Integrating Technology Throughout the Curriculum at Golden High School

Canada

Overview

An example of Golden High School s innovation in action:

Project: Telementor Project
School Web Site

Two grade 10 students worked under the direction of the former vice-principal to create a web page that demonstrated an understanding of HTML, design components, graphic and content size limitations, and school/community needs.
The students were matched with Telementors at one of the school s partners, a major manufacturer of computers and peripherals. The students corresponded with their mentors twice per week via email while designing the school s web site. The mentors offered suggestions and helped troubleshoot the project. Student journals and all correspondence with the Telementors were reviewed with the vice-principal. Students designed and completed a self-evaluation rubric at the end of the unit.

Golden High School opened in September 1999. The school s Technology Plan states that computers and technology should be used to:

- prepare learners for living and working in today s and tomorrow s society;
- enhance learning in all areas of the curriculum;
- enable learners to acquire and maintain a variety of computer skills;
- provide numerous opportunities for learners to employ and explore information-age skills;
- deliver aspects of all curriculum rather than merely isolated subjects.

The learner refers to both the student and the teacher within the school.

Golden High School is a large high school located just outside a major metropolitan area of Canada. This area is characterized by a high density of technology industry located in and around the city. The school has a population of 1050 students and 68 staff members. The majority of the students come from lower middle to upper middle class families. The school is newly built, intentionally wired and designed to incorporate a focus on technology.

Golden s innovation involves a wide variety of projects that fall into four main categories: equity, staff development and training, curriculum delivery and infrastructure. The administration and 3 school site-administrators (technology coordinators) collaborate with all staff and invite participation in the projects that the school undertakes. Technology is seen as a means of facilitating education and enhancing the learning environment. As such, technology is integrated throughout the school rather than isolated in one given project or specific area of study.

The ICT used in the innovation includes 250 Pentium 400 computers, located in 7 computer labs and in each classroom in the school. In addition, a wide range of software programs and peripherals are available. All students at all grade levels are involved with technology and the transfer of skills using technology, throughout the curriculum. Technology is used on a daily basis as a facilitative tool for learning and for various school activities.

Parents and individuals from the local high-tech community participate in strategic planning for the school and offer advice about technical issues. Golden High has 2 partnerships with local technology companies. The companies serve as advisors for the school technology plan, assist in fundraising and staff training, provide guest speakers, make software donations and provide network support. The school also accesses a variety of Federal government programs to obtain additional resources to fund ICT projects.

The principal and staff members at Golden share a clear vision that ICT should be integrated throughout the curriculum and used as a tool to enhance student learning. The principal says,
I think technology is a tremendous learning tool...it s a different way for students to learn.

The former vice-principal agrees, stating:
There is a vision and that s integrated through the Computer Technology plan. It s an all-encompassing vision. If I have to summarize it: integration of technology throughout the curriculum.

One of the site administrators feels that:
Part of this whole vision of this school is that we re going after the holistic student. For example, drama, art, music...they re using technology to enhance the performances.

This vision of technology is totally integrated into the prevailing school culture, as shown by the school s Technology Plan, the Computer Use Policy detailed in the student agenda books, and the school s Technology Projects binder which describes the on-going projects.

The school has a history of technological innovation, even though it is only 2 years old. The school is involved in a wide range of projects. For example:

- Techno Tot Day (math activity designed by high school students for kindergarten students at a nearby school);
- Voice Broadcast System (automatic telephone messages sent to all parents, e.g., when report cards are issued);
- English Portfolio Web page (examples of grade 7 student work over the year integrates language skills with technology);
- Telementor Project (3 students worked with staff at the school s partner, Hewlett Packard, to create the school web page students correspond with mentors via email);
- Distance Education and Teleworking (provides online supplements to courses and collaborative exam review).

The Past

Two school boards in the city area amalgamated in 1998. The board is still in the process of harmonizing practices and initiatives. The first of a series of schools focussed on technology was built in 1990 in one of the former boards. The board used the same architectural drawings, with modifications, for 4 additional high schools (including Golden) in order to save money.

Before Golden was built, the former vice-principal of the school researched and wrote a policy document about the use of technology in schools in the year 2000. Many of his suggestions were incorporated into the design of Golden . The principal and former vice-principal were instrumental in determining the vision of the school and choosing the staff. One of the criteria used in the staff hiring process was knowledge of openness to ICT. As a result, the vast majority of the staff is computer literate.

The board s administration is clear that the source of the school s accomplishments to date lies with the leadership of the school. The principal is seen as a risk taker, a creative individual with an entrepreneurial spirit. The former vice-principal, who was also instrumental in starting up the school, is seen as a visionary leader. Having a vision for the school, being able to motivate people and taking risks are seen as crucial in the school s accomplishments. A representative of the school board s administration explains by saying:
The principal is a risk taker, an individual who is not hesitant in going out and trying something and making a mistake and learning by it. But he also motivates people...he s prepared to work with the people around him...and it s the ability to motivate people and have people believe that they can make a difference. That s his strength.

A number of problems or barriers were encountered when implementing the innovation at Golden. Most of the implementation problems were technological or board policy-related. The board administrator explains:
There was a big discrepancy (between the former boards), both from the amount of money allocated to the schools. We re just finishing our board s equity plan this year, and that s to even up the inequities that one sector had compared to the other sector.

The former vice-principal feels that the structure of the school board was the major barrier to implementation:
The structure of the school board was the biggest barrier, because although we wanted to make decisions locally, there was a central idea about how much money was available and some of our funds went to another project... There was a huge barrier of the technicians, the secrecy of the network and the technicians not wanting to change anything... There were barriers in decisions about what kind of wiring we would have... There was network security, some of the things we wanted to do, the people at the board felt it might violate network security.

The Present

Golden has 250 Pentium 400 computers located in 7 instructional computer labs, along with 1 computer in each classroom. Students also have a wide range of peripherals and software programs available to them.

Golden has 3 site administrators that provide much of the technical support for the school, although their primary mandate is to provide curriculum support with computers. The site administrators are full-time teachers with release time for computer support. Technicians from the board are available when required, but take time to access. One teacher says:

Site administrators do a lot of technical support when they could be better spending their time doing curriculum support with computers.

One of the site administrators explains the conflict they feel:
Because we re all teachers first and foremost...because we ve had a few physical changes within the system...it s taken up a huge amount of our time just taking care of little quirks that are associated with that new server.

The ICT innovation takes place on a daily basis at Golden. The school s seven computer labs are used extensively, along with the computer located in each classroom. School documentation details how ICT is used in the school:
Golden is committed to the use of technology across all curriculum levels. All staff, students and curriculum areas use technology in a variety of ways with the result that the transfer of skills, knowledge and sharing of information is a basic practice within our school. All projects within the school fall into four main categories: equity, staff development and training, curriculum delivery and infrastructure. The administration and school site administrators collaborate with all staff and invite participation in the projects that the school undertakes. Our school does not isolate technology to one given project or any specific area of study. It is integrated throughout our school.

Examples of how ICT is integrated throughout the curriculum include:

- English assignments posted on the Web for students to select projects and resources listed with links;
- assignments e-mailed to staff members for grading;
- chat room set up prior to exams so students can study collaboratively;
- math software to supplement the curriculum;
- science simulations to replace experiments;
- physical education use of human anatomy software;
- novel study dialogue with school in other parts of the world comparing viewpoint;
- music experimentation with MIDI interfaces;
- video and sound editing connected to live performances in the theatre;
- marketing and computer classes assist with promotion and selling of yearbook;
- yearbook, newsletters, desktop publishing projects created by media club;
- computerized design and creation of school crest.

The school s ICT plan states that ICT is used to address a number of curriculum goals. ICT is used to:

- facilitate learning and provide a venue for student demonstration of knowledge and skills;
- facilitate instructional and pedagogical practices;
- prepare students and staff for the uses of technology within daily and professional lifestyles;
- increase equity of opportunity and facility of learning.

Students carry out a wide range of activities in the ICT innovation at Golden , including:

- word processing
- spread sheets
- graphic design
- digital photography and recording
- video/digital video editing
- multi-media presentations

- research
- Internet web design
- telementor projects
- mathematics, science and technology applications
- CAD programs

There is anecdotal evidence that the innovation has had a positive impact on students. Student and parent participation, community recognition, and the overall atmosphere of the school all indicate that ICT has had a positive impact.

Students feel they are benefitting from using ICT. One student says:
We learn more applicable stuff, things that we can actually use in our lives.

Students also feel they are doing different activities as a result of ICT. One comments:
If you re doing a group project, you can send projects over the Web. You can send information over the Web, you can give notes over the Web, you can notify them over the Web.

Another feels research is the basis of ICT use:
In every class you re doing research...English, you re researching a bunch of stuff. History, researching a lot of stuff on the presidents, prime ministers, wars and stuff like that. And then marketing, you re using them to type up your letterheads and stuff like that and your projects. And they re a great help, because they re so accessible in our school.

Students frequently experience technical problems when using ICT in the innovation. One student describes the school s dependence on ICT:
Our system is down maybe once a month. When the system goes down, the school pretty much shuts down...because teachers have to end up giving you different assignments than what you were going to do, because they couldn t print it off because it s on the network and the network is down. Or you have a project that s due and it s on the network and the network is down...there isn t a back-up.

Even though Golden is a brand new school, the site administrators feel there are hardware and software issues to be dealt with. One says:
In our school we re very fortunate, but even so, the RAM memory isn t there, the GIG space isn t there, we re working with proxy servers that do shut down, we re working with programs...I mean, for heaven s sakes, Microsoft Works from the Ministry, nobody in the real world uses this.

Another site administrator agrees, saying:
One of the barriers is that in any school, there will come a time where the school will be equipped with computers and with software, it s quickly out of date, or isn t up to date at the time it is installed... I find that in education there is a tendency to not use the most professional software possible to teach, so we re teaching with what I would consider second or third quality software packages.

Another teacher states that full-time technical assistance is crucial:
What a school with the number of computers that we have in it really needs is a full-time technician to keep them running.

Main Hypotheses

Role of technology in educational innovation and improvement

Evidence shows that staff at Golden view technology as a strong catalyst for educational innovation and improvement. The principal feels that the access to information that technology provides is an essential learning tool. The former vice-principal feels technology is crucial because it helps students with all ability levels. He says:
It plays a big role. It certainly helps the different levels of abilities in the classroom. The gifted students have the ability to expand their own knowledge the teacher might not be able to provide them, they have extra resources...And for the students who are at the other end of the scale, they can get resources through tutorials, different programs.

The school site administrators (technology coordinators) feel that the skills that students learn from using computers are evidence of the importance of technology. She says:
I think we ve got some situations where students are picking up marketable and employable skills, transferable skills that they can pass on and learn from one course to the next.

One site administrator explains how technology is important for her teaching and student learning:
Technology itself enhances my learning environment, it facilitates my learning environment, it helps my approach to students...Students bring a sense of wonder that is almost awe inspiring, because the way they adapt, the way they see the use for the potential (of ICT).

A teacher agrees, but emphasizes the need to use technology appropriately to enhance learning:
As a teacher, I think my job is for them to see that it (ICT) is a tool, yes it is useful, but you have to use it properly and you have to know what you re looking for so that it does actually enhance your learning.

One teacher agrees that technology is important, but stresses that he could still teach without it:
In my own classroom, the computer is an integral part of the academic content only because I choose to make it so. I could certainly teach much of what I m teaching without any technology, but it s not the same experience.

Finally, a representative from the board s administration explains the importance of technology:
ICT doesn t drive the curriculum, but in the last little while, we haven t written any curriculum that doesn t include an activity to be done on the computer, or suggestion that it be done this way, on the computer. And every document that comes out of the Ministry of Education now has references to how you can use the computer.

Diffusion of the innovation

The diffusion of the innovation/improvement at Golden has been a little unusual. Because a large portion of the staff was chosen specifically for their technology skills and/or openness to using technology, there have been fewer resisters than in most schools. As the former vice-principal says:
Certainly it was very important when looking at some of the staffing decisions. We wanted to find people

that had some technical background, or at least appeared open to use the technology. There was some element of choice, but there were also staff that were placed here... (Most staff) chose to come to a new school which was dynamic, they knew it was going to be a little bit different, there was going to be extra work. So you re getting people that wanted to change. So you already have that openness.

Of the staff who were placed at Golden (rather than chosen specifically for their skills), the former vice-principal feels they are becoming users of technology due to the modelling of other staff, as well as the board requirement that all report cards be completed on computer. He explains:
I think there s still staff at this school that are against technology, because they don t have the skill set...they re afraid...but what they re seeing is the modelling throughout the school and they re also in a culture of change and time of curriculum change. So by necessity, they have to, because report cards are being done by computer...everyone in this school has to use computers at one point.

The principal agrees, saying:
There are some that are still lagging, for sure. One of the objectives this year is that every teacher would do some Web-based assignment in one course this year. We use e-mail as one of the primary methods of communication, so it s expected they do that. And they respond to that and realize how it can save time.

ICT implementation outcomes

The administration places a huge emphasis on staff development. They firmly believe that successful implementation of ICT depends mostly upon staff competence in the integration of ICT into instruction and learning. As mentioned previously, this integration is central to the school s policies about the use of ICT, as well as the school s vision for the use of ICT.

The principal describes how staff development is handled at Golden:
Last year we tried to partner with a local organization, Learning Through Technology. And we had them come in and provide training on a weekend for staff on different programs. A high percentage of the staff signed up for those courses.

We try to use technology at staff meetings, whether it s just a Power Point presentation or a Web search...that kind of modeling, I think teachers pick up on.

The former vice-principal adds:
We put out as many models as we could: sending people on courses that they had requested or that we were aware of; taking ideas and bringing in a supply teacher for someone so they could spend some time on it, sending people to courses in the summer.

The former vice-principal feels that reducing the fear of technology leads to the use of technology, and as a result successful implementation in the school. He says:
I think the support network was quite clear, admin supported it, admin provided assistance, colleagues on staff provided assistance, training wasn t all high end all helped lower teacher s fear or discomfort with technology.

We realized that there are many people on staff that may have never touched a computer, so we had a low level training in a sense of how to do the basics.

I would say that two of the teachers that we had strong concerns about coming to this school, that we weren t able to select...both have excelled because of computers, and to be able to use the computers as a method of

controlling behaviour in their classroom, because the kids are motivated... they were given training and support.

School documentation also supports the view that staff competence in the integration of ICT leads to successful implementation of ICT. Documentation indicates the importance placed on staff training:

- Staff training project: continued workshops for staff to use the Internet to supplement their current teaching styles.
- Lunch Bag PD site administrators developed a technologies competencies checklist for staff. Staff were able to self-identify their current technology skill level, and then had the option to attend mini-sessions during lunch or after school.

Student academic performance

The staff at Golden feel that gaps in academic performance between high and low poverty students will not increase when all students have equal access to ICT. As such, the school has an equity policy designed to ensure equitable access to ICT. The policy includes:

- Computers on loan to students for an entire semester
- LapTop computers on loan to students for 2-3 weeks
- Computer labs open 1-2 evenings per week for community use

Laptops (low-end, donated) are available in the info-center (library), which students can book for home use. A school partnership with a local ISP provides home Internet access to families who would not otherwise have access. The school also has 2 Pentium computers with full multimedia capabilities available for two families for two-month periods. The goal is to make families more comfortable with computers so they will then access the community use computers at the school.

One of the site administrators explains:
There is an equity program in school. Many kids have computers in the home, but there are still those who don t. So the computers that are provided to the students for at home, as well as their accessibility to them here at school, (ensure) they can be at par with their peers and have the same learning opportunities.

The former vice-principal feels that computers help reduce gaps in academic performance for high needs students as well. He says:
Some of the tougher kids I ve dealt with, if they can get into computers, often that would really help them because they re not as likely to get into trouble in the classroom if you can give them a task on the computer where they re motivated. Give them a multi-media delivery platform, through all the senses, they are stimulated and stay on task.

A teacher on staff agrees, stating:
I know of some students that have never been considered very academic, but they are really adept at the computer, and they love the fact that they can show you they know this. It makes them feel really good...that has to be a positive.

One teacher expresses the view that ICT ensures gender equity as well. She says:
(ICT) is a real equalizer...I think it s given access to boys and girls equally, and the skills that allow them to do successful things on the computer aren t gender specific.

Academic standards

Evidence from staff at Golden indicates that they believe academic standards are a function of teacher and school expectations, and not of the standards of textbooks, ICT materials and the like. Rather than viewing poor quality material as leading to a lowering of academic standards, teachers feel that evaluating the quality of information from the web is an essential skill they teach students.

One teacher explains:
I think it s a mistake to build a box around students and say, We re going to keep you from going to sites that you re not supposed to, and you ll be fine. It s much more important for us to teach students to think about what they are doing. To know there are dangers, to know there are problems, to know that there are all kinds of sites full of information that is questionable at best, and to understand what the Internet is and what it provides them, and what it isn t.

He continues:
I feel like students today are drowning in information and starving for knowledge. And we make all this information available to them but they don t know what it is and how to deal with it. They can t discriminate... We have to recognize that as educators and give them the tools to make critical judgments...critical thinking is the most important part of what I teach.
Another teacher explains how his experiences with technology have led to higher academic standards:
I ve had some really good experiences with an on-line course...I had 15 or 20 grade 9 kids on-line, engaged in a conversation that was intellectually of a quality that I would expect a grade 12 class to engage in, because they were focussed, they were isolated... There is a real difference there in approach, and if we can integrate some of that kind of attention to the subject matter at hand, to the curriculum, if we can harness that in some way in our regular teaching, it s going to do nothing but improve what the kids are learning and how they re learning.

Projection to the Future

Sustainability

Golden s goals for the use of ICT are outlined in detail in the school s ICT plan. These goals are accepted in the school, and the principal and former vice-principal feel that teachers are committed to the use of ICT. They feel teachers are willing to deliver the efforts necessary in the long run to maintain the program. The principal says:
We lost a major player this year (the former vice-principal), and I think we re maintaining it. We have some teachers that can pick up some of that, but it s the level of technical expertise that we need... What I have to do is maintain that committee, get that committee working and make sure that when I leave (the principal is retiring), all our projects can be maintained. So I think it can be continued for sure.

Everyone in the school uses the ICT resources. The school s hiring policies include a focus on technology, ensuring new teachers to the school are knowledgeable and/or open to using technology. The principal explains:
I think it s very important that people know that we want to use technology, we want to implement technology, we want to move ahead. And basically, if you don t want to, don t apply, or you re not going to

get a job.

The former vice-principal agrees, stating:
Certainly that was one of the parameters, we wanted to find people that had some technical background, or at least that appeared open to use the technology. We let people know right from the beginning, this is a school of the arts. It s a school of the arts and it s going to be complimented by technology and a full extra-curricular compliment.

National and provincial policies have an impact on the sustainability of the innovation at Golden . Federal ICT initiatives have contributed by allowing the school to purchase more equipment and participate in a variety of projects. In addition, technology is integrated into the provincial curriculum.

Transferability
The benefits of the innovation are agreed upon within the school, and these benefits are considered important for schools in general. The benefits include:

- Professional looking presentations
- Stress and time reduction in terms of exam preparation
- Ability to modify resources quickly and use them over again
- Ability for students to access lessons on the Internet
- Boosts student self-esteem
- Motivating for students
- Provides equality of access

Teachers and administration alike feel that leadership and support are the most essential factors necessary for carrying out the innovation. Teachers require an open mind and willingness to try new things. In addition, staff development and training is essential to the success of the innovation.

The extensive resources at Golden are not likely available for other schools to carry out the innovation, however the former vice-principal feels strongly that they are not necessary. He explains:
The questions that I knew I would be getting (after my presentation at the conference) were, well, we don t have 300 computers. We don t have the money. We re not a brand new school. So what would it take? It would take some change agents. You need some people in the school who are willing to fight the obstacles, so the fact that you don t have computers doesn t mean that you can t go get them. People need to know sources of funding: that s a key area. They need access to information. They need some technical support, because the teachers are not technicians. There needs to be greater staff development, whether from a board or local level. And you have to have access to some computers. You don t need one in every class, not necessarily one on every desk, but you need at least one computer to start with.

Appendix A

Methodology

" 3 researchers spent 6 days at Golden (December 6-13, 2000)

Amounts and types of data

Classroom observations
- 3 classrooms (1 hour each)
- completed Classroom Observation Guidelines
- collected documentation related to observations

School observations (atmosphere)
- 1 morning

Photographs
- school
- classrooms

Documentation
- Technology Projects binder
- Permission forms
- Student Agenda book
- School web site information
- School profiles
- School newsletters
- Partnership documentation
- Board-wide testing program information
- Report card samples
- Map/school layout
- Sample communications from principal to teachers (e-mail)
- Census information for township
- Performance Appraisal Program documentation (teachers)
- Strategic Planning Process Action Plan documentation
- Staff Handbook

Surveys
- Principal Questionnaire
- Technical Questionnaire (2)
- ICT Practices Survey for Teachers
- Your Teaching Philosophy Survey

Interviews

Teacher A 1 teacher 3 hrs.
1 site administrator

Teacher B 2 teachers 1.5 hrs.

Student A 6 grade 11/12 students 1 hr.

Student B 4 grade 7/8 students 45 min.

Parents 2 parents 45 min.

Principal 2 hrs.

Former Vice-Principal 1.5 hrs.

Technical Coordinator 2 site administrators 1.5 hrs.

Administration Deputy Director 1.5 hrs.
Coordinator of Information Technology

Appendix B

ICT Practices Survey for Teachers
Total Number of Surveys: 41

How comfortable are you with using a computer to do each of the following? (1=very comfortable, 2=comfortable, 3=somewhat comfortable, 4=not at all comfortable)

	1	**2**	**3**	**4**
Write a paper	36	3	1	1
Search for information on the WWW	28	10	1	2
Create and maintain web pages	3	5	6	27
Use a data base	12	10	12	8
Send and receive e-mail	37	2	1	1
Programming	2	4	4	31
Draw a picture or diagram	13	8	11	9
Present information	8	11	7	15

During the past year, how often did your students on average do the following for the work you assigned? (1=several times each week; 2=several times each month; 3=a few times; 4=never)

	1	**2**	**3**	**4**
Use the WWW	10	13	16	2
Create web pages	0	3	7	31
Send or receive e-mail	9	11	10	12
Use a word processing program	15	10	8	5
Use a computer to play games	4	2	4	29
Use a spreadsheet	0	3	13	23
Use a graphics program	3	5	14	17
Join in an on-line forum or chat room	1	3	6	28
Use a presentation program	0	6	12	22
Use an instructional program	2	2	16	18
Other computer uses	1	1	3	4

How would you rate your ability to use a computer?

Good 23 Fair 14 Poor 3

Was student computer use every evaluated for grading?
Yes 23 No 16

If you assigned WWW searching, how much freedom did you allow students in locating sites to visit?
No restrictions 3 Some restrictions 27 Designated sites only 6
Did you create or modify a Web site with any of the classes that you taught?
Yes 6 No 30

What portion of the computer use in your classes was directly related to the course content?
All 20 Most 10 Some 6 Very little 3

What portion of the computer use that you assigned was done by students individually?
All 11 Most 20 Some 7 Very little 1

How often did you use a computer at home for preparing for teaching?
Several times a week 33 Several times a month 5 A few times 1 Never

Did you participate as a student or instructor in a virtual course through the Internet/ WWW?
Yes 3 No 36

Did you involve your students in collaborative learning over the Internet/WWW?
Yes 4 No 35

Are you currently using technology to collaborate with other teachers?
Yes 14 No 26

How many e-mail messages total do you send each day on average?
>12 1 6-11 12 1-5 27 None

How many of the following have you ever done? (0-5 or more times)

0 1 2 3 4 5

Made changes to a computer s hardware	27	2	2	1	1	6
Updated an application program	19	4	3	3	1	9
Recovered a damaged file	23	4	5	0	2	5
Created a web site	28	4	3	1	0	3
Developed a data base	24	2	2	3	1	7