzes, tests and exams – a system that is perpetuated by colleges, universities and Alberta Learning
- Outdated school structures including timetables and the design of the building itself which ensures that teachers work in isolation from one another discouraging collaboration and greater flexibility.

## Summary

The experiences of teachers involved in this initiative found that students become more engaged when tasks require them to take an active role in their own learning and work collaboratively with teachers, peers and experts to investigate meaningful issues, solve problems, wrestle with important ideas, debate, invent, create and test their understandings. Furthermore, when young people can use technology to direct their knowledge and understanding towards audiences beyond the classroom, school work appears to be far more compelling.

When teachers are supported both face-to-face and online through the use of technology to design strong inquiry work that reflects the following characteristics both students and teachers are pleased with the results. Such work involves:

- Authentic tasks, issues, problems and experiences
- Academic rigor created through the exploration of ill-defined, complex and multidimensional tasks
- The same demands as would be expected of high performance work organizations
- Opportunities for active exploration
- Opportunities to connect with discipline experts outside the classroom
- Assessment aimed at improving learning, and

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- Creative and mindful uses of technology throughout each phase of the inquiry.

Creating learning experiences that invite students to delve deeply into worthwhile topics and complex issues helps them to develop the skills and habits of mind conducive to lifelong learning. When students have the opportunity to tackle projects similar to those found within high performance work organizations, addressing real issues and problems, learning becomes worthwhile. Tasks that demand strategic reasoning, critical thinking, insight and creativity appear to be far more engaging for students and better prepare them to take their place in a knowledge society.

However compelling this vision of engaged learning, it is also clear that it cannot be attained without meaningful and ongoing professional development support for teachers, who indicated clearly the range and depth of obstacles they encounter when they attempt to move to more engaging ways of teaching and learning. Such professional support must acknowledge the extent to which learning to teach in these new ways runs counter to the grain of the current culture of high schools, and thus is not easily accomplished.

Technology enables educators to work collaboratively with mentors and colleagues throughout Alberta to change how they view teaching and learning. It is again clear, however, that the use of technology for professional development is effective for teachers when it occurs within larger frameworks of professional support, both formal and informal.

Changed teaching and learning practices came to replace the delivery of decontextualized content with work of a very different character. This shift enables teachers to develop new habits of mind and a new understanding of learning as a collaborative, inquiry-based venture. If teachers truly want young people who can use their minds well it will require a conscious effort on the part of educators to create meaningful and relevant learning experiences that would compel students to respond in those ways.

The implications for professional development to support teachers in making changes of this magnitude are enormous. It is not enough to cast blame, or to assume that identifying some of the roots of the current state of student disengagement will cause teachers to want, or know how, to change. Episodic professional development disconnected from the work of the classroom is not effective in shifting industrial practices to ones that better prepare students to take their place in a knowledge era. Teachers need ongoing job-embedded professional learning opportunities where growth is measured in terms of impact on student learning. This means job-embedded professional support to help educators design work, implement it, and measure the evidence of student learning in a collaborative, ongoing way. This requires educators to develop new working habits that are collegial and public in nature, rather than isolationist and private as has been the norm. Certainly the images of student learning and teacher professional development illustrated within this report present exciting new possibilities for high school renewal and effective ICT integration.

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