OECD/CERI ICT Program
ICT and the Quality of Learning

A Case Study of ICT and School Improvement at Bendigo Senior Secondary College, Victoria, Australia
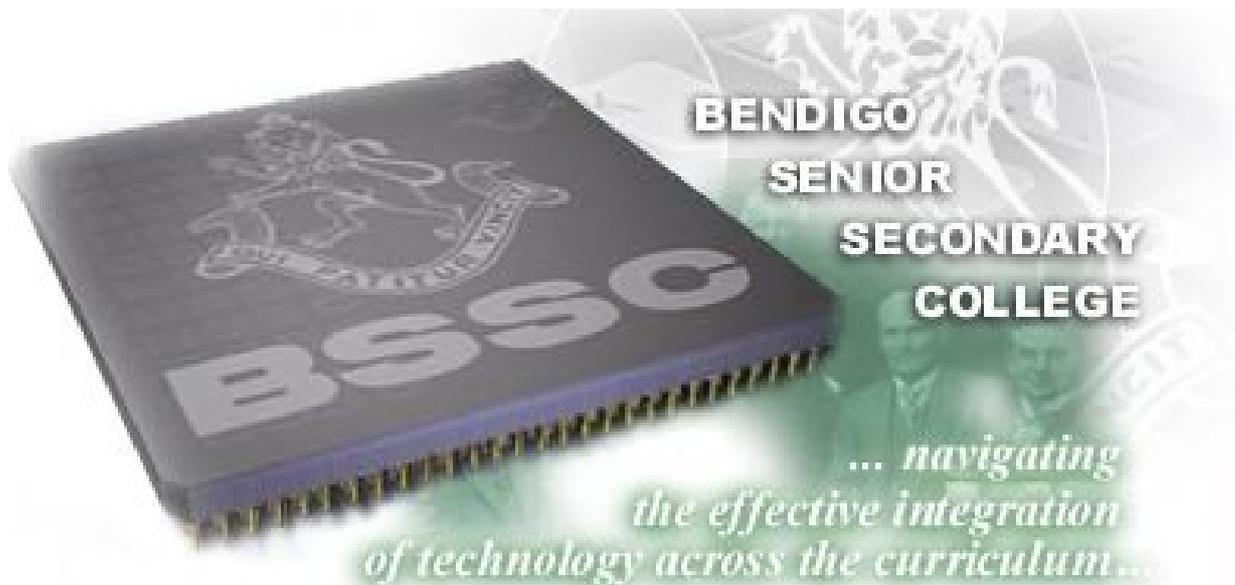
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1. Overview

> **Leadership and power sharing was a strongly held principle from the start of the Information and Communication Technology (ICT) plan. Committees developed both plans and four management level positions have a distinct role in the ICT plan: Technology Development Manager, Curriculum Coordinator, Learning Technology Manager and the Professional Development Coordinator. A number of teams have a strong commitment to the plan. Each of the nine faculty areas have individual ICT plans which are a subset of the overall school plan, the school library team, the five teaching and learning coaches and the technical support team.**
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> *Part of a paper delivered by the school Principal, early on in the project, that indicates a team approach, combined with decisive leadership, to whole school change was adopted at the school. The whole school change plan involved changing attitudes to teaching and learning, including the installation of an extensive ICT infrastructure, and changing the organisational and management practices of the school.*

1.1 The School and Its Context

Bendigo Senior Secondary College (BSSC) is a single campus senior secondary college with 1,787 students enrolled in years 11 and 12, the final two years of secondary school in Victoria, Australia. They are involved in 9 study areas including the Arts, Business Studies, English, Human Development, Mathematics, Science, Technology Studies including Information Technology, Studies of Society and Environment (SOSE) and Languages Other Than English (LOTE). There is also a range of Vocational Education and Training (VET) courses offered to students. There is a staff of 113 effective full time teachers and 46 support staff. The school s annual operating budget exceeds $8.6 million.

The college is centrally located, adjacent to the City of Bendigo s public gardens, which provide the outlook from the front of its nineteen twenties style red brick building. The school itself was established in 1907. Student and staff cars flood the available parking space behind the buildings. There is no student uniform. All

staff members prominently wear nametags. Between two thousand and four thousand visitors come annually to inspect the school on the grounds of its international reputation in the field of school restructuring and particularly the use of ICT in the restructuring process.

There is an air of collegiality about the school. Teachers plan and work in groups. There are numerous working groups, some developing new practices and others monitoring current practices. Students are considered to be young adults and are largely treated as higher education students. The expectation is that they will accept responsibility for their own learning. There is a sense of harmony and purpose within the energetic school community.

Bendigo is the Australian State of Victoria s fourth largest city of eighty thousand people. It is the regional centre for Central Victoria. It is a heritage city that has its origins in the gold mining that occurred in the district in the 1850s.

BSSC is in like school Group Seven[1] within the Victorian Department of Education, Employment and Training s categorisations of state secondary schools. Group Seven has a relatively high proportion of students on Education Maintenance Allowance/Youth Allowance and a low proportion of Non English Speaking Background (NESB) students. The schools in this like school group are not considered to be high performance schools.

The school places strong emphasis on lifelong learning skills. It offers the greatest range of units at the senior secondary level in Victoria (VCE)[2], a range of Vocational and Education Training (VET)[3] programs, apprenticeships, traineeships and is an accredited provider of CISCO, Microsoft and Aries[4] courses.

The VCE marks the satisfactory completion of secondary schooling in Victoria. It is comprised of forty-four study designs and more than twenty VET courses that are offered over the final two years of secondary schooling. Typically, students select the equivalent of five subjects each year.

The VCE has been in a transition period during the year 2000. Recently, it has been revised to incorporate more school based tests and fewer of the large scale, research based projects that characterised its previous form. According to some staff members at BSSC, this has made some students more inordinately focussed on the content and assessment aspects of study designs than was formerly the case. This has had, in their view, the effect of making generic skill development in young people more challenging at present as the new system beds down.

BSSC takes the notion of continuous improvement very seriously. All aspects of the college are subjected to ongoing evaluation processes. Recently, the college moved to be accredited by the European Council of International Schools (ECIS). One reason for doing so was the desire to be able to bench-mark itself against strong international criteria.

Since 1994, BSSC has been pursuing an agenda for whole school change. The key goal of the whole school reform effort has been to improve the quality of teaching and learning at the college. The incorporation of the widespread, effective use of ICT, a reconsideration of approaches to teaching and learning and an organisational restructure were all, in combination, intended to contribute to that key goal. ICT was the catalyst for the reform effort. Its introduction was to play a major role in the transformation of teaching and learning and the reorganisation of management and administration arrangements.

Over the past seven years the school has:
- Revised its overall organisational and management structure
- Reorganised its decision making processes and procedures
- Expanded and revised its curriculum arrangements
- Developed an extensive in-house professional development program

- Established a formal annual review and appraisal process for all staff
- Radically revised its timetable and the pattern of student access to the school and staff
- Redesigned much of the classroom space so as to accommodate better student centred-teacher guided learning
- Improved the sense of professionalism amongst the staff and increased staff s work ethic
- Integrated the school into the family, business and wider education community aspects of Bendigo
- Firmly located itself as an international leading school in the integration of ICT into a wholly changed school setting.

In short, it has very successfully achieved a program of whole school change.

Some of the main effects of the changes have been:
- Improved staff morale
- Increased skill levels in using ICT
- Improved student learning outcomes
- Increased parental satisfaction with the school
- Increased sense of professionalism on the part of staff, and
- Increased work ethic on the part of staff.

2. The Past

The vision for BSSC s transformation was articulated in the college's original charter[5] that was developed in 1993 by staff and the college council and implemented in 1994. The charter strongly echoed the views of the Principal who had been working for three years towards getting a more widespread use of ICT into the school and making major changes to the way the school operated. He had been canvassing his views about ICT, and about school reform, with key members of the school community. He was keen to see a new approach to learning adopted by the school and to have ICT play a defining role in the learning process.

The mission statement of the 1994 charter was *to provide an excellent education for all students in a supportive adult learning environment* . The college goals for the period 1994 to 1995 were:
- To provide a quality learning environment
- To promote excellence in all aspects of student learning
- To deliver quality teaching
- To have management practices which support the delivery of the college curriculum and encourage effective decision making and communication
- To involve the wider educational community and the general community in the college.

The priorities for the college were:

- To incorporate efficiently and effectively the principles and practices of a self-managing college involving a major internal restructure of the leadership and management of the college.
- To establish a system of services and programs that effectively support students at risk to gain their VCE. Three student support programs were initially established: VCE Management, Literacy Support and Student Skills. In addition, in nineteen ninety-four, work commenced on developing a further student support program, the EDGE Program[6] that was implemented in 1996.
- To provide opportunities for motivated and talented students to accelerate their learning.
- To improve the quality of teaching and learning through the introduction of a staff annual review program.

During Semester 1 1994, a model for performance review of all staff was developed by a committee open to all staff. The model that was adopted relied on self-assessment by each teacher, classroom observation by a review panel and responses to confidential student questionnaires. Staff in Leading Teacher Two and Three categories participated in the statewide Performance Management Process[7], giving them access to a possible bonus once they were accredited.

Prior to 1994 a working group involving council, the Principal, the technology manager and staff was developing the college s first ICT plan. When it was completed in November 1994, it was incorporated as a priority into the existing 1994 to 1996 college charter.

The timing of these events was fortuitous for, in 1995, as a result of the Principal s strong leadership, and whole school community involvement, the college gained:

- Responsibility for prioritising spending of its Global Budget under the Schools of the Future[8] program
- Responsibility for selecting staff
- Funds pledged to complete a major building program at the college, and
- The opportunity to incorporate ICT infrastructure requirements in the design phase of new buildings and refurbishment of permanent buildings.

In 1996, the college participated in a triennial review of the school that was conducted by the Office of Review within the Department of Education. The performance of the college was reviewed with respect to the goals and priorities expressed in the charter. A general comment included in the review stated:

The review presented by Bendigo Senior Secondary College highlights and confirms the leading status of the college, particularly in the successful provision of a most comprehensive post-compulsory curriculum and in the advanced use of learning technologies.

A subsequent charter was developed which would run from 1997 to 1999. ICT featured very prominently, as by this stage it was integral to the operations of the college.

The goals in the charter were:

To promote excellence in all aspects of student learning:
- By delivering a challenging and coherent curriculum program which maximises student outcomes
- By providing opportunity and access to curriculum enrichment for students
- To achieve improved student outcomes by technologically enhanced curriculum delivery.

To provide a quality learning environment:
- By providing a safe, caring environment which promotes a positive attitude to learning and excellence, respect for others, high self esteem and pride in achievement
- By providing a physical environment which promotes and supports excellence in the delivery of all aspects of the curriculum.

To develop best practice in the management of the college to:
- Ensure effective and efficient management of the college through democratic and participatory decision making structures and processes
- Maintain and further develop staff effectiveness and performance.

To develop, maintain and effectively allocate resources and facilities in line with the college s established goals and priorities.

The priorities articulated in the charter were:
1. To be at the forefront of educational provision and innovation.

Strategies to achieve this were:

- The conduct of professional development and provision of information for the
national and international community[9]
- The investigation of offering alternative and flexible models of educational
delivery
- The investigation and sharing of new technology and developments in education
- The establishment of the college as a provider for full fee paying international
students
- The development of links to provide opportunities for teacher and student
exchanges
- The development of high quality Vocational Education courses.

1. To enhance teaching practice.

Strategies to achieve this were:

- The review and evaluation of teaching in each learning area and the use of current and new ICTs and practices to improve teaching strategies
- The use of Annual Reviews and Performance Management to provide feedback on
staff performance and as the basis for Professional Development Plans
- The provision of professional development for staff based on current research and practice into teaching and learning
- The provision of an evolving and improving network infrastructure with all necessary administration and information services shared electronically across the college to support the teaching and learning process
- The establishment of a comprehensive wide area network infrastructure to share
information services across Bendigo, Australia and the world to assist in the teaching process
- Provision of notebook computers, appropriate software and professional development to staff.

1. To use ICT to enhance learning outcomes for students.

Strategies to achieve this were:

- The provision of an evolving and improving network infrastructure with all the
necessary information services shared electronically across the college to support the teaching and learning process
- The establishment of a comprehensive wide area network infrastructure to share
information services across Bendigo, Australia and the world to service student needs
- The provision of a Multimedia Centre with exemplary facilities
- The provision of opportunities for students to develop the skills to understand and
use ICT
- The provision of optimal access for students to ICT
- The further development of the Cyberlibrary.

BSSC s ICT Plan, by now in its second stage of development, was crucial to the effective implementation of the college s overall vision, goals and priorities. Original planning documentation as well as the first ICT Plan were evidence that the introduction of ICT was curriculum or teaching and learning driven from the outset. The overriding goal was ICT in all learning areas, in all rooms, and implemented by all staff.

The vision as expressed in the charter was developed by a working group of council and involved representatives of council staff and the leadership at the college. Like many other activities at the college it was a team effort led by strong and visionary leadership. The Principal had articulated a vision for the use of ICT and created a supportive leadership team eager to participate and lead developments. He relished the challenges associated with convincing staff, parents and others about the value of his ideas. One of his colleagues suggested that:

 He (the Principal) doesn t see things as obstacles, rather they are things that you need to think your way around .

Sometimes his pro-activity extended beyond thinking of ways around obstacles:

 He didn t always wait for things to be approved (by the central office of the Department of Employment, Education and Training). If head office dithered, he sometimes ignored procedure and just went ahead .

In summary, the original vision expressed in BSSC s charter documents intended to bring together three major reform agendas:

- An emerging consensus that teaching and learning had to be active, constructivist and experiential
- A belief that well integrated use of ICT enhances teaching and learning, and
- A belief that schools had to be restructured to support the changed classroom.

The Principal had shaped the reform agendas. He had shepherded his ideas through the college decision-making processes. Over the past seven years, teaching and learning practices, the way ICT is used and the way the school is organised and managed have all been very significantly transformed.

Students in a Year 11 Science class at Bendigo Senior Secondary College

2.1. Learning and Teaching

The broad curriculum structure of 1994 was not markedly different from that of 2000. The structure can be inferred from the following figure.

Subjects, Classes and Class Sizes 1994 - 2000

Studies	No. Classes 1994	No. Classes 2000	Av class size 1994	Av class size 2000
Arts	43	41	21.5	23.3
Business Studies **Accounting, Economics, Legal Studies, Business Management**	33	42	23.7	24.9
English	64	75	24.1	25.3
Human Development **Health Education, Human Development, Outdoor Education, Physical Education**	29	31	23.2	23.6
Information Technology	16	23	24.3	24.9
Mathematics	53	55	24.3	25.5
Science **Physics, Chemistry, Biology, Psychology, Science, Agricultural and Horticultural Studies**	46	52	23.3	24.4
Technology Studies **Design & Development, Materials, Systems**	29	29	19.6	20.4
Studies of Society & Environment **Australian Studies, Geography, History, Geology, Classical Societies, Environmental Studies, Politics,International Studies**	15	19	23.1	23.3
LOTE **German, French, Indonesian**	5	11	20.6	19.1
Non VCE Subjects	15	30	18.6	20.1
Numbers of Students	1,520	1,787		
Number of Classes	384	398		
Average Class Size			23.1	24.1

The similarity of the overall curriculum design in 1994 to that of the design in 2000 can largely explained by BSSC being a Senior Secondary College, mainly

offering the VCE. A state statutory authority designs the curriculum. Flexibility is limited. The curriculum is offered statewide and its results are used for tertiary admission. The main pattern of change in the curriculum over the seven years at BSSC has been growth. This has mainly been in the non-VCE area. Specifically, the growth has been in the VET offerings, traineeships and the commercial courses of CISCO, Microsoft and Aries, that together provide an ICT pathway highly valued by industry and commerce.

However, there have been very substantial changes to the approaches to teaching and learning that have occurred at the school over the last seven years. In an interview with the Principal, he described the stereo-typical approach to teaching at BSSC in 1994 as:

teacher centred, didactic, very examinations results oriented.

Teachers who had been at the school for many years concurred with the Principal s view about the approach to teaching that was dominant in the early 1990s. One ventured:

That is why he (the Principal) wanted to turn the place upside down. He could see that the approach many were using in their classrooms was not appropriate for the future. It didn t even suit the needs of the current students (in the early nineties) some of whom had no intention of going on to higher education.

There has been a dramatic shift over the last seven years to a more constructivist environment in the classrooms at BSSC. The extent to which constructivist teaching and learning is found in classrooms at BSSC is indicated in the following figure. The figure reports the data collated from over twenty five percent of teachers classrooms that were observed during 1999 and further observations that were made in late 2000.

Characteristics of the Teaching and Learning Environment at BSSC

Item	Description	%[10]
Cooperative activities	Students regularly work in groups where they sometimes have different roles, share knowledge and ideas, and support each others learning.	PPP
Teacher planning	In planning learning activities, the teacher takes into account student feedback from previous activities and conversations; the teacher listens to the students and takes their opinions into account.	PPP

Student decision making	While the teacher plans the overall shape of learning activities, at appropriate times students make decisions about their own learning.	PPP
Teacher student feedback	The teacher has planned student outcomes and provides regular feedback on student achievement of these; students are actively encouraged to take this feedback into account.	PPP
Teacher interaction with individuals	The teacher has an awareness of the needs of all students and regularly interacts positively with individuals and/or small groups.	PPP
Development of ideas and information	Students willingly participate in discussions, both small group and large, and listen to what others have to say.	PPP
Authenticity of tasks	The major learning tasks are decided taking into account student interests and the relationship of the tasks to real life situations accessible to the students.	PP
Thinking	Through discussions and planned activities, the teacher encourages the conscious development of thinking skills in relation to the selection and use of information; students are encouraged to reflect upon their actions, words and products.	PP
Challenging learning	Students are presented with tasks and activities, which extend them and take into account different intelligences and learning styles of students.	PPP
Caring for others	Teacher and students treat each other with respect and provide support for those who are in need.	PPP
Reflection / Meta-cognition	The teacher encourages the children to think about the process through which they have learned things during the lesson.	P
Co-learning	Teacher is prepared to be a learner in the classroom; students respect this attitude.	P
Student products	Students are expected to make products, which are attractive, accurate, creative and designed to appeal to an audience.	PPP

The items in the table capture some of the characteristics of constructivist teaching. The figure indicates that many of the classrooms observed were pursuing constructivist principles of learning and teaching. In particular, there was a great deal of cooperative work. Students were often working in groups on problems or issues they had decided to pursue, usually in consultation with the teacher. Similarly, discussion groups were regularly used to disseminate ideas. Often this was managed electronically. Students were also seen working on issues that were real world issues and of great significance to themselves. Again, much of this was done electronically, and with people in other parts of the world.

Previously, constructivism was uncommon at BSSC. In the interviews conducted to prepare this case study, several of the teachers who had been teaching at the school since the late 1980s observed the extent of the shift to constructivism over the past six or seven years. One commented that:

Many teachers here now think about their teaching in very different terms from how teaching was thought about during the early nineties at the college. We have been exposed to a huge amount of material on learning. Some of it has been during our after school professional development. This has made us think about our teaching. We have had people from outside the school who specialise in learning come in and show us about constructivism. We have had to explain it to others when they visit our classes during practicums. Most of all, I guess, when people started to show us how the computers could be used to help students learn differently, when we became more confident, that has also made us think about our teaching.

A group of teaching and learning coaches has also played a major role in advocating constructivism and having it practised by staff. By 1997, the within school professional development program was mandatory. It was also built into individual annual performance plans. A support structure of five teaching and learning coaches was used to promulgate ideas about constructivism and to assist teams apply them. Successful applications were then regularly showcased to whole staff groups.

Other groups also had responsibility for advancing the college s emphasis on constructivism. For example, formally integrating a process of reflection, in the constructivist sense, into the teaching program has been the responsibility of a group of staff in 2000. They conducted a pilot of a thinking skills program that was integrated across study areas. A belief in the positive effects that flow to learning outcomes generally from such a practice has been one of the main reasons for undertaking the pilot. Understandably, the pilot itself has been a source of new constructivist practices for many people.

Like the thinking skills pilot project, all the groups that have been charged with the responsibility for advocating constructivism have been organised so as to maximise teachers involvement and in ways that make any consideration of constructivism as practically oriented as possible.

Significantly, in the context of changed teaching and learning practices, and the new discourse at BSSC for describing them, learning outcomes have substantially improved over the period 1994 to 2000. Numerous measures of learning outcomes have been compiled by researchers at BSSC over the last seven or so years. Relative performances in Mathematics and English, two high demand VCE subjects, have been recorded for most of the period of the whole school reform effort. The mean of BSSC's results over the past four years has been significantly higher than "Like School" results and is also higher than the state mean score. Furthermore, the BSSC mean score in Mathematics Methods and Further Mathematics has risen significantly in comparison to both Like School- and State- Means.

BSSC s Performance in Mathematics and English 1996-1999

Year	Study	School Mean	Like School Mean	State Mean
1996	English	28.6	27.7	28.3
1997	English	29.2	27.4	28.4
1998	English	29.09	27.5	28.4
1999	English	28.9	27.5	28.4
1996	Mathematics Methods	30.2	28.9	28.8
1997	Mathematics Methods	31.24	28.6	29.9
1998	Mathematics Methods	32.05	28.4	28.8
1999	Mathematics Methods	32.6	28.4	**28.8**
1996	Further Mathematics	29.43	27.9	28.6
1997	Further Mathematics	30.58	28.6	28.8
1998	Further Mathematics	31.1	27.9	28.9
1999	Further Mathematics	32.1	28.8	**29.0**

The following table compares the college s performance with the State Mean at A+ through to B between 1996 and 1999.

All Studies Grades		A+	A	B+	B	Total
1995	State	10.6	12.0	12.1	13.0	47.7
	BSSC	8.0	12.9	12.2	15.0	48.1
1996	State	9.3	11.6	11.8	13.6	46.3
	BSSC	10.5	13.0	13.4	15.0	51.9
1997	State	10.4	12.2	12.0	13.7	48.3
	BSSC	13.0	14.0	14.2	15.2	56.4
1998	State	10.8	12.4	12.3	13.6	49.1
	BSSC	15.0	15.6	14.9	15.4	60.9
1999	State	11.3	12.5	12.2	13.8	49.8
	BSSC	17.5	16.5	15.1	14.8	63.9

The pattern is clear. The table indicates that the gap between the performance of students at BSSC and that of the state is widening.

Other data compares BSSC s performance in all VCE studies with the state mean in all studies. These are shown on the following table. This table also illustrates that the gap between students at BSSC and the state is widening.

**BSSC s Mean Performance in all Studies Compared with Like School Means
1996 to 1999**

Year	School Mean	Like School Mean	Difference
1996	29.8	28.6	1.2
1997	30.4	28.5	1.8
1998	30.9	28.5	2.4
1999	31.1	28.6	2.5

Furthermore, other significant learning outcomes have been produced at BSSC over the time of the innovation. A survey of staff conducted in late 1998 identified a range of outcomes, which the staff identified as being significantly enhanced by the use of ICT at the school during the period of the innovation. The set of classroom observations, and the analysis of the student work that was done during this investigation, confirmed the teachers perceptions.

Nineteen generic outcomes were identified through the process of survey, classroom observations and analysis of student work. They included the following:

- Investigating
- Searching for information
- Selecting relevant information
- Researching

- Being creative
- Visualising ideas
- Working cooperatively with others
- Keyboarding

- Organising information
- Solving problems
- Using information to support a point of view
- Presenting information
- Communicating in ways appropriate to an audience

- Deciding

- Learning autonomously
- Learning independently
- Sharing skills and ideas
- Awareness of global issues
- Making connections between school and the real world

Of these, four were especially well developed in students: investigating, researching, searching for information and presenting information.

Finally, BSSC s performance on the GAT test[11] has been continually improving over the last six years. On the GAT test, BSSC students traditionally perform below the state mean. However, over the past few years the gap between its performance and the state mean has been narrowing. The important fact here is that the students perform below average on the statewide GAT test and yet VCE results are significantly above the state average. So at the same time as student performance on the GAT has remained below the state average and like schools' performance, BSSC students' VCE results have improved more than both like school and state results. This suggests that the learning outcomes at BSSC are getting better and better each year.

2.2 Technology

The use of ICT in all classes is very keenly promoted throughout the college by the leadership team, learning area coordinators and the teaching and learning coaches as a teaching and learning tool . As one staff member explained:

 There are extremely high expectations that all current and new staff have a strong commitment to the ICT plan. The plan is part of the school charter, and its influence is seen in the annual reviews and performance plans of all staff, and in all job descriptions. We think it, we talk it and we do it.

The integration of ICT, however, in the sense of total staff commitment and an integrated use of technology across the curriculum, was not immediate at BSSC when it commenced the innovation in 1994. The various forms of ICT and the applications that are currently utilised at the college have gradually, but systematically, been integrated into the teaching and learning process. Initially, ICT was used in a relatively primitive way. In

English, for example, students were taught to use, say, Microsoft Office specifically for word processing work requirements and assignments. In the Arts, Adobe Illustrator was taught so students could produce creative graphics applications within Graphics and Studio Arts. Staff members skill levels at this time were relatively rudimentary. One staff member commented during an interview:

When I first came here I knew nothing about technology. I was soon made aware that it was to be taken seriously here. I taught myself a lot at first by just experimenting. I m the sort of person who learns that way. Gradually, I gained confidence. I also think the way I experimented with the technology in those early days actually influenced my teaching. I learned the value of discovering things for yourself through that experience and I encourage the students to behave like that now.

Another commented that an initial task was to improve the skill level of the staff with ICT:

There were not many people here in 1994 who knew much about ICT. It has been an enormous learning curve for everyone. At the start we were shown how to do simple things. It all looks so simple now but at the time it was not. We had to learn how to use the computers at a simple level.

Subsequently, the technology has come to be used more incidentally, pragmatically and in a more integrated sense. The obstacles to its use in this way were largely ignorance, fear of technology and non-acceptance of the need to change. The way professional development was mandated for all staff helped change such attitudes. So too did the work of the teaching and learning coaches. The Principal and his supporters purposely raised expectations about the use of ICT. One staff member commented:

This is a pretty big place. You can hide here for a while (by not using ICT) but sooner or later you will be discovered not using it and then you will not be allowed to get away with it. Everyone here expects you to use it.

The college surveys staff annually to ascertain levels of use of ICT. Teachers use of ICT has grown dramatically over the period of the innovation, including usage between home and school, and for purposes of communication with students.

ICT is now viewed by most teachers as an adjunct to good teaching and effective learning. For example, most students routinely use the Internet as one of many sources of information. Any teaching about its use is incidental to the task of obtaining the information sought. Currently, the use of technology is becoming more and more incidental and routine in classrooms. It is used primarily to enhance teaching and learning as distinct from any attempts to automate them. Many staff members now refer to the generic use of technology in their teaching. By generic is meant:

Unlike how we used to think about it...some applications were specifically for a subject area and not used by others...we are now more generic in how we use it. You will find word processing, Powerpoint, multimedia, digital cameras, the Internet, E-mail, Web Page publishing and more in many classes regardless of the faculty they are in.

BSSC students editing video

2.3 School Organisation

In 1994 the school conducted a review of its organisational structure. There were three people at the principal class level in 1994 although the school was entitled to many more. The Principal had already gathered enough support to commence a process of flattening the structure. However, there were still numerous faculty heads with assistants. The structure was largely hierarchical and was geared to the needs of a subject based curriculum. The Principal was keen to see a structure that emphasised teams rather than the ill defined and hierarchical structure that existed before 1994. He wanted a structure that gave him more flexibility and enabled him to deploy resources more effectively.

The terms of reference for the review were intended to:

- Devolve considerable responsibility, authority and accountability
- Improve internal and external communications
- Form teams to take responsibility for allocation of resources, decision making, evaluation and outcomes.

Through the review process the school developed the beginnings of a flat management structure. This in part enabled salary savings to be redirected to purchase ICT. The structure has been reviewed almost annually since 1995. Gradually, a formal team culture has emerged. A formal structure of eight management areas has evolved. This is represented in the organisational chart that appears in Appendix C. Those in the management positions depicted on the chart are responsible and accountable for the development and implementation of action plans in their areas of responsibility. This is done in consultation with the Principal and the other managers. The management team meets formally every week.

The leadership group at BSSC has always considered it important to find the time for staff to undertake the substantial innovation that has been underway there since 1994. One way time has been found has been to use ICT more extensively for management purposes, thus freeing time to work on the whole school change effort. Perhaps the most significant development in this regard has been the establishment of BSSC s Intranet. The school has developed this password protected, private Internet web site for college staff and students to

explore, search and collaborate without having to rely on outside systems. The network is now used for the following:

- Curriculum content
- Unit contracts
- Teachers classroom notes
- Keeping attendance records
- Timetables
- Posting of deadlines
- Communication and collaboration
- Electronic submission of work
- Electronic correction of work
- Distribution of policies, handbooks and notices
- Announcements
- Taking of practice tests accompanied by computer assisted instruction
- Student reports
- Student photos
- Daily notices
- Distribution of newsletters
- Distribution of minutes of meetings
- Attendance records and accessing attendance history
- Access to student details
- Access to student subject enrolments
- Academic records
- Room and facilities bookings.

Additionally, the college library centralises information and distributes it across a Local Area Network that carries and facilitates the school s Intranet. Library information is now provided in a number of different ways:

- Metamarc software provides a Web enabled catalogue of the college s books, CD- ROMs, video- and audio- tapes, curriculum web sites and substantial information from each learning area.

- Alchemy Gold is used to catalogue electronically scanned and distributed newspapers and articles each year for teachers - and students - use. The articles are current and provide students with easy access to important information from anywhere via the college Intranet. This is a vast improvement compared to the previous limited access the students had to newspaper clippings and similar resources located in a Vertical File accessible only in the library.

- Teacher librarians support all learning area teams. As the learning area teams plan, the teacher librarians contribute resources. These are sometimes web based and at other times electronically produced and made available on the Intranet. "Virtual Veronica", a virtual teacher librarian, responds to student e-mail requests for assistance with material on a twenty four hour turn a round basis. Anyone can view the library catalogue online; students and staff can book materials from any location via the Internet. Sites relevant to topics under investigation are catalogued and made available world wide.

Parenthetically, but very importantly, having to create and build such a technological resource has added to the levels of staff and student expertise with ICT. Technology has become a necessary tool for learning.

"Virtual Veronica", the virtual teacher-librarian,on the BSSC library homepage
http://www.bssc.edu.au

3 The Present

Over the past seven years the school has been transformed. Its overall organisational and management structures, its decision making processes and procedures and its curriculum arrangements are very different now from what they were. Many other aspects of the school are also dramatically different, most especially how it approaches teaching and learning. The school has very successfully achieved a program of whole school change.

ICT has played an important role in the whole school change process. In 1994, the school s first ICT plan was developed and endorsed as a priority by Council. This enabled the school to incorporate ICT infrastructure funds into the design and refurbishment phases of the capital works program. By 1997, however, in the second college charter produced for the triennium 1997 to 1999, ICT had assumed a very prominent role in the school and was a major influence on the whole school reform effort.

BSSC considers that whole school change is a process and not an event. People at the school constantly refer to the way their confidence and ability with new approaches to teaching and learning, and with using ICT, are continuously developing. They also speak about the innovation being *on-going* , *a continuing experiment* and having *no finish line* . At least five things have helped to shape the innovation into this pattern: the way ideas about the innovation were diffused (diffusion patterns); leadership; staff development; accountability mechanisms; and management processes.

3.1 Organisation of Evidence
3.1.1 Diffusion Patterns
Roger s (1962) diffusion theory considers technological innovation to be communicated through particular channels, over time, and among the members of the social system that comprises the organisation into which the innovation is being introduced. There are opinion leaders within the social system who enlist the support of change agents to communicate the innovation to other members of the social system. People adopt the innovation at different rates. Innovators , or venturesome people, adopt it more quickly than laggards , people who are more traditional. People move through stages during their adoption of the innovation, commencing with a stage of gathering information about it, through to a stage of confirming its usefulness through practical application.

There are three aspects to the innovation at BSSC: changing practices regarding teaching and learning; introducing ICT to support improved teaching and learning; and changing the management structures to support the new classroom practices.

The diffusion of new ideas about teaching and learning took a form closely resembling Roger s (1962) theory. The views of a set of opinion leaders were sought. Dr Julia Atkin, an education and learning consultant whose work in education spans educational research, curriculum design, consultancy and teaching at all levels of the education system, was employed to conduct professional development sessions during which she elaborated constructivist principles of teaching and learning. Overseas visits were made by key staff to identify best practice examples of constructivist teaching and learning. However, the diffusion of these ideas was not simply a matter of communication. The ideas were continuously made the object of practical application and evaluation within the college's in-house professional development program and later in classrooms. This approach has been maintained. This contributes to the feeling that the innovation is a journey , never having an end .

The ideas about constructivism are, therefore, simultaneously communicated and refined in practical settings.

The ideas and practices about the introduction of ICT to support improved teaching and learning also had a set of opinion leaders. The Navigator School Project Officers, the Technology Development Manager, the Principal and others, all articulated a vision for the role of ICT in schools. A broadly based team of eighteen developed a school wide plan for their introduction. Much of it drew on the experiences of the staff who visited other schools, some of them overseas, to investigate leading practice use of ICT. The change agents were the teaching and learning coaches, the project officer, the professional development coordinator and the technology development manager. Generally, teachers proceeded through Roger s stages of knowledge acquisition to confirming the usefulness of ICT through practical application. This process took several years. Some moved more quickly than others, some are still coming to grips with the changes. The professional development program and the way ICT use is tied to annual reviews greatly influenced attitudes in this area.

The changes to the organisational structures and the management practices were also diffused through the system along the lines of Roger s diffusion theory. Some of the ideas about possible reorganisations were developed within the Department of Education, Employment and Training as part of the Schools of the Future policy. They were communicated to Principals who were encouraged to experiment with them. BSSC also obtained other ideas from overseas when staff members returned from study tours. The change agent was the Principal, who had a commitment to establishing a team culture and a desire to get a more efficient and accountable system into place.

3.1.2 Leadership
The teachers and parents at BSSC all attribute much to the leadership by way of explaining how the school has transformed itself since 1994. One teacher described it as follows:

 He (the Principal) has an uncanny ability to see where we need to be going, what the future holds. He saw very early the need to change the way we approached teaching. He saw the inevitability of a prominent role for ICT. He keeps up with developments with ICT and how they can improve our core work. He also has the ability to articulate his vision and make it seem real. Moreover, things are followed up and acted upon here. Something is actually done to make sure we are all keeping on track.

Two key leadership principles at the school are democratic decision making and collegiality, in the team work sense. One staff member spoke about decision making at the school in the following terms.

 He (the Principal) has made a genuine effort to introduce democratic decision making here. There are teams for most things and a system of reporting the work of teams back to the whole staff. Everyone is given the opportunity to be involved in the process.

This claim is consistent with the facts about much of the approach to organising and managing the introduction of the ICT program. The original plan was developed by a council committee working as team with interested staff members. Similarly, the management structure is team oriented and flat . It is also characterised by strong leadership. The Principal sets very high expectations for his staff and regularly monitors people s performance, whether they work in the management-, classroom- or support- area.

Notwithstanding its emphasis on democratic decision-making and teamwork, the college is nonetheless results oriented, performance focussed and draws on a number of systematically kept data bases to assist with decision-making. Student results are tabulated and comparisons with other schools are recorded. Student performance within subject areas is mapped year by year. A research officer, jointly funded by a local university and the college, worked part-time during 1998 to 1999 on gathering data about the effectiveness of teaching and learning. All staff members in leadership positions develop performance plans which incorporate the ICT thrust of the school. All Level One teaching staff members have annual reviews where ICT skills and attitudes are audited resulting in professional development plans. Teamwork and democratic decision making are conducted within an environment of high expectations and performance appraisal.

The Triennial School Review that was conducted in 1997 indicated that both the broad college community and a significant majority of the staff supported the type of culture that has developed at BSSC. Over the period 1997 to 1999 their level of support for it has grown according to the review data. Moreover, advertised positions at the college are eagerly sought. Many of the staff members who were interviewed expressed great support for the direction the college is taking.

The culture of collegiality that has developed at BSSC has been largely fashioned by a management practice which the school identifies as whole school planning . This approach involves several stages. Each stage involves a different team. The stages are:

" Creating a vision

- Providing a structure to accommodate change
- Developing mechanisms for supporting staff development
- Engaging continuous improvement techniques within a context of transparent accountability.

Strategic groups within the college assume responsibility for the carriage of the above four aspects of the change process. The groups are shaped by the school leadership team under the guidance of the Principal. They are formed on the basis of the contribution team members can make rather than their roles within the college, seniority or other criteria. The task of creating a vision for the use of ICT, for example, fell to Technology Development Steering Committee. The team of eighteen included the Principal, two council members, ten teachers and the Technology Development Manager. It involved the team in designing a vision statement and placing teaching and learning in the social and economic context of the twenty first century. Within that context, it has suggested approaches to teaching and learning consistent with life-long learning. It has also predicted changes that are likely to occur to where learning will occur, what resources will support learning, the main objectives of learning and who/what will facilitate learning in the future. Most importantly, it focussed the change process on curriculum and on teaching and learning practices. According to an information sheet distributed by the college:

 The clear focus of the introduction of ICT was curriculum or teaching and learning driven from day one. It was ICT in all learning areas in all rooms implemented by all staff."

Each of the other elements of the process is the province of a group that has the delegated responsibility for its carriage. In a business like flat structure, there are eight managers each with a particular area of responsibility including students, business, school to work, curriculum, student activities, ICT, technology development and navigator school responsibilities. Groups coordinated by these managers and containing people from many quarters of the college community, form relatively autonomous decision making bodies designed to address issues or tasks as they arise. For example, the Technology Development Manager, Learning Technologies Manager, Intranet Coordinator and two full-time multimedia trainees all contribute, along with a number of students, to ensuring that the college Intranet- and Internet- sites content is improved daily.

All groups report regularly to the whole staff. The focus of the staff meetings is on the provision of information and the encouragement of staff participation and involvement. Ultimate decision making is the province of the college leadership team. It takes account of feedback from staff meetings. Consultation is wide. The process is formal and decisive.

3.1.3 Knowledge Inputs - Staff Development and Involvement
In 1994, teaching practices at BSSC were teacher centred. Use of ICT was at best marginal and rudimentary. Progress to a more seamless use of ICT and a broadly based acceptance of constructivism required staff development. A range of knowledge inputs was used as part of the process of obtaining staff commitment to these new practices. The knowledge inputs came from within and from outside BSSC. Visits to other schools were used to garner ideas for possible new practices in keeping with the intent for changed approaches to teaching and learning and for the use of ICT to enhance teaching and learning. These were systematically fed back to other staff through a routine reporting process.

An in-house, supported, professional development program was initiated. The program was highly practical. New approaches to teaching consistent with principles of constructivism were translated into action plans and the professional development program was used to put them into practice, monitor outcomes and refine practice. Support for the practical orientation of the program was the responsibility of a set of teaching and learning coaches. They were selected on the basis of willingness for risk taking, relative superior knowledge and practice about constructivism and the use of ICT. They were allocated time to perform their role and to develop and implement leading classroom practice, which they could then share with their team.

BSSC staff has both received, and provided, professional development experiences. The way the staff level of expertise with ICT significantly exceeds norms across the state, the extent to which this expertise has improved in recent years, and the capacity of the students to use ICT, can be attributed in significant part to the professional development support that the staff has received. For example, in 1999 staff participated in an average of twelve days professional development per person, most of this with a teaching and learning focus.

In 1995, as part of the whole school planning process, the college conducted a needs analysis of the staff in terms of expertise with learning technologies and their applications for enhancing student learning. One outcome of the analysis was the formulation of a policy that dedicated funds to professional development to enable the introduction each year in December of a two week intensive in-school set of workshops on the use of ICT in classrooms. All staff members are required to participate. Each staff member sets a number of measurable personal goals for the year regarding their professional development in the learning technologies area. In turn, these are incorporated into the staff plans for professional recognition. They therefore become indicators of suitability for career advancement.

Weekly professional development sessions are also conducted on Thursday afternoons. Attendance is mandatory. Coordinated by a professional development coordinator, the sessions reflect areas of need detected in the annual survey. They include professional development opportunities within two main categories: technical applications; and teaching and learning. Staff members, therefore, have a regular opportunity to fulfil their expressed personal goals by devoting substantial time to the array of sessions offered. Sessions are offered by staff members with advanced skills in the area, and sometimes outside specialists are used to run the sessions. Importantly, staff members consider these sessions to be emotionally supportive as one described them:

The weekly professional development is run by a colleague. They are very practical sessions. The people running them are sensitive to you as a person and where you are personally. You feel it s ok to be where you are with the use of the technology but it s not ok to stay there. They help you to get better with using it but it s a very personal experience.

In addition, a mentoring system has been established. More expert staff members work with colleagues on practical aspects of improving the uses of ICT. All of this has been tied to a peer appraisal system that forms the basis of the staff performance appraisal system. In 1995, $11,500 of the global budget was allocated to this approach to professional development. In 1996 this was increased to $41,000. By 1998, a total of $60,000 was assigned to externally provided professional development activities. This included opportunities to attend conferences and to work in schools abroad for an extended period of time.

By 1998, some seven hundred hours of professional development were scheduled annually for staff. Similar programs have occurred in the past two years. Furthermore, staff has the opportunity to visit and work in other schools to witness developments and they are asked to systematically feed that information back into colleagues at BSSC. Staff members are supported to undertake further study and several at BSSC are enrolled in higher degree or doctoral programs.

Finally, the school offers professional development to other schools through teacher practicums and leadership programs. The Navigator School Project Officer plays a major role in this process. BSSC offers professional development to over two thousand people annually. This number of visitors to classrooms in the school has added to the sense of responsibility of staff to be competent and innovative not only in the use of ICT but also in their general teaching skills and the way they talk about their work.

3.1.4 Accountability Mechanisms

Accountability was made a key part of the process very early in the whole school reform effort. In 1995, a system of performance appraisal was introduced and all teachers were expected to adopt a common philosophy to teaching and learning including mixed ability learning, student centredness, negotiated curriculum and constructivism. Individual progress with the adoption of the philosophy is monitored by a peer review process that is signed off with the Principal. The review process also requires individuals to set goals for improving their use of ICT and using it to improve learning outcomes. These changes were soon accepted by most staff. As one staff member said:

 The system (of performance appraisal) is fair. You really could not disagree with it. I found that it gave me a new purpose, something I had lacked for a long time. I had been teaching for a long time and had become stale. The system (of performance appraisal) was professionally reinvigorating for me. I m sure many others will say the same thing.

Less formalised accountability mechanisms have also been present at BSSC since the mid 1990s. With well over two thousand people visiting the college annually, teachers feel the need to be teaching well.

 You have to be on the ball here. There are always people watching what you are doing. There is no hiding. All that drags you along and makes you want to do your best.

Another subtle form of accountability comes from the practice of team work encouraged at the college.

 A great deal of the work here is done in a team. Being in a team breeds collaboration. You have to learn to work together. You also feel responsible to the team. You do not want to let the others down. That can make the work harder of course but it also makes you feel accountable. I find that being accountable in that way makes me feel more professional.

3.1.5 Management Processes

The reorganisation of the management structure into its current flat arrangement has had several effects on the innovation. It has enabled the college to redirect funds to areas that advance the reform effort such as professional development, network maintenance, increased levels of paraprofessional support and the like. The automation of report writing and roll marking, communication by e-mail and the virtual library have all enabled teachers to devote more time to improving teaching and learning in a less restraining environment.

These four elements combine to form a process of whole school change at BSSC that has distinctive diffusion patterns. Also, ICT plays a critical role in the process.

3.1.6 ICT and Innovation Connections

The plan for the role of ICT at BSSC was to have it focussed on improving teaching and learning. It was to be

a catalyst for the whole school reform effort.

The original College ICT Plan contained five goals:

- To provide a quality learning environment
- To promote excellence in all aspects of student learning
- To deliver quality teaching and professional development in all learning areas
- To streamline administrative communication, record keeping, reporting and student attendance by using computer technology, and
- To involve the wider educational community and general community in the College.

As can be seen from the plan the intention was that ICT contribute to reorganising the structure and management of the school, helping to change approaches to teaching and learning and improve student learning outcomes. These were all aspects of the whole school change plan.

3.1.6.1 ICT and School Restructuring

ICT has played a significant role in the way the college has restructured its organisational arrangements and its management practices. ICT has enabled a highly efficient use of time to be made at BSSC administratively and in the classroom.

In 1997, the college timetable was changed to three contact periods per week for each class of one hundred minutes, seventy minutes and fifty minutes duration. Changing the timetable resulted in a range of positive benefits to both teachers and students including:

- Less change over
- Greater face to face time with classes
- More student centred classrooms with the extended blocks of time
- More time for group work and collaboration, and
- Timetabled professional development time within the school day for staff.

A Student Enhancement Program[12] was timetabled on Tuesdays. Learning Areas conducted weekly meetings. Staff professional development was scheduled on Thursday afternoons during school time. A special catch up session was introduced by staff on Sunday mornings for students who missed classes. With resources on the college Intranet continually developing and being used creatively by staff and students, the extension of class time without geographic or time limits is a reality at BSSC.

From 1994 to the year 2000, teachers use of time has changed substantially. There has been:

- Less reliance on print for communication
- Greater contact, and increased ease of contact, with students and colleagues
- Significant time benefits associated with the ease of editing work each year, submitting reports, keeping student records and attendance electronically
- Greater awareness of the enhancement of learning outcomes through effective use of ICT
- More time focused on planning effective integration of ICT and becoming familiar with new software
- Increased collaboration and communication across learning areas
- Increased time on whole of staff professional development, and
- Greater use of college resources with the ease of working with files, the Internet and software from home.

3.1.6.2 ICT and Changed Teaching and Learning

The integration of ICT into the teaching and learning process required the identification of the key components of high quality teaching, learning and assessment. The original ICT Plan detailed comprehensive teaching and learning goals, thus beginning the development of a shared definition of excellence in teaching and learning. In nineteen ninety six, the Teaching and Learning Coaches developed a Teaching and Learning Charter that, like the first ICT Plan, articulated an educational framework for the integration of ICT into the teaching and learning practices and ethos of the college. These documents encompassed the principles of:

- Student centred classrooms
- Experiential learning
- Constructivist learning involving the production of knowledge and meaning by students
- Active learning
- Mixed ability learning
- Teacher reflection
- Collaboration with colleagues
- Teachers as guides, co-learners, constructors and facilitators
- Teachers with a belief that ICT enhanced teaching and learning.

Each learning area in 1995 was required to develop a Teaching and Learning ICT Plan, which stipulated teaching and learning outcomes at six monthly intervals. These separate learning area plans had to be consistent with the overall college wide ICT Plan and had to be signed off with the Principal.

Consequently, when aligned with the signing of a Memorandum of Understanding by individual teachers when they took possession of their college provided Laptop computer, a culture of ownership, accountability and commitment was rapidly established.

From 1996 to 1998, the Teaching and Learning Coaches had a key role in supporting groups of teachers in the development of projects that would effectively integrate ICT into the pedagogies used in the classroom. Each coach worked with approximately twenty staff and they were required to develop an area of specialism in ICT: online services, ICT in writing, homepage development, multimedia authoring and presentation, computer assisted instruction, graphic calculators, or computer aided design.

In 1997, after expressions of interest from staff, six Leading Edge Projects[13] were established, supported and evaluated. By this time, the role of the coaches in conducting professional development activities for staff was well established. The outcomes from the Leading Edge Projects were shared with the whole staff.

It was apparent that professional and collegial reflection among teachers was occurring and that a professional conversation was part of the ethos of the college. This culture and environment included the following features:

- Teacher teams operating within and across learning areas
- Informal and formal professional support groups
- Sharing and support from trusted and caring colleagues
- Committees and individuals with responsibility for leadership organisation and implementation.

In 1998, five Team Teaching Projects were established in four different learning areas. The members of each team had their classes timetabled at the same time, thus facilitating team teaching, flexible groupings and the trialling of innovative curriculum delivery methods. All teams were provided with a budget to develop multimedia materials. Evaluation of the projects at the end of the year revealed very high levels of student and staff satisfaction and, in the Year Twelve classes, improved student results. The Triple Science Team (involving Biology, Chemistry and Physics teachers and classes) won the Department of Education s Teacher Team of the Year Award for innovations using technology in 1998.

A significant innovation was the introduction of electronic discussion groups in English texts. Responses revealed a high level of participation from students of all abilities and depth of thought given to the texts and issues raised.

By 1999, numerous discussion groups and global classroom projects across a wide range of learning areas existed. Extensive online materials had been developed in all learning areas. In Biology, a fully animated, multimedia unit on disease was developed. The module incorporated responses from students being e-mailed automatically to teachers, and the ability of students to produce a pointed summary of their understandings.

3.1.6.3 ICT and Learning Outcomes

The improved learning outcomes at BSSC are attributable to a range of factors. Over the last few years BSSC has developed the following attributes:

- Increased skill levels on both staff and students parts in the use of high end technology
- High staff morale
- High quality staff
- Increased work ethic amongst staff
- Greater sense of professionalism on the part of staff and an increase in its pride about its work
- High levels of experimentation with approaches to teaching and learning involving the use of ICT
- A culture of trust in the students
- A sense of collaborative competition with other schools and their performances on the VCE
- Formal and strong links with the other schools experimenting with the use of ICT to improve teaching and learning and with the Department of Education, Employment and Training s Unit centrally responsible for the innovation
- A process of continuous improvement and self-analysis
- An incipient thinking skills program that is directed at helping students understand how they learn and thus increase personal capacity for learning.

All of these attributes interact and form a synergy that contributes to the overall pattern of improvement in student outcomes.

Between 1994 and 1999, the students have become more and more adept, inventive and effective in the way they use ICT. In that time, they also have grown significantly in confidence in using ICT. In response to a questionnaire administered by the research officer in 1997 students asserted that both Year Eleven and Twelve students placed a high value on use of technology for:

- Ease and quality of presentation of work
- The facility to draft and edit work
- Making the completion of their own work more interesting and satisfying
- Access to information
- The quality of the communication it affords
- The acquisition of skills which they see as important for their futures.

In short, ICT has been a key motivating force for student learning.

Teachers also report that over the past two or three years students have noticeably increased their active involvement in work when technology is involved. Moreover, they report that this is the case for the full range of students . Similarly, they claim increased motivation on the part of the students they teach. Interestingly, one factor they single out is that students who usually were reluctant to actively participate in class were significantly more participative when chat sessions involving ICT were used.

Similarly, staff at BSSC has become increasingly expert in the use of ICT. Staff members have moved from using ICT mainly as word processors to developing Web pages, using high end Multimedia as presentation tools and experimenting with students to extend the uses to which the high technology can be put.

These improvements in staff and student competence have not been produced just from the staff development program, or from staff showing the students how to use the ICT. Staff members have been eager to develop their skills for many reasons including:

- A sense of professional responsibility to be, and to appear to be, highly competent during practicum visits to their classrooms
- The way professional recognition programs are tied to improvements in the way individual staff use ICT
- The effectiveness of the team based approach to professional development to obtain a commitment from staff to participate.

Improvements in student competence with ICT have occurred because:

- The culture of trust in the students encourages experimentation and inventiveness
- The sense of competition with others for good VCE results encourages widespread use of technology
- The shared sense of engagement with teaching and learning between staff, and
- The expectation that all students will extend themselves as users of ICT.

Synergies like these are everyday occurrences at BSSC. For example, as teachers and the student body have over time come to incorporate routinely ICT into their daily work, and as the technologies have become increasingly used as learning tools, teachers and students have experimented with various innovative forms of teaching and learning. Some of the principal ones have included self directed learning, cooperative learning, cognitive apprenticeship, the use of technology as a tool , problem solving, discovery learning, visual learning, reflective learning and various forms of experiential and authentic learning.

As one student who was participating in the English Unit 3   Text discussion forum said:
 you can take time to go away and think about an idea and then come back with a response whereas in an oral discussion the moment would be gone.
In this way the students and teacher in the subject were creating a reflective learning environment. More importantly, it is the synergy between the teacher experimentation, the student response and the use of ICT that produces the effective learning environment.

High staff morale is also a key feature of the teaching and learning environment at BSSC.
This is reflected on Table 5 below.

Table 5   Morale Factors at BSSC over Three Years Compared with the State Averages

Item	State	BSSC 95	BSSC 96	BSSC 97
Worklife quality	3.0	3.2	3.6	4.3
Morale	3.3	3.5	3.8	4.3
Admin Support	3.7	3.6	3.8	4.2
Goal Congruence	4.0	4.2	4.2	4.4
Staff support	3.8	4.2	4.6	4.8

Again though staff morale does not exist in a vacuum. Morale has improved at BSSC, in part, because staff and students have enjoyed experimenting with ICT, because they have become expert users, and because visitors have been impressed.

A constant theme in the staff interviews was the notion of improved sense of professionalism on the part of staff. Most described themselves as *more professional* as a consequence of their experiences at BSSC.

Different comments were made about the growth of professionalism:

I am more professional. I accept assignments from students electronically and turn them around more quickly now.

It s a very powerful thing to give a teacher a note book and the training to use it. It made me feel very professional.

Again the synergies at BSSC contribute to this growth of professionalism. The growth in the professionalism of staff is accompanied by an ability of staff members to talk about their work in new and insightful ways. This has come about because the professional development groups in which they work require that type of dialogue. So too does their active role in teacher practicums.

3.2 Outcomes

3.2.1 Infrastructure

In 2000 the college has:

- Four hundred and sixty Pentium PC s distributed throughout the school : 65 computers in the multimedia centre for students to access from 8am to 6pm, 20 rooms with 6 computers, 20 rooms with 4 computers, 25 rooms with 2 computers, 3 computer laboratories for IT classes. 200 of these computers are Pentium 500 s
- 146 staff notebook computers
- An Internet connection of 5Mbit connection with 2Mbit radio return link
- A network speed of 100Mbit with 16 NT servers supporting over 1,200 points
- Microsoft NT4 workstation system operating on 97% of PC s
- Unlimited hard disk space for all students
- E-mail addresses for all students
- 50 software packages on all PCs
- One hundred and fifty capacity jukebox centrally distributing 80 CD-Roms
- Four technical support staff and a number of students paid on an hourly contract basis to support the system
- Teachers encouraged to manage relevant areas of the servers to reduce administration time and increase their capacity to deliver curriculum outcomes
- Network printing on an automated user pays basis
- Free access to the Internet for an educational amount, then an automated user pays system
- Large screen TV s in all rooms for free to air television, satellite television, internal video and class multi media displays
- Appropriate numbers of additional peripherals including digital cameras, scanners, colour printers, dataloggers, graphing calculators available for students and staff to use
- The college registered as an ISP provider and providing a commercial internet service
- A thin-client server for supporting the operation of any of the college s software in students and staff members homes or remotely via modem connections
- Servers with a typical configuration of 256 Mb Ram, 54Gb hard drive space, Tier 1 brand, flexible and upgradeable and including seven Microsoft NT4 servers, one LINUX server and one UNIX server
- Two hundred and forty 56k modems for student / community use.

All of this has been installed to facilitate the whole school reform process, which in turn is designed to create an improved teaching and learning situation at BSSC.

BSSC students at work in the Multimedia Centre

3.2.2 Effectiveness

The effectiveness of the innovation and the impact of the use of ICT within it can be demonstrated in numerous ways:

- Motivating Learning with ICT

Many teachers spoke of the way the introduction of ICT produces high motivation in the students. One student during a focus group session commented:

It s well known that this school is a leader in the use of technology. It makes you feel proud to be here. There s no doubt that I am more interested in study here than I would be in some other school. The technology helps to make you feel like that .

- Learning Effects

ICT in combination with effective, constructivist teaching practice has produced a range of generic skills in students as well as producing relative superior performance on standard state wide performance measures.

- Teaching Motivation

Teachers have been challenged by the introduction of ICT and many attribute their reinvigoration to their having to master it.

- Teacher Professionalism

Teachers say that they feel more professional by being given a laptop computer and by learning to use it to increase the efficiency and effectiveness of their teaching.

- Teacher Articulateness

Explaining to visitors new practices about approaches to teaching and learning and ways of working and developing materials in teams in an ICT rich environment has enabled teachers to develop a common discourse about their practice. It has also enabled them to explain their practices persuasively.

- Work ethic

Having to master ICT has required extra time. Seeing the positive effects it has had on the students and on their own professional growth has encouraged staff to work harder and longer at mastering it.

- Authentic learning

ICT allows students to interrogate the world for information relevant to real world tasks that they are working upon. In so doing it produces a situation in which the students thinking is challenged. It provides a natural support structure for students to use to develop their own thinking about real world issues and tasks.

3.2.3 Academic Rigour

BSSC is a highly competitive senior secondary college committed to excellence. Academic rigour is a cornerstone of the school. ICT enables the academic program to be more rigorous, challenging and individualised than it would be in the absence of such technology. Students have immediate access to high quality curriculum materials on the school s Intranet that have been developed by the staff and the Multimedia support team. They also have access to selected commercial materials like Britannica and XSIQ. The college is in partnership with a range of producers of such commercial material in an effort to make the material pedagogically sound.

The students have continuous, ongoing access to the class lessons and materials that staff members have developed for use during class. Many regularly use e-mail to clarify issues that arise from work in the classroom with staff from home.

Valuable time is saved for students because browsing time is significantly reduced at BSSC. Useful web sites are catalogued with hotlinks for the students. This screening process ensures limited wasting of time by students and access to the most useful sites for student research at a reduced cost because they are cached on the server.

Staff members are regular presenters at international and national conferences. This adds to the culture of academic rigour at the college as does the constant need to explain practice to the stream of visitors to the school.

Academic results are analysed annually and the results of the analysis, containing performances amongst other things with statewide performances, are fed back routinely to staff. This too heightens the culture of academic rigour at BSSC.

1. *Equity*

There is open access to ICT and college facilities in general for students and staff, with a policy that if facilities are available then anyone has the right to use them.

Bendigo Senior Secondary College is the sole government provider of VCE in Bendigo. There is a high number of students receiving Education Maintenance Allowance / Youth Allowance assistance at the college. However, recent surveys of the student population has shown that ninety percent of the student population has a computer at home and eighty five percent of these computers are connected to the Internet, mostly through the college Internet Service Provision. Most resources are available to the college community on their Intranet, providing twenty four hour access.

All students have routine access to ICT from eight am to six pm every school day. The college is open during school holidays. There is an access policy in place whereby students and teachers may use available resources in any classroom with the teacher's permission if the facilities are not being used by the class.

On their first day at the school all students are given passwords, shown how to log in to the network and access all resources and software. Further support in the use of ICT is completed by peer mentoring and work groups in class.

There is undoubtedly a wide range of attitudes and abilities in the use of ICT amongst the student population. However, the issue of access is comprehensively addressed and monitored and is not a valid reason for lack of skill or use of ICT. Students and staff are encouraged to take responsibility for their individual attitudes, skill

level and confidence in the use of ICT by practising strategies involving the use of lifelong learning skills and attributes actively fostered by the college.

The Multimedia Centre at BSSC - an area freely available for students and staff from 8am to 6pm

1. *Disadvantages*

Staff surveys (see Table 5 page 28) are evidence of the widespread support the college leadership provides all staff. However, staff members are not unanimous about the benefits of ICT at BSSC. Whilst many speak about the way their professional life has been rejuvenated by having to master its use, others are concerned about the demands it makes of them.

"I have never worked so hard. Introducing technology to your teaching is very demanding. I m one of the low-end users. It takes me a long time to get prepared to use it. Not only that, but the feeling of guilt I have about not using it more weighs on me."

The innovation at BSSC has produced a pressure on all to perform and to work in teams to effectively integrate ICT in teaching and learning. Everyone is aware that the students results are the ultimate measure of success and this crystallises the pressure. Whilst some consider this to be a disadvantage others thrive on the pressure and anticipate that their achievements will produce personal and professional rewards for them. Scholarships for overseas visits that the college awards annually are one such reward. Some consider that the pressure of external examinations distracts students from the goal of emphasising lifelong learning skills.

3.2.6 Benefits

The following present themselves as major benefits:

- Improved student results
- Increased sense of professionalism by staff
- Staff participating in research (such as this study)
- Visibility of the college internationally
- Respect for staff by colleagues outside the college
- Restructuring of school day to make better use of time and to enable classroom innovation
- The ability to cater for a wide range of student learning needs and styles
- Increased study options such as ICT pathways and Vocational and Education Training programs
- Students as independent learners and global citizens.

3.3 Projections
3.3.1 Sustainability and Scalability
All the teachers in a focus group agreed, in a choral response to the question about who is responsible for the innovation, that we all are . A teacher librarian described her perception clearly:

"We all are (responsible for it). The teachers have to implement the new teaching and learning principles. The management level has to coordinate all the support structures and make sure they are working for the teachers. The leadership has to keep showing the way, coming up with the next step and making sure the funding is there."

The way the college is organised as a set of teams enables the whole school process to maintain momentum. The Principal is regularly out of the school for meetings in Melbourne or elsewhere. As one of the managers noted:

"He (the Principal) was away recently for nearly six weeks and the place did not fall over. There is no way this is a one man show."
Because the college views whole school change as an ongoing process, there is no questioning its sustainability.

With regard to scalability, the initial grant to the school of $1.3 million is sometimes held up as a reason for other schools not being able to do what has been accomplished at BSSC. Certainly, set up costs were substantial and enabled the infrastructure implementation, what the college saw as a three year plan, to be completely funded in one year. The intent was always to implement the original three year plan, with or without funding.

As a result of the guidance from Bendigo Senior Secondary College and six other Navigator Schools from 1996 to 1999, advice on whole school change and the effective integration of ICT in all areas of administration and learning in a school has informed decision making at a system level. Most government schools in Victoria now have better than the beginnings of a substantial ICT infra-structure to build upon because of funding initiatives like: a Notebook for Teachers Program, Technical Support Program, Hardware Support Project, Software Rolling Fund, Learning Technologies Planning Guides, Statewide Planning Surveys, NetDays, and a statewide broadband wide area network linking all schools(VicOne). Student to computer ratios of better than five to one are now commonplace in Victorian government schools[14].

The level and pace of change at BSSC has been supported by two system wide innovations in Victoria: global budgets, which provide enormous flexibility in the allocation of resources, and the capacity of schools to select their own staff. New staff members at BSSC are well aware of the nature of the school before they are selected to be a staff member.

The challenge will be to enable all schools to appreciate the value of whole school reform and equipping them with the insights and skills to accomplish it.

4.Conclusion to the Hypotheses

1. *ICT as a catalyst for change or as an additional resource.*

At BSSC, ICT was a strong catalyst for educational innovation. Whilst the focus of ICT usage at the school was from day one on curriculum and on teaching and learning it was, nevertheless, the vision that ICT would transform schools that spawned the whole school change effort at BSSC. ICT has been the catalyst for changing teaching and learning practices. It has been the instrument for changing management practices.

4.2 *Diffusion follows the pattern described by Rogers or a different diffusion pattern exists specifically for ICT.*

The diffusion of ideas about the use of ICT to improve teaching and learning followed the pattern described by Rogers. People proceeded through stages. Most started by getting to know the details of ICT. Over time they proceeded through the stages of deciding to use ICT through to personalising its uses and integrating it into their repertoire of teaching skills. People moved at different rates through these stages. They were assisted by peers. The process of moving through the stages was helped when people felt they were emotionally supported . By emotional support people meant:

"the teaching and learning coaches also provided emotional support. They didn t make you feel you were silly or inferior if you had trouble with the technology. You felt you were part of a team all working on it together."

There were groups of early adopters and resistors. Early adopters are characterised by their colleagues as risk takers and reflectors . There were also groups of laggards who resisted using ICT because they feel it is unnecessary or because it required them to develop new skills, which they felt would require too much time. Tying performance with ICT to annual performance plans helped to overcome this frame of mind.

4.3 Successful implementation of ICT depends mostly on staff being able to integrate ICT into instruction and learning or the technological infrastructure and student competence (rather than teacher competence) determine ICT implementation outcomes.
Successful implementation results from having ICT supporting good teaching and learning in an environment where teachers are expected to implement it through ICT implementation plans, teaching charters and the like. Successful implementation requires the staff to gradually acquire competence with ICT, sometimes with the assistance of students and regularly with the help of colleagues. It is also essential for the technology to be absolutely reliable and effective.

4.4 Gaps in academic performance between high and low poverty students don t increase when equal access to ICT is available to allow more advantaged students leap ahead in an ICT rich environment
Staff members suggested that ICT rich environments enhance opportunities for more able students. They are able to master them more quickly and utilise them to good effect more quickly. College external examination results (VCE) indicate that all students benefit from access to ICT when it is effectively integrated in teaching and learning.

4.5 In an ICT rich environment academic standards will improve because they are a function of teacher and school expectations and not of the standards of the ICT or academic standards will be lowered.
The case study demonstrates that academic standards are set by a range of factors, but most especially high staff expectations, the sense of competition with other schools and the culture of student trust.

5. Projections to the Future
The Principal of BSSC presented a paper in November 2000 at the European Council of International Schools conference in Nice, France, entitled *Restructuring School for the Twenty First Century*. In it he articulates his projections for the future of BSSC. The organisational arrangements and the management procedures currently in place will be used to enable the school to realise the vision. The vision includes:

- By 2001, eighty percent of communication at BSSC will be digital and twenty percent paper based
- Professional development will be conducted online and supported by face to face sessions
- There will be an even greater acknowledgement by the whole school community that every student can learn and learn to a high standard

- The concept of the nine to four school will be anathema at BSSC
- The college will become a place where students learn as distinct from watching teachers working
- Teachers work will be reorganised. Professional roles will be emphasised, non professional work done electronically by para-professionals and support people
- A sound pedagogy for online learning will be developed
- Highest quality online content will be developed
- The development of instruments that measure ICT outcomes will help to transform the curriculum
- Online autonomous learning will be further enabled by commercial products like XSIQ.

None of these projections has yet been formally introduced into the school decision making processes. Nevertheless, during the interviews conducted for the preparation of this case study several staff talked in committed ways about many of the above ideas. The Principal has been quietly sowing seeds in the form of these projections. The seeds have taken hold. Such is the way of the Principal of BSSC.

6. References

Clarkson, P. Dunbar, A and Toomey, R (2000) *ICT and Whole School Reform: An Evaluation of the Navigator Schools Program.* Melbourne: DEET.
EkinSmyth, C. (2000) *A New Kind of Education: A School s Story. Bendigo Senior Secondary College1994 to 2000*
Merydth, D. et al (1999) *Real Time: Computers, Change and Schooling.* Canberra:DETYA.
Rogers, E. *The Diffusion of Innovations* (1962) NY: SAGE.

Appendix A: Methodology
Bendigo Senior Secondary College self-selected for involvement in the study. It did so to enable it to bench-mark itself with strong international performers in the whole school change area including the role of ICT in the whole school reform process.

The data for the case study was collected over a twelve month period. During 1999, BSSC was involved in the Victorian Government s evaluation of its Navigator Schools Project. As part of that evaluation, for which the author was principal investigator, a large number of interviews of staff, administrators and students were conducted. Also a great number of classrooms were observed. In 2000, there were further interviews of staff conducted. Parents and students were interviewed. Additional classes were observed.

Appendix B: ICT Practices Survey for Teachers

Total number of participants who have completed this survey.

Bendigo Senior Secondary College: **79**

How comfortable are you with using a computer to do each of the following?

	Very comfortable	Comfortable	Somewhat comfortable	Not at all comfortable	Not answered
Write a paper	66	11	1	0	1
Search for information on the World Wide Web (WWW)	52	21	4	1	1
Create and maintain web pages	19	15	12	30	3
Use a database	32	15	16	12	4
Develop a database	14	9	19	31	6
Send and receive e-mail	68	10	0	0	1
Write a program	6	5	10	49	9
Draw a picture or diagram	30	17	18	10	4
Present information (eg. Use Powerpoint)	57	11	5	3	3

How important is each of the following computer-related skills for your teaching?.

	Very important	Important	So-so	Not at all	Not answered
Write a paper with a word processor	60	15	1	2	1
Search for information on the WWW	43	24	10	1	1
Create web pages	19	21	22	15	2
Use a database	17	25	20	15	2
Develop a database	7	16	29	24	3
Send a receive e-mail	48	23	6	0	2
Write a program	5	6	23	37	8

Draw a picture or diagram with a graphing/drawing application.	23	19	21	13	3
Present information (eg. Use Powerpoint)	41	22	9	2	5

During the past school year, how often did your students on average do the following for the work you assigned?.

	Several times each week	Several times each month	A few times	Never	Not answered
Use the internet	23	30	22	2	2
Create web pages	0	9	29	37	4
Send or receive e-mail	19	16	30	12	2
Use a word processing program	29	29	17	2	2
Use a computer to play games	2	3	10	55	9
Use a spreadsheet	2	6	32	34	5
Use a graphics program	6	13	27	28	5
Join in an on-line forum or chat room	1	6	18	50	4
Use a presentation program (eg. Powerpoint)	7	37	27	5	3
Use an instructional program (including simulations)	2	17	24	30	6
Other computer users (specify)	[Click here to view the answers to question 29]().				

How would you create your ability to use a computer?.	**Poor**: 0 **Fair**: 13 **Good**: 57 **Not Answered**: 9

Answer the below questions based on experiences or policies from the last school year?.

Was student computer use ever evaluated for grading?	**Yes**: 48 **No**: 29 **Not answered**: 2
If you assigned Internet searching, how much freedom did you allow students in locating sites to visit?	**No Restrictions**: 24 **Some Restrictions**: 39 **Designated Sites Only**: 9 **Not Answered**: 7
Did you modify a Website with any of the classes that you taught?	**Yes**: 21 **No**: 56 **Not answered**: 2
What portion of the computer use in your classes was directly related to the course content?	**Very Little**: 7 **Some**: 24 **Most**: 22 **All**: 22 **Not Answered**: 4
What portion of the computer use that you assigned was done by students individually?	**Very Little**: 4 **Some**: 32 **Most**: 36 **All**: 5 **Not Answered**: 2

If you have a computer at home, how often did you use it for preparing for teaching?	**No Computer**: 6 **Never**: 1 **A Few Times**: 10 **Several Times a Month**: 14 **Several Times a Week**: 45 **Not Answered**: 3
Did you participate as a student or instructor in a virtual course through the Internet?	**Yes**: 7 **No**: 70 **Not answered**: 2
Did you involve your students in collaborative learning over the Internet with students from other classes?	**Yes**: 12 **No**: 65 **Not answered**: 2

Are you currently using technology to collaborate with other teachers (eg. Chat / Forums)?	**Yes**: 21 **No**: 56 **Not answered**: 2

How many e-mail messages do you send each week on average?	**None**: 0 **1 To 5**: 19 **6 To 11**: 16 **More than 12**: 43 **Not answered**: 1

How many of the following have you ever done?

Made changes to a computer's hardware	**Yes**: 28 **No**: 51 **Not answered**: 0
Updated an application program (eg. Word Processor)	**Yes**: 57 **No**: 21 **Not answered**: 1
Recovered a damaged file?	**Yes**: 40 **No**: 39 **Not answered**: 0
Created a website?	**Yes**: 40 **No**: 39 **Not answered**: 0
Developed a database?	**Yes**: 37 **No**: 42 **Not answered**: 0

Appendix C: Documentation

Diagram of the Leadership Structure at BSSC in 2000

Bendigo Senior Secondary College 2000

COLLEGE COUNCIL

COUNCIL SUBCOMMITTEES

Education Finance Facilities

PRINCIPAL GROUP

College Leadership
College Leadership – Specific Responsibility Area – Personnel & Priorities
College Leadership – Specific Responsibility Area – Administrative Systems

R Lake
B Millen
R Hallikoy

Management Area	Students	Personnel & Priorities	Business	School to Work	Curriculum	Administrative Systems	Educational Leadership	Learning Technology	ICT	Web Project Officer
Responsibility Position	Manager	Assistant Principal	Manager	Manager	Manager	Assistant Principal	Manager	Manager	Manager	Manager
Name	Amanda Hubber	Rev Miller	George Dekloet	Rosalie Lake	Barry Nash	Rob Hallikoy	David Castles	Peter Nicolson	Peter Harvie	Peter Lasstock
Team	VCE Coordination; Student Welfare Coordination; Student Support	AAC Chairperson; Student Activities (extra curricular)	Support Staff; VASS; Cleaners; Maintenance Officer; Emergency Management; Occupational Health & Safety	Careers; VET; JPP; DSE	Learning Area Coordination (including VCE Management); Library; Student Coordinator; Activities (Curricular); UIC; Sport	Daily Organiser / Timetabler	Graduation Ball Coordinator	Internet Development Coordinator; Curriculum Teams; On-line Curriculum Development Coordinator; CEGO Coordinator	Technical Assistants	Multimedia Development Officers
Responsibilities	Student Code of Conduct; Enrolments; Welfare; Management	Staffing; Allotments; Annual Report; Teacher Performance; International Program; Awards Night	Finances; Support Staff; Facilities	Careers; Vocational Education	Key Learning Areas; Accelerated Learning; Assessment and Reporting; Authentication; Curriculum; Professional Development	Administrative Systems; Approval of Professional Development; Excursions; Census	International Accreditation; Triennial Review; Navigator Schools; Conference; Graduation Ball	College Internet; Delivery of Professional Development; Research; CCNA; AAP; Arias	Development & Maintenance of the College Network; On-line Team Management	Teaching and Learning; Best Practices; Global ICT; Professional Development; External Web Contracts; External PD Program
Representative Committees	Group Teacher	AAC	Facilities Finance		Education				Technology Steering	

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[1] The Victorian Department of Education, Employment and Training clusters schools into groups of like schools to enable comparisons of schools to be made of their relative performances on a state wide testing scheme.

[2] The Victorian Certificate of Education (VCE) is the credential used to mark the satisfactory completion of secondary schooling in Victoria. It is used to calculate tertiary entrance scores of applicants for places in the further and higher education systems in Victoria.

[3] There is a range of specifically vocational education programs incorporated into the VCE system.

[4] The CISCO, Microsoft and Aries courses are all commercial technology related courses.

[5] Schools in Victoria develop triennial strategic plans that are used for planning and accountability purposes that identify each school s mission statement, goals and priorities for action. The Triennial Review process assesses the school's progress and degree of success in the implementation of these goals and recommends priority areas for improvement.

[6] The EDGE Program was a program designed to equip students with job skills   Education Diversity Gains Employment.

[7] The Performance Management program is a statewide program of performance appraisal for leading teachers.

[8] The Schools of the Future Program was Victorian Government policy in the early 1990s. It emphasised school self management, made provision for schools to manage their own Global Budgets and monitored performance through an accountability framework coordinated by an Office of Review with the Department of Education, Employment and Training.

[9] Navigator Schools are expected to conduct leadership and teacher professional development for Victorian government schools.

[10] PPP=greater than 80% of classrooms observed demonstrated this feature. PP=greater than 60% of classrooms. P=greater than 40% of classrooms.

[11] Students performance on the VCE is statistically moderated with their performance on a statewide General Aptitude Test (GAT), which all VCE Units 3 and 4 students complete in mid-year. Results are used to moderate internal assessment.

[12] A formal study skills session for students timetabled within normal school hours.

[13] These were projects developed by faculty based groups designed to stretch the use of ICT and indicate the expectations the school had for ICT. Datalogging in Science was one project. The electronic publishing submission of VCE work to the Victorian Board of Studies was another.

[14] Data returns from the Department of Education, Employment and Training, Victoria Government schools' survey in December 2000 recorded an average ration of 1:4.6 (one computer per 4.6 students.