Research Question One

How is the availability and use of ICT changing the use of existing classroom spaces?

Introduction:

Most schools in New Zealand are over fifty years old with some, like my own, having existed for over a century. The classroom spaces we operate in were designed to reflect the traditional, transmissive style of curriculum delivery with little, if any thought being given to investigation-based, group learning, let alone fibre-optic cabling. While some funding is available for renovation and rebuilding, the reality for most schools is that existing spaces must, in the short term anyway, be adapted to accommodate new learning technologies.

Thinking differently about teaching spaces

The arrival of even one computer in the classroom can have a profound effect on the way students learn and the way the classroom operates. Teachers integrating computer use into the curriculum, soon modify their classrooms to reflect the changes in student learning behaviour that inevitably emerge. Creating space in the classroom for computers and peripherals such as a printer, network connection and large monitor initiates a rethinking process by the teacher, leading to re-evaluating how classroom activities and learning experiences work best.

Early responses to ICT often involved creating a technology centre, or dedicated building to house computers and peripherals, with students being taken to these facilities when work with computers was needed. Computer laboratories were developed with classes being booked in for whole class use of the technologies; this arrangement still exists in most schools visited. Alongside the laboratories, however, a variety of solutions has developed, enabling in-class access to computer facilities and it was these arrangements that were of interest in this research.

Little research has been carried out into the effects of room arrangement on children's learning. Stephen Heppell[7], at the ACEC conference in July 2000 asked: What do we know about the placement of tables in classrooms? What are the relationships of children inside the classroom to the outside world? Are we creating barriers to the outside and adults with

[7] Professor, Anglia University, UK, originator of *UltraLab, NotSchool.com*

our classrooms? Where should the computers be?[8] This paper reflects some answers found by educators.

The anytime, anywhere access to information sources, "ubiquitous" computing, enables students to engage directly with expert sources when they are needed and the *sight, sound, touch* experience becomes a powerful motivator in learning. Bernard Hollkner[9] says, "The Cast of Players in a student's learning experiences has increased dramatically. Convergent technologies now allow experts, peers and collaborators to join the student's world, enriching learning experiences."

Professor Hedley Beare in 1998[10] saw the role of the teacher becoming more fluid and covered by "a range of professional educators – tutors, instructors, mentors, learning theorists, curriculum planners and experts, assessors, curriculum writers, assignment markers, editors and student counsellors". A mix of on-site and distance programmes seems a likely mix for the student of the future.

What is the Ideal Classroom?

Brett Hunter[11] believes today's classrooms need Internet access for research, distributed multimedia curriculum on line, access to digital libraries, distance education courses and remote collaborative tools. Information on demand for students also includes video, live video broadcast, desktop videoconferencing and 3D modelling. "The use of voice (for activities such as interviews, speeches, background music, explanations) and Video (for live conferences within and between schools) will change the way schools operate".

Tomorrow's classroom

Paul Butler, Head of Information Technology at Caulfield Grammar School, Melbourne, believes classrooms will be characterised by:

- access to on-line resources which use a powerful combination of video, multimedia, text and graphics, prepared by specialists in a centralised resource development facility and delivered to individuals or groups by technology

- provision for the teacher to teach the whole class or part of the class, assisted by technology as appropriate

[8] Paraphrased by writer

[9] *Faculty of Education, Monash University, speaking at ACEC Conference, Melbourne, 2000*

[10] IARTV Seminar Series, quoted in *Schools Without Walls,* David Campbell in Independent Education Vol. 30/No 3, October 2000

[11] *Industry Development Manager 3COM. ACEC 2000*

- provision for all students to learn the same way or to choose ways which suit their own individual learning styles, assisted by technology as appropriate
- access to individualised curriculum pathways, managed by technology
- access to individualised diagnostic testing and assessment of progress, managed by technology
- students moving independently between learning areas as necessary, managed by technology
- flexible room layout and furnishing
- large-screen video display
- individualised access to network resources – wireless networking; cheap, light-weight notebook computers; e-books
- continuity of access to network resources away from school

So what is really happening in classrooms?

My research revealed that, although some classrooms remain apparently untouched by technology, many classroom configurations have changed to incorporate easy access to the computer(s) and to facilitate the discussions, problem solving and decision-making that inevitably follow their use.

Schools in my research group made a number of differing responses to ICT. Through grouping these responses, I have created the following list of observed trends in the use of classroom spaces with ICT:

- Rearranging the Classroom
- Creating New Spaces From Old Configurations
- Providing Centralised, Shared Facilities
- Creating Dedicated, Flexible Classroom Space
- Developing Virtual Classrooms And Campuses
- District Networks Creating Learning Communities
- Web Hosting By An External Provider
- Classroom Redesign For Maximum Flexibility
- Wireless Technology Offers New Options
- Changes In Traditional Library Areas

Re-arranging the existing classroom

My most frequently-viewed, changed classroom design involved creating **three main areas for student use**: grouped and networked computer facilities, student desks facing a whiteboard and monitor linked to the teacher's computer and an area designated for group-working space. In some smaller rooms, the latter was created when needed by rearranging the desks to form groups. Adjustable chairs and/or desks enabled safe use of computers for students.

No "front" to the classroom

Classrooms at John Paul College, Brisbane reflected computer use in several ways. The aim is that **old and new spaces are no different in operation**: **flexibility and power** being the keys to successful programmes.[12] Older classrooms have been adapted for use with new technologies[13] by installing more power points and benches. Two rooms with connecting doors have been rearranged to enable more group, presentation and combined class activities. As the teacher explained, "having a board at both ends means there is **no *front* to the classroom, anymore"**. A pervasive air of purposeful activity surrounded the class: groups of desks were placed close to network points (although the growth in wireless technology will soon free up this restriction); a centrally hung screen allowed another group of children to view a data-show presentation. Tables of resources were placed near groups and a printer, scanner and monitor were on a mobile trolley. The two rooms work together and share resources.

Sharing resource spaces

New classrooms are built around **a central, well-equipped, soundproofed wet resource space** which each of the four classrooms used for Art, withdrawal groups, remedial assistance or project work. All of these classrooms used wireless technology, all classrooms have a large TV monitor/display ("couldn't function without this") and classes had a small "sound" room at the rear of classroom for recording in multimedia presentations. Flexibility is important to the operation of the classroom.

Easily-moved desks

Movable desks in classrooms are individual and can be **reconfigured** for the many different functions in the room ("we used to have tables but found them too constraining of activities"). Wireless cards were stored in a wall-hung, individually named organiser, enabling the teacher to see at a glance whose cards (very expensive!) were in use. Each day began with 30 minutes of basics using notebooks – spelling, mathematics facts, journal time and keyboard skills.

[12] Aidan McCarthy, Director of IT
[13] This is a Laptop school

> *"This gets students into correct habits of unpacking notebook, storing bags, checking for functionality"*[14].

Security needs to be managed

Security is a big issue at JPC; before leaving classrooms, windows, lights and doors must be checked. On-site security checks are made each break and lunchtime and teachers who forget are named. Routines are important.

Shared software

Le Fevre College, Adelaide enables **computer group work** to take place by arranging seven computers in an oval central "island", screens and keyboards outwards, and using **shared software**[15]. Each student in the group can add to the combined project from their individual keyboard and the combined project can be viewed and shared by all.

Configurations evolve with use

A great deal of research went into setting up the classrooms at Advanced Technologies Academy, Las Vegas, a school that is only five years old. The English classes comprise PC's on benches around the walls, large areas of space for movement and other activities and a set of circular tables for students to work at in groups. In Mathematics, the classrooms were originally set up with each student having a PC on the desk, two large monitors at the front of the class and the rear wall of the classroom completely mirrored so that the teacher could see the PC screens from the front of the room. **After two years, that set-up changed as the teachers realised that computers were not used all the time in class**. Now the computers are ranged along each of two walls with a large monitor at the front of each row. Desks are arranged in the middle of the classroom for whole-group teaching and the teacher's demonstration desk (in all classrooms) comprises a computer, video, monitor (connected to the two large monitors) and printer.

Creating a Business Centre Model

Vanguard School, District 214, Illinois is the result of rethinking the needs of students who have not succeeded in the traditional school model. **The rooms have been redesigned to replicate a fully equipped, modern business centre,** complete with a reception foyer. All curriculum subjects are integrated and project-based, so students do not study English, Mathematics, Science …. There is one computer to every two students and no classrooms: they are *conference rooms.* Classes became *workgroups* and appropriate styles of address and appearance are expected when the students undertake work experience in community businesses. A high level

[14] Head Teacher, Jan McNamara
[15] Zing Technologies

of success has been experienced with students although other schools in the district have not taken up the model.

Central "island" in the classroom

At Weydon School, Surrey, the ICT teacher changed the *rows of desks pointing forwards* style of classroom to **creating a central island in the class** with an interactive whiteboard on the end wall. This arrangement enables a more easily monitored, friendlier environment.

Creating new spaces from old configurations

At MLC, Melbourne, in the late 1990's, a long block **of ten "shoe-box" classrooms was rebuilt to form four large, flexible glassed-in teaching spaces with teacher conference rooms in between.** The walls of the conference spaces were also glass, enabling staff to view student activities. The new spaces were designed to allow maximum student space both inside the "classroom" and in the outer corridors, carpeted and stepped to provide student seating. Network access points were arranged in these areas as well as in the classrooms.

In the Oregon School District, Wisconsin, within the old footprint of the building**, a large, flexible space was created where movable walls** separated off teaching spaces while a shared, central resource space contains abundant computer and presentation resources. These are used co-operatively among teachers and collaboratively on cross curricular and class projects.

King George V School, Hong Kong is **developing a shared workspace from two "old" classrooms.** "The layout of the classroom has changed from each student needing a computer on his or her desk, because teachers can now assume that students have all the necessary computer skills so can concentrate instead on teaching Business Studies, using the computers as and when appropriate. The design includes a glassed teacher space between the two classroom areas to reduce teacher isolation, enable supervision of other teachers, ease of movement between classes and opportunity for team teaching and planning."[16]

Both classrooms are set up with computers around the perimeter of the room and work tables grouped in diamond-shaped "islands" in central space. A whiteboard was placed in the teacher's teaching space.

Workshop spaces, formerly assigned to industrial arts education, have proved to be **excellent in housing ICT facilities**. At Pacoima Middle School, San Fernando, a visionary teacher, to offer students experiences in applied computer technology, has transformed a former workshop. The room comprises sixteen bays, large enough to allow adequate working space for two students and the equipment involved in e.g. Virtual

[16] Head of Department, Economics

Architecture, Aerodynamics, Robotics, Digital Music, Computer-Aided Drafting, Telecommunications, Health and Fitness or other activity. Students apply the skills they are learning to a real task and spend two weeks of their allotted time on each activity. A similar concept, produced by a different company, was successfully being implemented in previous workshop space at higher secondary level at King George V School, Hong Kong. Tasks here included: Industrial Control Technology, Electronics Technology, Robotics and Automation Technology, Mechanisms, Materials and Processes, Aerodynamics (wind tunnel), Pneumatics, Multimedia, Graphics and animation.

At Elk Grove, District 214, Chicago, Illinois, the Applied Technology Laboratory has been created through the combined effort of industrial arts and science staff. Again, **two-student booths have been created in a large space** and students work through a series of applied technology models.

San Fernando Senior High School has been successful in gaining funding for a huge computer facility, the design resulting from school research. Housed in a disused industrial arts space, the **Community Inspiration Centre** will house sixty–four IMacs, videoconferencing room, digital imaging and editing facilities, blue filming room, Think Rooms and a huge **video wall for image projection**.[17]

> *"There was a "huge battle to get this room for IT; the Board wanted to build an auto shop so that graduates would get jobs in the automotive industry – but Ford downsizing had a huge impact on this community and I finally convinced them that IT is the way of the future".*[18]

Providing centralised, shared facilities

Providing leading-edge facilities and ICT equipment in a centralised environment has enabled students from many schools access to learning technologies that would otherwise not be available to them. This is the solution chosen in Adelaide where the DETE[19] has established the **Technology School of the Future**[20], a spectacular district **technology centre**. TSoF is a highly sophisticated project with 11 specially set up labs with the latest technology in every curriculum area. State of the art in Music, production and editing; CAD, pneumatics, and other technologies. Music suite has presentation area with smart lighting, curtains, sound operated from footpad sensors; smart workstations with cabling and special effects mounted under the centre of elevating tables. It is a teacher and student training facility with skilled ICT trainers where teachers can book to bring classes for short or long term projects.

[17] Plan available
[18] Marco Torres, IT Coordinator
[19] Department of Education, Training and Employment South Australia
[20] www.tsof.edu.sa.au

Creating a dedicated, flexible classroom space

Keeping one**, fully equipped classroom space to be shared by a block of six or so classrooms** has enabled teachers at Caulfield Grammar in Melbourne access to computers for a whole class. The room can be configured to suit an individual teacher's needs with 16+ network outlets, PC's on trolleys that can be placed to suit and a set of laptops permanently available (stored in a security locker in the room).

Creating virtual classrooms and campuses

Creating a virtual classroom space where students can log in and find course notes, resources, worksheets and teaching tips enables students who are home-bound, out of school for sport or cultural activities or on fieldtrips, to maintain contact with their coursework and teacher. Many schools are now pursuing this method of improving services to students and their families. Caulfield Grammar, Melbourne **links all five campuses (one in China) through their Virtual Campus**.

> *"One of the school's aims is to establish a network of learning institutions around the world, linked together through strategic alliances and sharing best practice through the exchange of staff and students and the use of learning technologies."*[21]

See also Denbigh OnLine, UK.[22]

At John Paul College, Queensland, where each student has a laptop computer, course outlines, assignments, key teaching points and research suggestions are all available on the **school intranet. Remote access** enables student, parents and school community members to access these "anytime, anywhere". This individualised learning capability has allowed for individual differences in learning while clearly delineating the learning outcomes required at each level.[23]

Using Oracle software, (Think.com) Netherhall, UK[24] have created an **on-line community of students, most staff and parents with Internet access at home or work.** This has "torn down the classroom walls" and enables teachers to utilise the home computers to extend the school's capabilities. On-line communications are enabled and students can work on projects from both school and home. Students who are ill or absent for other reasons can maintain contact.

Bendigo Senior Secondary College, Victoria**,** host of the Navigator Schools' Conference in July 2000, has a highly developed intranet enabling each student and staff member to access course information readily**. Aiding individualised learning** has been a key goal for BSSC

[21] Caulfield Grammar spokesperson, quoted in *Educare News*, May 2000
[22] www.denbigh.net
[23] Also www.kingscollege.school.nz , www.kgv.edu.hk
[24] www.netherhall.cambs.sch.uk

and the school provides an impressive role model for others in ICT provision for staff and students.

Starship School, created by Edventions in Skokie, Illinois, is an example of a **commercially developed virtual school which existing schools can adopt to supplement the resources and administration services they already have in place**. Starship School provides validated, "kid-safe" databases of on-line resources, teaching plans, self-marking modules and the provision is expanding all the time. Web-based administration systems save schools time and staffing and a fully developed, on-line fundraising service has been well received.[25]

Schools linked to share classrooms and teachers

A **District Interactive Classroom** comprising classrooms replicated in four or eight schools was viewed at Edgewood College, Madison and Oregon, Wisconsin. These **distance learning facilities** operated not on the videoconferencing principle but were **interactive** so that what was happening in each classroom could be seen and participated in by each of the connected classrooms. Each room was equipped with a bank of monitors at the front and rear of the room, each monitor showing a different participating class. A roving video camera in each classroom automatically focussed on the person speaking. Each student in each participating classroom had a microphone mounted on their desk and when he or she asked a question, the camera moved in to film the speaker and the image was displayed on the screen.

One classroom led proceedings and the teacher had a document camera, video, data-show and other presentation equipment to use in the course of a lesson.

Although resource intensive, these classrooms offered an excellent **opportunity for schools to share scarce experts and to bring distant classes together for research projects**. In Oregon, a community Book Discussion Group used the facilities to excellent effect.[26]

District networks creating on-line learning communities

Developing the *virtual classroom* concept even further, school districts in the USA are using **highly developed networks to bring all public schools in the district together in a collaborative way**. Each teacher, student and administrator becomes a participant in the Learning Community. The Clark County school district, Nevada is an excellent model of this approach. Their *Technology Development Services* division, through the network InterAct, "concentrates on fast-tracking innovation".[27] InterAct hosts web pages for all schools, provides Internet access for teachers

[25] www.starship.com
[26] Pictures of this facility available
[27] Bruce Daley, Technology Development Services, Clark County School District, Nevada

and students (8000+ accounts) and provides a platform for collaborative resources. Teachers pay $12.50 for a lifetime account, students are paid for by the District. Students have to qualify for their computer *Driver's Licence* before getting their account (computer, e-mail and Internet training)

> *"The network provides space where teachers get used to working together – they collaborate and come up with inventive solutions. They use the contacts to teach each other and share resources. They get to know each other across 8000 square miles* ***- the network is creating*** **technological capital."** *Bruce Daley*

Areas on the CCSD Network include:

Exchange – where a person who can be a "shared resource" e.g. US Senator or a Native American storyteller, is available for asynchronous chat and some real-time questions and answers. These programs are cached and can be video-streamed to all schools.

Policies and Regulations, District documents with a search facility included.

lnformation for subject teachers, elementary and secondary; FOSS (Science on line), teacher tips, **Classroom Connect** (four scientists in the area attached to projects)**; Special events** e.g. the Treasures of Russia exhibition, are used as a basis for digitised resources for the TV station and picture videos on the network, printed resources are available for teachers to extend the knowledge gained on the trip to the museum.; **Concert series** (bands from schools in district).

QUEST – additional resources are made available for teachers through KLVX, the public broadcast station – videos and broadcasts supplement classroom teaching; field trips available in schools, requests for pictures sent out and these requests allow sharing of resources and planning.

Professional Development opportunities offered on-line

Virtual Art Gallery is not a *real* art gallery at all. The digital art works change every nine weeks and the lighting in the roof of the gallery changes depending upon time the computer accesses the site. A library could be made in the same way, with orchestral concerts for the schools,[28] Digital Art Exhibition published on CD for the district.[29]

It will soon be possible for students to place music auditions on the network so music colleges all over the world can access them for scholarships.

Virtual School tour – so that residents can see what the planned school is like when voting to have it in the neighbourhood. (55 new schools are to be built in the next 10 years).

[28] Comment by Bruce Daley
[29] CD of Art Exhibition available on loan from the author

After-school tutorial programme meets twice a week and all sorts of topics are covered: health, nutrition, hygiene, music, arts, fine arts (this was a student idea).

Ask the Experts Students submit questions; research teams of high school students try to answer: if they cannot, university personnel work on the question. Each month there is a special focus e.g. in September/October there was a Mock Election, prior to the USA elections.

Junior Web Fifth Graders did not like some of the sites the adults recommended so came up with their own grading criteria – when they find sites they like, they submit their evaluation for inclusion on the network. The site of the week is featured. There are plans to do the same with Book Talks. Preparing items for the network develops children's analytical skills.

Global Village Students and teachers from schools from different countries form this. Schools from England, Scotland, Canada, Germany, Sweden, and New Zealand connect at night to discuss issues – e.g. arming Police and they get to know each other and their views.

Private contact areas available for teachers or discussion groups.

Global moderators offer customised conferences for new teachers. This concept would be very useful in New Zealand for those in their first five years of teaching.

> "Social networks are very important in building the human capital of the district"[30].

Other areas visited offered district-wide services to schools. Los Angeles Unified School District has created a **virtual museum,**[31] offers district information, professional development and has 2000 plus videos which they make available on demand via network and, using high band width via cable, download educational programmes in "off hours"; schedules sent to schools and selections recorded on demand. (The Internet will soon supersede this technology.)

District 214, Chicago, Illinois,[32] where the entire curriculum is available on the website, offers data support, all **registrations are on-line**, cataloguing of all **district databases** (60+) on web. **Livetext allows teachers to put up content on a webpage and enables them to offer on-line classes.** Conferencing, calendar, fostering collaboration, conferences, students will have email addresses throughout district. BadgerNet, Wisconsin links all schools that have suitable connections.

[30] Bruce Daley, Technology Development Services, Clark County School District
[31] www.lausd.net
[32] www.dist214.K12.il.us

The BECTA site, England[33], *Connecting the Learning Community*, offers a range of national services including the National Grid for Learning site, a Virtual Teacher Centre providing information and resources for educators using ICT.

The DETE network in South Australia **DESCtech2001** (Department of Education and Children's Services technology plan) **has set up LAN's in all schools with Internet connections. A state-wide LAN connects all schools with ISDN**.

New Zealand's Ministry of Education website[34] offers national information and Te Kete Ipurangi[35] is the portal for on-line resources for the New Zealand education community.

The concept of on-line learning communities is fast developing and has the potential to transform the way teachers connect, collaborate and achieve professional development.

Web hosting by an external provider

In Hawaii, the Maui High Performance Computing Centre (MHCCP, to be renamed SuperComputer) is the largest Internet service provider (connected to over 600 ISP's) and offers service hosting and can store programmes for schools. There is an **E-School with virtual spaces where students log-on for real-time interactivity "like a sandbox"**[36] where they meet, discuss, share ideas and co-operate. Bill Wiecking believes that **Chat and instant messaging** will be important communication media in the future.

MHPCC also offers:

ASP – **Application Service Provider**– e.g. allowing schools or companies to go to a page and do wages every Friday so there is no need to buy licences, or maintain software in workstations. Also they provide AutoCAD, a high cost application beyond the means of most schools, hosted by SuperComputer (MHPCC); students can log on, take the course at their level, work and then save to the web. Students can log on at school or at home.

Sixty-two schools in the Hawaii Association of Independent Schools through the state are involved in a distance learning project through SuperComputer. **Remote coaching** is also hosted and used as a professional development tool.

One school needed a computing teacher so is now videoconferencing with a school that has a teacher with 8 students. The teacher has on-line hours

[33] www.becta.org.uk and http://futureclass.ngfl.gov.uk
[34] www.minedu.govt.nz
[35] www.tki.org
[36] Bill Wiecking, Manager of Educational Programs

and class hours, but, as Bill Wiecking says, “this is not a total solution because a class needs a “warm body” at times also”. A school has also hired an astronomer in this way for a number of hours.

Videoconferencing chat with a shared whiteboard screen: Snapshots of the participants are represented on each screen connected to each of the nine participating sites – Boston, Hawaii, Maui, New Mexico and others. “Some participants appear in bathrobes to emphasise the time difference”.

Streaming media: Real media (what everyone uses for radio, TV and taping movies for demand viewing) when hosted in a server enables up to 2000 to watch a hosted video at once. For example, people in six or seven continents watched MaryKnoll’s MayDay celebration in Hawaii. (NB: There are only 200 students in this Grade School). Also, personnel from the University of Hawaii at Hilo audiostreamed, in Hawaiian language, interviews of “old” Hawaiians. There is now a database that allows you to select the categories you want to access.

Digital Video – At Hawaii Preparatory Academy[37], students **make and edit digital films**. All the video is recorded and edited at school and uploaded to the Maui server at night. **Relatives in the mainland can hit the server at night and view the films**. Live screening of video is possible also. Another project, *SeeMore Turtles*, involved students placing video cameras in a very secluded reserve, a turtle habitat. Waterproof cameras are aimed at the turtles and from the school, students can control the cameras and pick out the turtles they want to see.

Streaming Server – asynchronous: Because the streaming server catalogues all of the contents, users can choose the item wanted and it will download just that. (“Rather than non-streamed where you used to have to wait a long time and watch the whole thing. You don’t have to have big connection you can use a 28K modem.”)

Classroom redesign for maximum flexibility

The advent of ICT has allowed – many would say, demanded - the classroom teacher to develop more individualised approaches to the learning needs of students. The immediacy brought to classroom experiences by contact with on-line experts, the world’s best libraries and encyclopaedias via the Internet means that curious students can learn far beyond the planned lesson.

Using laptop computers

In the search for flexible teaching styles, schools in more affluent circumstances have invested in, or engaged parents in the purchase of, mobile learning technologies (laptop computers, I-Books) for each student. ***Laptop schools*** proliferate through the countries involved in this research

[37] www.hpa.edu

and much is written to support the success of the **24/7** (twenty-four hours, seven days a week) **access to ICT** and the Internet for students.

District 214, Illinois is conducting **research into the effectiveness of laptop technology in learning** using 90 IBooks with a wireless network. Pre and post research being carried out on both the control and experimental groups for a year at least beginning January 2001. Two identical courses are being taught – one with 24/7 (24 hours, 7 days a week) IBooks, the other without. Three test areas will be involved, English, Social Studies and High-risk students. Testing involves both an attitudinal survey and academic achievement, measured on standardised test. Every week students are given a survey to measure progress and detect problems.

> *"We are trying to measure how student-teacher interaction changes and whether the types of learning activities are different with the application of technology."*[38]

Virtual Learning System (VLS)

At Fenton Charter Elementary School, San Fernando, **a desktop computer has been supplied for each student from Grade Two**, and children younger than this have ready access to computers for appropriate tasks. The school engages in a **Virtual Learning System** whereby **all resources are digitally stored and children pursue individualised learning programmes.** The dynamics of the class were quite different from a traditional classroom and it was interesting to view a classroom of Grade Six students who had been involved in the VLS since Grade Two and whose new computers had not arrived by the end of the first week of the semester. Both teacher and students were finding the adjustment to a whole-class, "whiteboard and folder paper" environment difficult. It was allowing more emphasis on handwriting, but the teacher said that she had forgotten the "I'm finished. What will I do now?" syndrome as students on-line always had personal investigations and research projects underway.

Desks, each with an IMac, were placed in groups of four or six in the younger classes and in double rows, with students facing each other, in the older grades. Storage areas for books, pens and resources were established between each computer and moveable dividers were placed between students for assessments.

Flexible facilities in Science

Science facilities at Edgewood, Madison aimed for flexibility by **having mobile bench units able to be networked via ceiling points**. Michael Kinnaird[39], when demonstrating the mobility of the science facilities,

[38] Ken Wiseman District Technology Co-ordinator
[39] Advanced Technologies Academy, Nevada

commented “fixing the teacher’s demonstration area in one place was a mistake as it reduced the flexibility of other possible configurations”.

Redesigned science facilities at Worth and King George V School placed computer areas in one or two spaces in the laboratory, work desks/benches facing whiteboards and monitors, with practical work areas in easy reach of both.

For practical work in science at Parry Sound High School, North Toronto[40], free-standing bench units are made into required sizes from **trapezium-shaped, movable components that can be reconfigured around central “cores” to which water, air, gas, electricity and network points are directed**. Further flexibility was gained by a computer area extending into the generously-sized corridor. A **combination of a roller door inside the lab and lockable doors into the corridor, enabled computers in this area to be accessed from the corridor** when the laboratory was not in use.. All computers used in the classroom are linked to the teacher’s computer and display unit so demonstrations can be made in the teaching area, facing the main monitor or via each individual student’s screen.

Portable Hubs

Over the past few years, schools such as MLC in Melbourne have created this flexibility to some extent by the **use of portable hubs** which provide up to 16 connections for student laptops from a single plug-in point that connects all sixteen to the intranet and Internet.

Tools for Flexibility

Laptop carts

Providing security, network connection and recharging for up to 30 laptops, laptop carts, *pictured on the front cover,* were in use in many USA schools. A Teacher Assistant (TA) managed the cart maintenance and bookings. Able to be wheeled from classroom to classroom easily, the carts **give teachers flexibility through access to a class set of computers when needed** without the space implications of permanent desktop PC’s. Lift access enabled their use in multi-storeyed buildings.

Interactive Whiteboard

Niel McLean[41] cited the use of the interactive whiteboard (IWB) as a key tool for enabling teachers to transform their teaching activities. Connected to the teacher’s computer and data projector, the whiteboard becomes a

[40] Viewed in 1995
[41] Director, Evidence and Practice, BECTA, UK

touch sensitive computer screen, and changes made with light pens or electronic erasers are saved into computer files.

Using the IWB to share prepared files with the class enabled closed, private and transmissive teaching (where teachers maintained control of the classroom), to move through stages to more open, collaborative and interactive teaching styles. Control is thereby shared with the students and the needs of varied groups within a class are met.

He explained the evolution in terms of *Stages, Control* and *Arena:*

STAGE	**CONTROL**	**ARENA**
First Stage	Private	Private
Teachers controlled classes in closed classrooms		
Second Stage	Private	Public
Teachers still controlling but interactivity includes others (teacher still controls the IWB)		
Third Stage	Public	Public
Where teachers empower students to organise their learning in an open arena		

Jenny Noel-Storr, Head of Redhill Primary School, Shropshire[42] believes the IWB to be "dramatically successful"[43] in enabling ICT use to permeate the school. "The whiteboards combine with data projectors to give teachers complete, touch-sensitive control of the computer from the front of the class."

Additional software can enable on-screen chat between teachers and students and remote control of the data from a student's individual screen.

Using the IWB at Greensward College, Hockley [44], desktop documents can be displayed (Word, PowerPoint, graphics etc) then adjustments made during the **lessons are archived, with time and date, for recall and revision. This has cut down dramatically the amount of photocopying, text and paper resources. Students who have missed lessons can download these to take home**. The school is preparing to create a 24-hour Lifelong Learning Centre for pupil access anytime, anywhere.

[42] http://atschool.eduweb.co.uk/redhill.primary cited in *ICT in Practice Awards, 2001*, BECTA
[43] TES Online, January 5, 2001
[44] *The Classroom of the Future* DfEE, 2000 http://futureclass.ngfl.gov.uk

Portable presentation system

An interactive presentation station for the classroom could be wheeled between rooms and took up very little room. It comprised a hard drive, data projection, document camera and digital recording camera which enabled computer images to be displayed on wall and filmed as the teacher made adjustments with a light pen during the lesson. Internet connection, keyboard and mouse were included and all were mounted on sturdy cart Lessons can be programmed in and all saved to network or hard drive for retrieval by students later.

Wireless technology offers new options

Schools are **combining the use of wireless networks** – connecting laptop computers within a radius varying from 50 metres to 30 miles[45] **- with already established cabled networks**. This provides "**the ultimate flexibility**" according to Marco Torres, Apple's Teacher of the Year, who is the Technology Co-ordinator at San Fernando Senior High School, California. Picnic tables with shady umbrellas have been set up in the courtyard outside the second-story main laboratory and students are able to work in more relaxed surroundings while still having connectivity.

H P Academy, Hawaii used **wireless cards in their laptops** when studying the regrowth of plants in a burnt out area. Students from different areas of the study scene took **digital pictures** and downloaded them into a central database. The **school jeep, with a wireless broadcast antenna beamed the pictures back to school**. They compared results on site and the pictures were also discussed back at school. The teacher suggested an expert on the mainland who could look at the pictures and comment on what they have found. Now the students are overlaying their data on to old surveillance maps and creating a useful resource.

At Hamakua, **wireless broadcast antennae** were set up in 5 schools to assist students who "do interesting stuff at school but have **no power at home**" (Power only on 2 hours a day.) They **take laptops home** and do interviews of old people. Then download the information back to school.

Similarly, at John Paul College in Queensland, classes are gradually being provided with wireless cards for their laptops. Flexibility in classroom groupings and activities has been enabled by **freedom from having to be connected to stationary network points**.

Because **WAN technology (wireless area networks) obviates the need for costly cable infrastructure**, schools embarking on ICT provision at this time, could well save considerable expense.

[45] Quote: Bill Wiecking, Maui High Performance Computer Centre, Maui, Hawaii (SuperComputer)

Changes in traditional library areas

Resource-based learning has placed a heavy reliance on school libraries so I was interested to observe how learning technologies had changed the configuration and operation of libraries. All **had computers available for accessing catalogues and on-line resources and the most proactive included facilities for students to create digital presentations**. It was seen as increasingly important to ensure that staff in the library understood curriculum objectives and had the will to become a "**cybrarian**".

Media centres where computer access, digital presentation equipment and reference materials are combined in one central area e.g. Elk Grove, Chicago District 214 where the media centre comprises 100+ computers attached to library pending integration into single space. Separate writing room adjacent.

MLC Sydney - the **Independent Learning Centre** is a four storeyed building combining laptop service centre (ground floor) integrated library and IT services on each floor; fiction area and multipurpose space on top floor. Double-glazed, silent reading and study rooms are incorporated on each floor and computer suites are located on two floors.

Worth School, West Sussex – Featured an **Integrated Learning Centre** combining their computer training laboratory with reference and fiction resources.

Oregon, Wisconsin – Information Centre also **distributes video on demand to teachers in classrooms**. The keypad on the telephone in each classroom has the dual function of video control.

The Resource Centre at John Paul College, Queensland, (library) comprises Fiction Lounge, IT teaching area with screen and projector, research area, **multimedia teaching room attached with removable walls** and Primary library area. The laptop station with screen and printer provides a space where students have free use of scanners, printers, data-projector, video, and monitors to connect to their laptops.

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Appendix 1

Supplementary website addresses

UNITED STATES OF AMERICA

www.att.com/learningnetwork AT & T Learning Network. Resources, ListServs, Virtual Academy, professional development, On-line journal et al

www.highwired.net Global High School community; free web building and hosting service; classroom section; tutorials, collaborative, web-based projects

www.mff.org/edtech Education area of the Milken Family Foundation website. Articles and downloads re learning technologies and on-line learning environments

www.virtualhighschool.com Ontario secondary school, advice for parents

http://fhs.net Florida Virtual High School

www.cyberschool.k12.or.us students around the world taught entirely over the internet; includes interactive textbooks with text, audio and video

http://online.usu.edu Utah State University distance education course. Excellent resources for students

www.scholars.com/scholars.asp On-line advisors mentor students 24 hours a day, courseware

www.glef.org George Lucas Education Foundation, K-12 media materials and website.

http://www.nettech.org/tc/common/listservs.html Listservs for Information technology co-ordinators

www.newtechhigh.com Virtual High School, California

www.cpsr.org/home.html Computer Professionals concerned about the impact of computers on society. Essays, newsletters, competitions et al

www.paly.net Digital School, Palo Alto High School

www.ccsd.net Clark County School District, Nevada

www.ccpef.org Clark County Public Education Foundation

IBM REFERENCES

http://ceoforum.org

www.ibm.com/au

www.lotus.com/learningspace

UNITED KINGDOM

www.teachthinking.com

UK project site used by Glen Waverley Secondary College

http://news.bbc.co.uk

www.the-educator.co.uk On-line magazine for educators, curriculum outlines and resources, assessment tools

www.englishonline.co.uk

www.mathsonlune.co.uk

www.virtualschool.co.uk Curriculum sent by e-mail, targeted at parents

www.standards.dfee.gov.uk/thinking

Dr Carol McGuiness *From Thinking Skills to Thinking Classrooms*

www.ultralab.ac.uk

Professor Stephen Heppell's research and activities here. Also: notschool.com the virtual school set up for second chance students with Uni students and adult experts (often retired) as mentors.

http://www.ecis.org/it/Index.htm Information Technology Resources for International educators

CANADA

http://olt-bta.hrdc-drhc.gc.ca/info/eljoue.html Electronic Journals related to Learning Technologies

AUSTRALIAN SITES

www.edna.edu.au/EdNA Education Network of Australia. Excellent on-line discussions for teachers, resources, information

http://education.qld.gov.au Virtual School pilot where students log on and attend "real time" classes and interact with the teacher via voice or software applications.

www.worldschool.com learning resources, tutor for homework assistance, QMAT's (questions, models for an answer and tips) Infobank, Wordbank, Linkbank (thousands of other useful sites)

www.ngs.com.au Net Grammar School, soon to be opened in Sydney

www.xsiq.com Interactive curriculum modules for students, supported by use of multimedia CD's

http://www.tsof.edu.au/LT.SA (learning technologies/teaching plans)

www.linkideas.com (teaching ideas)

http://education.3COM/netprep (course for students)

www.vsg.edu.au (virtual school for the gifted)

NEW ZEALAND SITES mentioned in paper

www.tki.org.nz New Zealand Ministry of Education portal for educators

www.minedu.govt.nz New Zealand Ministry of Education website

www.marsden.school.nz Website address of Samuel Marsden Collegiate School, Wellington, New Zealand.

www.kingscollege.school.nz Kings College, Auckland, offering on-line courses for distance students.

www.tahatai.school.nz Innovative primary school established as an IT school

Further copies of this report may be obtained from:
The Winston Churchill Memorial Trust
P.O. Box 10-345, Wellington, New Zealand.

It may be viewed digitally at www.marsden.school.nz or www.tki.org.nz .